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1972

Volume III

AREA REPORTS: INTERNATIONAL

Prepared by staff of the

BUREAU OF MINES

UNITED STATES DEPARTMENT OF THE INTERIOR • Rogers C. B. Morton, Secretary

BUREAU OF MINES • Thomas V. Falkie, 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, preseving 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

For 91 years, the Federal Government, through the medium of the Minerals Yearbook or its predecessor volumes, has reported annually on mineral industry activities. This edition of the Minerals Yearbook presents the record on worldwide mineral industry performance during 1972. In addition to statistical data, the volumes provide sufficient background information to interpret the year's developments. The content of the individual volumes is as follows:

Volume I, Metals, Minerals, and Fuels, contains chapters on virtually all metallic, nonmetallic, and mineral fuel commodities important to the domestic economy. In addition, it includes a general review chapter on the mineral industries, a statistical summary, and a chapter on technologic trends.

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

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

The Bureau of Mines continually strives to improve the value of the Yearbook for its users, and toward that end, the constructive comments and suggestions of readers will be welcomed.

THOMAS V. FALKIE, *Director*

Acknowledgments

In preparing this volume, the Bureau of Mines gratefully acknowledges the statistical data and other basic information on mineral production, consumption, and trade which were provided by various foreign government mineral and statistical agencies through a variety of official publications. Material, both statistical and informational, was also obtained from publications of the United Nations, from airgrams of the Department of State, and from both the domestic and foreign trade and technical press. Particularly helpful in preparing this volume were the routine and special reports received from the mineral, petroleum, economic, and commercial officers and other members of the embassy and consular service of the Department of State, and their contributions are sincerely appreciated.

The individual chapters of this volume were prepared by the staffs of the Divisions of Ferrous Metals, Fossil Fuels, Nonferrous Metals, and Nonmetallic Minerals of the mineral supply activity, with some contributions from various members of the Foreign Service. The "Minerals in the World Economy" chapter and the production and trade tables of the country chapters were prepared in the Geographic Statistics Group of the Office of Technical Data Services. Final correlation and checking of this volume were performed by the Minerals Yearbook staff of the Office of Technical Data Services.

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

ALBERT E. SCHRECK
Editor-In-Chief

Contents

Minerals in the World Economy

By Charles L. Kimbell [1] and George A. Morgan [1]

In 1972, virtually all phases of world mineral industrial activity registered gains in performance over the levels of 1971, as the continually expanding population of this planet persisted in its quest for an ever-higher standard of living. As in all recent years, mineral industry activity expansion was most pronounced in the commodity area of energy materials; this growth reflected not only the world's expanded energy requirements necessitated by intensified industrial activity, but also continually higher levels of energy use for what might best be described as human comfort, convenience, and pleasure, particularly in the world's developed countries.

Overall world total industrial output, as measured by the United Nations' index of industrial production advanced by nearly 6.7% in 1972 over the 1971 level.[2] This growth rate exceeded the increase recorded for the extractive sector of the minerals industry (up only 2.6% in aggregate), but was lower than that registered for processing of metals (up 7.2%) or for the production of petroleum, coal and chemical products (up 9.4%). It is worthy of note that within the extractive sector of the minerals industry alone, the crude petroleum and natural gas component recorded a gain of 4.0%, far greater than the 2.6% average increase for the extractive sector, and as such was responsible for the entire increase. In contrast, the metal extraction component index was on a par with that of 1971, while the third major extractive industry component, coal production, registered a 1.9% decline.

Despite the continued gains in production of energy materials, there were localized instances of energy shortages (specifically, of petroleum) which pointed to the precarious balance between world supply and demand. Despite these relatively minor 1972 problems and evidences of potentially greater problems in future years, the pressures for economic and social advances drove fuel material consumptions higher in most world areas, leading to an even more precarious balance, with the developed nations dependence upon less developed, crude oil-rich nations increasing, thereby setting the stage for the international oil crisis of 1973.

Available partial and preliminary data on world trade in mineral commodities suggests that the total value of these materials moving in international trade almost assuredly topped the $100,000 million level in 1972. A part of the increase, to be sure, was the result of virtual worldwide inflation and the devaluation of the U.S. dollar relative to some foreign currencies. However, a substantial gain in the physical volume of material moved also played a significant role. In the case of crude oil, the overwhelmingly dominant single mineral commodity traded (on both the tonnage and value basis), figures available to the Bureau of Mines indicate that exports exceeded 10,409 million barrels (about 1,426 million metric tons) in 1972, an advance of 11.2% over the 1971 level.[3] Similarly, petroleum refinery product exports apparently advanced by over 5.7% to more than 3,132 million barrels (almost 450 million tons).

From the viewpoint of consumption of mineral materials, 1972 was a year of increases rivaling if not exceeding output of crude minerals, resulting in some stock drawdowns. Considering energy materials, although available data were insufficient to

[1] Physical scientist, Office of Technical Data Services—Mineral Supply.

[2] The United Nations' index of world industrial production for 1972, as reported in the United Nations Monthly Bulletin of Statistics for August 1973 stood at 176 (base 1963=100), 11 index points higher, or 6.7% above the 1971 level recorded in the same source.

[3] 1971 level was over 9,361 million barrels, or about 1,282 million tons, a figure 179 million tons higher than that reported in the 1971 edition of this chapter.

measure the growth in consumption in 1972 relative to that of 1971, available information indicates that the 1970 to 1971 growth rate of 4.0%[4] was significantly exceeded, with world energy use reaching a level of nearly 7,600 million metric tons of standard coal equivalent. World consumption of both iron ore and steel scrap increased in 1972 in contrast with declines for both between 1970 and 1971, with iron ore consumption still falling short of the 1970 record level, but scrap consumption reaching a new high. In the case of major nonferrous metals (aluminum, copper, lead, zinc, and tin), world consumption in aggregate advanced by an estimated 8.3% in 1972 (6.2% between 1970 and 1971), with aluminum again accounting for the greatest increase, both tonnagewise and percentagewise. However, the growth rate for aluminum use was markedly lower than that between 1970 and 1971, while copper, lead, and zinc recorded larger gains between 1971 and 1972 than in the 1970 to 1971 period.

Price rises were noted in fuels, although these, for the most part, were more in line with the general inflationary trends and with rising production costs rather than as a result of efforts to increase profit margins or because of actual materials shortages. Among the major nonferrous metals, the average 1972 annual prices for aluminum and for copper actually were lower than those of 1971 on major metal markets, while lead, zinc, tin, and silver recorded gains.

The influence upon mineral industry activities of the principal areas of international hostilities in 1972 was outwardly somewhat less than in the previous year. In Southeast Asia, despite occasional flareups of military activity, there was a continuing diminuation of the role of U.S. combat forces, with a concomitant reduction in the fuel requirements to support the war. It might be noted that for this area, the virtual destruction of the single refinery in the Khmer Republic was a rather significant event, although by world standards, this was of little importance. In the Near East, despite the limitation of military activities to rather minor border skirmishes of short duration, the Suez Canal remained closed, with a continuing influence upon the price of mineral commodities, most notably oil, on the European markets.

The brief period of open warfare between Pakistan and India at the very end of 1971 over the question of independence for the former Eastern Wing of Pakistan (now Bangladesh), had little influence on world mineral supplies except for a short (and relatively unimportant, by world standards) period of intensified fuel demands by the military forces of these nations. Moreover, the long range effect of this partition of one state into two seemingly would have little influence on mineral supplies. Neither the new, smaller Pakistan (formerly West Pakistan) nor newly separated Bangladesh could be regarded as significant mineral producers at present. Looking to resources potential, former West Pakistan has some promise as a natural gas supplier, despite obvious transport difficulties, and may have some nonferrous metal possibilities, though these are inferred, rather than known.

[4] Calculated from United Nations World Energy Supplies 1968-71. Statistical Papers, Series J, No. 16, New York, 1973, pp. 6-9.

PRODUCTION

The value of 1972 world crude mineral production was estimated at $109,000 million, exceeding the $100,000 million level for the second straight year. This is $6,900 million over the previous years' estimated total, as indicated in the following tabulation:

Year	Value of 53 major crude mineral commodities [1]	Value of all crude mineral commodities [2]
1950	37,224	42,100
1963	67,042	75,800
1968	77,908	88,000
1969	83,985	94,900
1970	87,857	99,300
1971	91,168	103,000
1972	97,284	109,900

[1] For details on commodities included see 1970 edition of this chapter, table 5. Figures for 1950–68 are those reported in Annales des Mines, No. 1, January 1971, p. 14; figures for subsequent years are extrapolated from the United Nations' index of world extractive industry output (see table 1 of this chapter).

[2] Data are extrapolated from those in first column to compensate for commodities not included in original source study. For details on the basis for extrapolation, see the 1970 edition of this chapter, under "Value of World Mineral Production."

From the foreging tabulation, it is evident that the growth rate of mineral output value considerably increased in 1972 over the rate prevailing during 1969–71.

The value added by processing of crude mineral commodities in mineral industry plants of various nations is estimated at $240,000 million for 1972, and is considered a low estimate because of the lack of complete data for all crude mineral commodities processed.

PRODUCTION INDEX PATTERNS

United Nations indexes for world mineral production (excluding that of Communist Asia) are given in table 1, and include index figures for major sectors of the industry and selected major geographic areas.

The data given, which are based on production levels in 1963, again show an increase in overall mineral output for 1972. Comparison of the growth rate for 1972 with 1971 also shows an increase over that taking place between 1971 and 1970. The increases in both production level and rate of growth are due mainly to output of the processing industries as a whole, with chemicals, petroleum, and coal products having the greatest influence.

Examination of table 1 on the basis of general industry sectors indicates considerable variation in performance. Metals repeated their performance of the previous year, but coal declined two index points in 1972. However, with regard to percentage increase, only base metal processing and the processing of chemicals, petroleum, and coal products recorded increases exceeding that of overall industrial production. Production of petroleum and natural gas was again below the growth rate for industry as a whole in 1972, while nonmetallic minerals, one of the higher performing sectors the previous year, increased 5.5% compared with an overall industrial production increase of 6.7% over 1971 levels. The processing of chemicals, petroleum, and coal products increased by 9.4% over the 1971 level.

Analysis of overall mineral industry production for 1972 by quarters indicates a moderate increase between the last quarter of 1971 and the first quarter of 1972 which continued through the second quarter, decreased moderately in the third quarter, and ended with a substantial gain (11 index points) in the last quarter. The extractive industry as a whole showed a modest gain between the last quarter of 1971 and through the first half of 1972, declining slightly in the third quarter and rising moderately in the fourth quarter. This pattern was generally the same for the subdivisions metal mining and coal extraction. In contrast, production of crude petroleum and natural gas jumped substantially in the first quarter of 1972, declined moderately in the second quarter, increased by one index point in the third, then climbed seven index points in the last quarter, rounding out the year at 184, up 4% over 1971. Among the several processing industry sectors covered in table 1, base metal processing climbed sharply from the final quarter of 1971 through the second quarter of 1972, registering a gain of 16 index points in that time period. That sector then declined moderately in the third quarter, but rose again in the fourth quarter to a new high. As in the previous year, nonmetallic minerals declined in the first quarter of 1972 with respect to the last quarter of 1971, rose sharply in the second quarter, declined marginally at the end of the third quarter, and then rose slightly in the final quarter. The index of chemicals, petroleum, and coal products production indicates that the pattern set by that sector in recent years remained in effect, with consistent gains for consecutive quarters except for a slight decline in the third quarter.

As in the past year, examination of United Nations' world production indexes by regions indicates that the Communist European countries again increased their output in all sectors in 1972. This is in contrast with non-Communist nations which showed declines in metal mining and coal extraction, with all other sectors advancing in output. Variations among nations of the non-Communist world were considerable, with metal output falling off modestly for industrialized countries, but increasing moderately from a higher base for less industrialized countries. Within the group of industrialized nations, countries of the European Economic Community decreased their production of metals for the fourth straight year, while Australia and New Zealand continued their steady increase. In the case of coal, non-Communist countries again exhibited considerable variation in production, but for crude petroleum and

natural gas, only Latin America showed a declined from 1971 to 1972, with all other non-Communist world countries advancing. In the processing industries, 1972 was a year of advance in production levels for all mineral industry sectors and regions indicated, but with varying growth rates.

In reviewing the production indexes, it should be noted that growth rates alone do not give an accurate indication of a given area or country's contribution to total production. Specifically, in the case of the Communist areas which have generally shown consistently higher growth rates than non-Communist regions, it should be remembered that these output levels are from a lower base level in terms of quantitative output of most commodities. In other cases, rates of growth shown by some regions may be almost entirely the result of expansion of output in certain industries, as is the case with iron ore and bauxite in Australia.

QUANTITY COMMODITY OUTPUT

Total world output of a number of mineral commodities is summarized in table 2 for the years 1970-72. Regional distribution of output of these commodities for 1972 in terms of percent of world total is given in table 3. The statistical summary at the end of this chapter includes world output of selected major commodities by principal producing countries for 1970-72.

Nonfuel Mineral Commodities.—Of the 39 metallic mineral commodities listed in table 2, 29 registered production increases in 1972 compared with 1971 results, and 10 showed declines.

Among the 23 industrial nonmetallic mineral commodities for which output data are listed in table 2, 16 showed higher production levels in 1972 than in 1971, and 7 registered declines.

Tables 32 to 50 in the statistical summary section of this chapter give output levels of selected major nonfuel mineral commodities (metals and nonmetals) by major producers for 1970-72.

Mineral Fuel Commodities.—In 1972, the estimated world production of energy from mineral fuel commodities attained the highest level yet recorded in terms of standard coal equivalent (SCE). Expanded production of major mineral commodities [5] resulted in a world energy output totaling 7,595 million tons SCE in 1972, compared with 7,261 million tons SCE in 1971 and 6,991 million tons SCE in 1970. Record world production levels were again posted for each of the major commercial energy sources listed in table 2. The percentage distribution of each major energy source (coal, petroleum, and natural gas) along with hydro-geothermal-nuclear power for the period 1970-72 is given in the following tabulation:

Energy source	Share of total energy production (percent)		
	1970 [1]	1971 [1]	1972 [2]
Coal (including lignite)	34.3	33.0	32.5
Petroleum	43.0	43.7	44.1
Natural gas	20.5	21.0	21.0
Hydro, geothermal, and nuclear electricity	2.2	2.3	2.4
Total	100.0	100.0	100.0

[1] Based on data in United Nations, World Energy Supplies 1968-71. Statistical Papers, Series J, No. 16, New York, 1973, p. 10.
[2] Estimate, based on extrapolation of United Nations data for 1971 using world production data for listed commodities reported and published by the U.S. Bureau of Mines.

Petroleum accounted for 44.1% of total energy production, as that commodity continued to increase its proportion of the total. Although world natural gas production increased in 1972 by nearly 5% over 1971 output, its percentage of the total energy produced remained unchanged at 21%. The proportion of total energy output attributed to coal continued to decline, while hydro-geothermal-nuclear energy rose slightly. Output data by major producing countries for coal, natural gas, and crude petroleum for the 3-year period 1970-72 is given in tables 48, 49, and 50.

TRADE

GENERAL TRENDS

The aggregate value of world mineral trade in 1972 unquestionably exceeded that registered for 1971 as a result of both generally increasing unit prices and increasing volume of shipments, but available information was inadequate to fix the level of growth either from the viewpoint of

[5] Excludes wood, charcoal, bagasse, animal dung, peat, and other minor fuels, although such fuels are used as commercial fuels in some countries, and a few nations account for a significant part of total energy consumption.

value or volume. The estimated value of all mineral commodities traded in 1971, the latest year for which reasonably complete data are available, was $90,662 million, an increase of 8.2% over the 1970 total. Although this is a lower percentage increase than the 17.6% recorded the previous year, the 1971 level represents the highest level of world mineral commodity trade value recorded, a $6,908 million increase over the previous year's high. In terms of major mineral commodities' share of all commodities traded, the aggregate of mineral commodities accounted for 26% of the total, compared with 26.9% in 1970. This represents the lowest proportion in several years, as indicated in the following tabulation:

Year	Estimated value of all mineral commodities traded [1] (million dollars)	Increase relative to previous year (percent)	Mineral commodities' share of all commodities traded (percent)
1967	56,748	6.9	26.5
1968	63,361	11.7	26.6
1969	71,202	12.4	26.2
1970	83,754	17.6	26.9
1971	90,662	8.2	26.0

[1] Value estimated from data on mineral commodities appearing in table 4 to which have been added a factor for all mineral commodities not included in that table. The factor added is based on comparison of complete mineral trade value returns for selected countries with data given for these same countries in the source for table 4, which includes only the selected mineral commodity groups specified in the footnotes to that table. This comparison indicates that the recorded mineral commodities listed in table 4 represent about 81.5% of total mineral commodity trade.

Comparison with the previous year's total of world trade in mineral commodities indicates an upsurge in terms of both value and percentage of mineral commodity trade by the developing market economy countries, since these nations expanded their output of mineral commodities for processing in the developed countries. Although the value of trade by developed market economies increased, their share of total world trade declined by nearly 3%, and centrally planned economy countries and developing market economy countries gained a larger share of the total. The increase in the share of the total by the latter may be attributed to higher demand for raw materials by the developed nations.

COMMODITY GROUP TRADE PATTERNS

The distribution of the total value of export trade for five major mineral commodity groups over the 5-year period 1967-71 is given in table 4. The export value of the separate commodity groups varies considerably, with mineral fuels accounting for the highest value, $35,780 million in 1971, an increase of $7,170 million over 1970. The percentage of the total value of world trade in major mineral commodities accounted for by each major group is given in table 5, and the growth in value of each major mineral commodity group from year to year is detailed in table 6. It can be seen that while iron and steel, nonmetals, and mineral fuels all increased in value in 1971, only mineral fuels gained a larger percentage of the total. The rate of growth of value of world trade in mineral fuels increased to 25.1%, compared with a 15.1% rate of growth for that group in 1970 and an 8.2% growth rate for major mineral commodity groups as a whole. This increase reverses the trend of a declining percentage of the total registered by mineral fuels over the past 4 years. The value of export trade of ores, concentrates, and scrap declined for the first time in recent years, and the value of nonferrous metal trade fell for the first time since 1967. The above-mentioned growth rate of 8.2% for all major mineral commodity groups also was the first decline since 1967, and is considerably below the 17.6% growth rate for mineral commodities recorded in 1970.

In general, excluding minerals fuels, the rates of growth of the separate mineral commodity groups in 1971 were considerably below those recorded in 1970. Nonferrous metals, which accounted for 14.1% of the total value of export trade, registered a decline in growth rate of 14.8%, but the growth rate of the group ores, concentrates, and scrap declined 8.0%. In spite of the declines in both value and percent indicated by several major mineral commodity groups, the increase in the total value of all major mineral commodity groups may be attributed to the heavy increase in the value of mineral fuels exported, as well as the performance shown by iron and steel, which is the second largest group, accounting for 24.1% of the total value of major mineral commodities.

In 1971, the rate of growth in the value of aggregate major mineral commodities

fell behind that for all commodities traded, with the latter declining to 11.7% from 14.6% the previous year.

REGIONAL TRADE PATTERNS

The distribution of world trade by geographic area for the major mineral commodity groups (metal ores, concentrates and scrap, iron and steel, nonferrous metals, nonmetals, and mineral fuels) in terms of dollar value in 1971 is given in tables 7, 8, and 9. Table 7 compares major mineral commodity export trade by region with total commodity trade for these same regions in both value and percent. Table 8 gives the origins and destinations of each major mineral commodity group in terms of exports from and exports to the regions indicated. Table 9 elaborates in more detail the data appearing in the previous table by indicating the source of exports of the aggregate of major mineral commodities and their destinations by the countries and regions shown in the major portion of the table. These last two tables also help to illustrate the relative self-sufficiency in or dependence upon mineral commodities by the regions selected.

The overall pattern of 1971 world trade in major mineral commodities in terms of developed and developing market economies and centrally planned economies is given in the following tabulation:

Destination [1]	Sources of exports [1]				
	Market economy countries		Centrally planned economies	Undistributed [2]	Total
	Developed	Developing [2]			
Value (million dollars):					
To market economy countries:					
Developed	29,020	23,475	2,915	--	55,410
Developing	4,420	5,233	610	12	10,275
To centrally planned economy countries	1,832	517	4,630	1	6,980
Undistributed [2]	568	455	200	2	1,225
Total	35,840	29,680	8,355	15	73,890
Share of world total in percent:					
To market economy countries:					
Developed	39.3	31.8	3.9	--	75.0
Developing	6.0	7.1	.8	(3)	13.9
To centrally planned economy countries	2.5	.7	6.2	(3)	9.4
Undistributed [2]	.8	.6	.3	(3)	1.7
Total	48.6	40.2	11.2	(3)	100.0

[1] Sources and destinations grouped according to United Nations' practice; developed market economy countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, the Republic of South Africa, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States, and Yugoslavia; centrally planned economy countries are: Albania, Bulgaria, People's Republic of China, Czechoslovakia, East Germany, Hungary, North Korea, Mongolia, Poland, Romania, the U.S.S.R., and North Vietnam; developing market economy countries include all countries not specifically listed previously in this footnote.
[2] Figures represent difference between reported totals and reported detail.
[3] Insignificant.

Examination of the above tabulation indicates that, in comparison with 1970, every entry recorded an increase in value except for trade in mineral commodities from developed market economies to developing market economies. Of greater significance is the change in percentage distribution of total world mineral trade by the different economies relative to the previous year. The percentage of world trade in major mineral commodities from developed market economies to all economies declined from 51.4% in 1970 to 48.6% in 1971. In particular, export trade from developed to developing market economies declined from 7.2% to 6.0%. In 1971 developing market economy countries gained a larger percentage of world mineral exports, increasing to 40.2% from 38% the previous year. Export receipts by developed market economies decreased slightly from 75.6% in 1970 to 75.0% in 1971, while receipts of developing market economies declined by slightly over 1% to 13.9% in 1971. Centrally planned economies increased their value of receipts from the previous year, but the percentage increase of the total was slight. Although the percentage shares of total world mineral trade changed from the previous year, developed market economies continued to account for most of the trade.

The significance of export trade of major

mineral commodities, to total trade of the countries and regions selected (as given in table 7) varies considerably. In the Near East, 87.8% of all commodities exported from that region were mineral commodities (chiefly crude and refined oil). This is the largest percentage of total national exports accounted for by mineral commodities from the areas and countries listed, followed by other Africa at 54.6%, "Not reported" at 44.7%, and Latin America at 42.3%. Comparison with 1970 data indicates that, in general, the percentage figures given in the "Exports from" column were lower in 1971 except in the case of Communist European countries, other Africa, the Near East, and other South Asia and Far East. Although there was an increase of $5,180 million in the total value of major mineral commodities exported from the countries and regions indicated, this was more than offset by an even larger increase in value of nonmineral commodity exports. Countries and areas whose export trade in major mineral commodities accounted for the lowest percentages of all commodities traded were Communist Asia, with 5.3%, and the United States with 8.6%, both down from the previous year. The Republic of South Africa, with 11.4% of total listed trade accounted for by major mineral commodities, does not have included in the value data figures for gold, diamonds, and a variety of metals, the inclusion of which would increase the mineral commodity percentage appreciably. Japan continued to lead as the main importer of major mineral commodities in terms of the percentage of total commodities imported, with the share rising to 41.3% in 1971 compared with 36.5% in 1970. Major mineral commodities accounted for 32.5% of all 1971 commodity imports of those nations included under "Not reported"—down from the 78.1% share registered in 1970 due to large increases in the value of nonmineral commodities exported to countries in that category. The share of total commodity trade accounted for by major mineral commodities was 21.2% for all countries and regions in 1971, down slightly from 21.9% in 1970. The relatively low level of mineral commodity imports for Canada, the Republic of South Africa, and Australia and New Zealand resulted in mineral commodity export receipts for those countries of 13.1%, 10.4%, and 11.9%, respectively, in 1971. The percentage of major mineral commodity export receipts to most major areas remained unchanged or declined.

In table 8, value of world trade in three of five major mineral commodities increased in 1971. By far the largest increase was in mineral fuels, up $7,080 million from 1970. The major portion of the increase, $4,090 million, is the result of increased exports to non-Communist Europe. Value of total world trade in nonferrous metals and metal ores, concentrates, and scrap declined, with exports to Europe of nonferrous metals alone falling off by $1,400 million. It should be noted that data for several of the commodities does not appear and is presumed to be included under "Not reported." Owing to the system of reporting used, the Standard International Trade Classification Revised (SITC-R), gold continues to be excluded.

Destinations for the aggregate of major mineral commodities in terms of major world areas and countries, as given in table 9, indicates the relative export-import position for those areas. Specifically, comparison of total exports credited to each country or region (vertical grand total column) with total export receipts (horizontal grand total line) will indicate the position of each area as a net importer or net exporter of major mineral commodities. Excluding the Republic of South Africa, the United States, Canada, Latin America, and other Europe, export receipts for all areas shown increased in 1971, with the Near East showing the greatest increase.

CONSUMPTION

NONFUEL MINERAL COMMODITIES

Although data is lacking on world consumption of many mineral commodities, consumption of most major nonfuel mineral commodities presumably advanced substantially, judging from the performance of selected major metals and nonmetals. Examination of these selected commodities indicates that only tin consumption did not advance in 1972, remaining at its 1971 level of 172,000 tons. Consumption of iron ore, the major ore of the metallurgical industry, reached a level of 592.6 million tons in 1972 in 22 selected nations, a figure

17 million tons in excess of the 1971 level. The countries selected included all major world producers of pig iron except the People's Republic of China. The iron ore consumption figures are based on iron ore use in agglomerating plants, blast furnaces, and steelmaking. Table 10, which shows iron ore consumption by selected major country, indicates that the United States and the nations of the European Economic Community increased consumption by 11.4 and 11.2 million tons, respectively, in 1972. These increases more than made up for the declines in iron ore consumption registered by the European Free Trade Association countries and Communist Europe. These consumption levels, which are based in part upon estimates, indicate that of the total iron ore consumed, about 6 million tons was used directly in steelmaking; approximately 41% of the iron ore was treated in agglomerating plants prior to being fed to blast furnaces; and the remainder, amounting to over 58% of the total, was fed to blast furnaces and other facilities for production of pig iron and other products with or without agglomeration.

In 1972, iron and steel scrap consumption in 23 selected countries rose more than 17 million tons to over 264 million tons. This is the highest consumption level of iron and steel scrap yet recorded, just slightly exceeding the revised 1970 total. Consumption of this commodity by the countries listed in table 11 parallels somewhat the consumption of iron ore. However, lack of complete data necessitated the estimation of totals for certain of the countries listed in the table. The United States, the major consumer listed, retained its 1971 consumption level of 75 million tons. Finland and Spain together reported a consumption increase of about 1 million tons in 1972, while the Communist European countries raised their level of consumption of iron and steel scrap by nearly 5 million tons.

Table 12 gives estimated world consumption of five major nonferrous metals over a 3-year period. Aluminum showed an increase of 10.2% over 1971, or slightly over 1.1 million metric tons. Consumption of copper, lead and zinc also increased in 1972. Of the five nonferrous metals listed, zinc had the second highest percentage increase after aluminum, 9.2% or 433,000 tons. Copper and lead indicated increases of 7.4% and 3.8%, respectively, in 1972. In terms of tonnage, copper consumption rose 533,000 tons, the largest increase since 1969 when consumption was up 601,000 tons over the 1968 total. Use of lead, for which there has been a characteristically modest consumption for the past decade, jumped by 135,000 tons in 1972.

As in the case of metals, data on a worldwide basis on the consumption of most nonmetallic mineral commodities is not available. Despite the lack of overall data, it is reasonable to assume that major commodities in this group, limestone, cement, and fertilizer materials, again advanced in 1972. Although the enforcement of pollution control regulations was expected to reduce worldwide demand for sulfur, consumption of that commodity in 1971, the latest year for which data is available, increased slightly. With regard to fertilizers, world consumption of nitrogen fertilizer for the 1971-72 fertilizer year (July 1, 1971 to June 30, 1972) was reported at 33.8 million tons, a 6.6% increase above the previous year, but still, on a percentage basis, below the 7.3% increase registered in the fertilizer year 1969-70. Phosphate consumption in terms of contained P_2O_5 increased from 21.4 million to 22.4 million tons, a 4.4% increase. Potash consumption in terms of K_2O equivalent for the 1971-72 fertilizer year was nearly 17.1 million tons, a 2.8% rise over the previous year's total.[6]

MINERAL FUEL COMMODITIES

Consumption of mineral fuel commodities may be viewed in terms of the energy produced from these commodities. In 1971, the latest year for which comprehensive reliable data is available, the total world consumption of mineral fuels, which includes coal, oil and natural gas, and primary electric power (that power produced by means other than the burning of the aforementioned fossil fuels) amounted to 7,096 million metric tons of standard coal equivalent (SCE). This is an increase of 4.0% over the total 1970 aggregate of 6,822 million tons SCE, but a lower percentage increase than the 6.5% rise between 1969 and 1970. Table 13 gives

[6] The British Sulphur Corp. Ltd. Statistical Supplement No. 4, November-December 1972, London, 1973.

a detailed breakdown of energy consumption in terms of major source (solid fuels, liquid fuels, natural gas, and primary electric energy) and by continental divisions for the 5-year period 1967-71 as reported by the Statistical Office of the United Nations. Liquid fuels continued to increase their share of the aggregate of energy in SCE consumed in 1971, amounting to 42.7% compared with 41.9% in 1970. The most significant change in the percentage distribution of these energy sources with regard to their share of the aggregate energy consumed was evidenced by solid fuels, which registered a quantitative decline in terms of tons of SCE for the first time since 1967. As a result of this decline, coupled with quantitative increases in consumption of other fuels, solid fuels accounted for only 33.6% of all fuel consumption in terms of SCE in 1971.

Although the quantity of solid and liquid fuels consumed in terms of SCE was considerably greater than that for natural gas, the rate of growth of natural gas, 6.8% in 1971, exceeded that for all other sources. This growth rate is due in large part to intensification of efforts to utilize the relatively large presently available quantities of natural gas, which is a less expensive (in terms of caloric value and pollutant content) energy source. Natural gas utilized was equivalent to a total of 1,513 million tons SCE, or 21.3% of total energy consumed. Primary electricity increased by 6.4% to 167 million tons SCE although this figure represents only 2.4% of total energy consumption.

With regard to consumption by all market economy countries and centrally planned economy countries, it can be seen that market economy countries again decreased their consumption of solid fuels, increasing consumption in all other categories. Centrally planned economy countries increased consumption in all energy sources except primary electrical energy, which remained at its 1970 level. The difference shown by the two types of economy countries with regard to their consumption of solid fuels is due partly to the importance of pollution control affected by the market economy countries and partly to the ready availability and lower cost of coal in centrally planned economy countries. On a regional basis those areas with historically low consumption levels experienced the largest percentage growth in consumption of aggregate fuel sources. Other America, Africa, and the Near East increased aggregate consumption by 8.9%, 11.9% and 11.1%, respectively, in 1971. Western Europe, where consumption of natural gas still accounts for less than 10.1% of the aggregate energy consumed, increased consumption of that fuel source by 29.6% in 1971. Liquid fuels accounted for nearly 56.8% of the total, with the remainder being made up by consumption of solid fuels (29.5%), and nuclear and hydroelectric power (3.5%). In the centrally planned economy countries, solid fuel consumption amounted to nearly 59% of aggregate energy consumed, compared with 23% for the market economy countries.

Per capita consumption increased for all world regions listed, with less developed areas generally showing higher percentage gains than developed regions. However, developed market economies by far maintained the highest per capita consumption, over four times that for centrally planned economies.

RESERVES, RESOURCES, AND EXPLORATION

Continued growth in demand for virtually all mineral commodities in 1972, coupled with prophecies of impending depletion of known economically operable deposits of certain commodities within the remainder of this century, provided impetus for intensification of exploratory efforts aimed at expanding the known resource base. These same forces also motivated an intensification of development exploratory work and technological studies directed toward converting those deposits now in the category of a resource into materials that qualify as a reserve. Although space limitations preclude detailed discussion of the world reserve-resource situation, even for only the major mineral commodities, either in terms of the total available supply or in terms of 1972 additions to reserves, some albeit incomplete and brief comments on this aspect of world mineral industry activity seem in order.

Analysis of the reserve-resource situation of any commodity must be considered using accepted definitions of the terms involved. The term reserve is applied to deposits that are economically recoverable at present prices using current technology, and the term resource is applied to deposits that are identified but not known to be economically recoverable under present conditions, including those areas where the degree of mineralization may later prove adequate for exploitation of the mineralized zone.

Reserves of a number of major mineral commodities in 1972, as estimated by the U.S. Bureau of Mines, are given in table 14. The table also includes the distribution of these reserves by market economy and centrally planned economy countries, with some detail on major countries. In terms of the percentage of the world total reserves of the selected commodities, reserves of the principal market economy countries indicated together with those of the centrally planned economies, generally account for over 70% of the total. Exceptions to this generalization are natural gas, approximately 626,000 billion cubic feet of which are accounted for by unspecified market economy countries, and sulfur, with Near East countries accounting for 472 million tons.

As can be expected, the reserve situation of a mineral commodity may not vary considerably in the short term. However, reexamination of available data has resulted in substantial revisions of previous estimates for several commodities, most notably aluminum, phosphate rock, potash, natural gas, and petroleum. Estimates of phosphate rock and potash have been revised downward due to previous inclusion of deposits which since have been determined as uneconomical at present prices and technology. Estimates of aluminum, natural gas, and petroleum reserves have increased, primarily as a result of advancing prices, new discoveries, and inclusion of additional deposits previously known but not incorporated into previous reserve figures.

In light of the development of the international energy crisis in 1973, it seems appropriate to briefly comment on reserves of crude oil, the most significant fuel material of our time. There were additions to world crude oil reserves in 1972 that could be regarded as individually significant in size when examined with respect to the preexisting reserve availability of the country where the addition was made, but these changes did little to alter the relative regional shares of total world reserves. As shown in table 14, three nations of the Near East (Saudi Arabia, Kuwait, and Iran) control virtually one-half of the total oil reserve of market economy nations. When reserves of other Near East nations and of the countries of the Northern tier of Africa, most notably Libya and Algeria, are added, the share of market economy world reserves controlled by Near East-North African producers swells to well over half the total. The potential international political power that can result from such a reserve concentration within a single bloc of nations was amply demonstrated in 1973.

Indicated reserves of natural gas in the U.S.S.R. have increased from 423,000 billion cubic feet in 1971 to 636,000 billion cubic feet in 1972. The increase in aluminum reserves was registered by market economy countries, with new deposits in Australia accounting for a large portion. It may be assumed that, with regard to the proportion of a number of these commodities accounted for by centrally planned economy countries, the U.S.S.R. maintains a high percentage of the total by virtue of its land mass and known estimated reserves.

With regard to nickel, estimated known reserves of 16,329 thousand metric tons exist in Cuba. In the area of worldwide exploration for mineral deposits, available information indicates that during 1972 major exploratory work was again centered on the continent of Africa. Gabon, the world's third largest producer of manganese, has indicated that its' maganese ore deposit at Moanda contains an estimated 200 million tons of 50% to 52% manganese, one of the largest in the world. An iron ore deposit at Belinga has been put at 800 to 1,000 million tons of 60% iron content; however, exploitation of this deposit is awaiting completion of a rail link to the coast. Several deposits of uranium have been located, and indications are that these will be used to supply requests from the French Atomic Energy Commission. The Mounana deposit is reported to contain 1,780 tons of uranium metal; 3,280 tons are located in a deep deposit at Boyindzi and 10,000 tons were reported in a deposit at Oklo.

In the Ivory Coast, iron ore deposits in

the Man region are believed to constitute a 2 billion ton low grade (38% iron) reserve, with upgrading expected to result in a 68% iron concentrate. Prospecting is currently underway over a 4,066 square mile area in the Bangolo region. The most promising deposit thus far is at Mount Klahoyo, where 20 million tons of ore are indicated. If production is initiated, the Ivory Coast will become one of the leading iron ore producers in Africa. A primary problem here, as in developing other remote deposits in other countries, is the lack of transportation. The possibility of transporting the pulverized ore by pipeline in the form of a semiliquid mud is being studied, with the slurry then dried and converted to pellet form. However, in spite of the increased expense involved in the construction of a railroad from Man to San Pedro, it is more likely that that will be the choice due to the Government's desire for greater contribution to the economic development of the region. Copper prospecting is also underway in Toulepleu-Danane, with molybdenum and columbium-tantalum included in the search.

In Mozambique, prospects were good for the construction of the Cabora Bassa Dam which will lead to the exploitation of mineral deposits in that and neighboring countries. Output would be facilitated to the extent that coal production at Moatize in the region of Tete may be increased to 2 million tons per year, compared with the current 300,000 tons per year that is shipped through the port of Nacola. The Zambezi basin contains deposits of fluorite at Canxixe and Djanguire estimated at 600,000 tons. Titanium-iron reserves at Madeduo, Txitiza, Inhantipisa, and Massamba, although still in the process of being evaluated, are believed to be exploitable at the rate of 700,000 tons per year.

A bauxite deposit reportedly covering an extensive area in the region of Minern-Martap has been estimated to contain reserves of 2 billion tons. The deposit has been put at 43% alumina and 3.4% silica. As noted previously, the necessity of transporting the ore great distances in a region of general isolation involves considerable expense; thus any concern interested in exploiting the ore body must consider the cost of a reasonably dependable infrastructure as well. In the case of the bauxite reserve at Minern-Martap, the extension of a railroad to the base of the Ngaoundal range may eliminate a considerable portion of the difficulty.

INVESTMENT

Available sources indicate a rather dramatic growth in worldwide mineral industry investment in 1972. Although comprehensive data on such investment are not available, those figures available on petroleum industry and iron and steel industry investment by major market economy countries, together with overall mineral industry investment figures for the United States, clearly reflect this growth pattern. The most notable exclusion from a geographic viewpoint is the lack of readily comparable mineral industry investment figures for the centrally planned economy nations—the U.S.S.R., other East European countries, and the People's Republic of China. For these areas, however, although the level of investment is not quantifiable, it is at least generally indicated in announced expansion and development plans which point to significant increases.

Despite the inadequacy of the base for extrapolation to estimate worldwide investment, the data on the commodity sectors of the mineral industry which are available do serve to indicate an expanded growth rate of investment for the industry as a whole, as well as a quantifiable general rate of growth for non-Communist countries.

Investment expenditures in the steel industry for selected countries in 1970 and 1971 are given in table 15. Total investment expenditures in 1971 amounted to $7,282 million, a 16.2% increase over the revised investment total of $6,267 million in 1970. Japanese investment growth was again the largest, amounting to a $592 million increase in 1971 over that of 1970, reflecting that nation's continued expansion in steel production. The $476 million growth in investment recorded for the European Economic Community (EEC) consisted mainly of increases of $229 million by Italy and $179 million by France. The United Kingdom accounted for $246 million of the $277 million investment expansion made by members of the European Free

Trade Association (EFTA). Those nations with decreased investment expenditures in 1971 included the United States, Spain, Belgium-Luxembourg, and Ireland.

Non-Communist world petroleum industry expenditures for capital investment and exploration expenses are given by geographic area in table 16 and by industry sector and type of expense in table 17. In 1972, the total of capital expenditures plus exploration expenses increased 14.2% to $26,490 million, up $3,295 million from 1971. This increase is considerably larger than the 8.1% increase recorded between 1970 and 1971 and well ahead of prior recorded increases.

The geographic distribution of investment in the non-Communist world petroleum industry in 1971 and 1972 is given below by area in percent of total:

Area	Percent of total	
	1971	1972
United States	34.3	37.0
Other Western Hemisphere	15.5	12.7
Western Europe	18.2	17.3
Africa	4.9	4.5
Near East	3.8	3.9
Far East	11.4	10.9
Unspecified	11.9	13.7
Total	100.0	100.0

The United States continued to account for the largest percentage of non-Communist world petroleum expenditures in 1972, regaining a portion of the 7.1% drop recorded between 1970 and 1971.

Examination of regional distribution of petroleum expenditures and exploration expenses indicates a major upsurge in U.S. investment, greatly offsetting the negative effect which the United States had on the world total in 1971. That country, after a decline of 925 million between 1970 and 1971, increased expenditures for capital investment and exploration by 22.9% to $9,790 million, up $1,825 million. Another significant development was the regionally undistributed investment in tanker construction, which increased 32.7% to $3,650 million from $2,750 million. All other regions increased total expenditures except for the Western Hemisphere (excluding the United States), which declined by 6.5% in 1972. The Near East, while operating from a smaller base, increased total expenditures by 17.7% with an additional investment of $150 million in 1972.

Regarding non-Communist world petroleum industry, capital expenditures by industry sector and exploration expense, it can be seen that crude oil and natural gas production again accounted for the largest percentage of the total. That sector, already larger in comparison with all others, registered an increase of 47.1% in 1972 amounting to $3,070 million for a total of $9,590 million, or 36.2% of the non-Communist world total. Expenditures for marine facilities increased 31.3% or $900 million to $3,775 million, the second largest increase in any sector after crude oil and natural gas. The various sectors of the petroleum industry ranked in order of percentage of total expenditures after crude oil and natural gas are as follows: Refineries, 18.7%; marine facilities, 14.3%; marketing, 10.7%; exploration, 5.8%; chemical plants, 5.1%; pipelines, 4.6%; natural gas plants, 1.9%; and all other miscellaneous expenses accounting for the remainder. The relative ranking changed slightly for several of the sectors since capital expenditures for marine facilities exceeded those for marketing by $950 million, and expenditures for chemical plants, down 12.1% from 1971, fell behind outlays for exploration.

Direct U.S. investment in the mineral industries and petroleum industry in foreign areas, along with earnings and income, is given in table 18. Overall U.S. investment in mining, smelting, and refining increased 6.7% in 1972 to $7,131 million, while U.S. petroleum investment rose 9.3% to $26,399 million. Geographically, it is significant to note that U.S. mining investment in Chile fell by nearly $100 million, with a slightly larger amount added to mining investment in Australia. Petroleum investments in the Latin American republics declined slightly, but increases were recorded in all other countries and regions. U.S. petroleum investment in Europe was up 12.7%, with a considerable portion of this allocated for North Sea exploration and development. A 14.6% increase was recorded in the Far East and Pacific region, and a 23.3% increase in investment occurred in the Near East. Table 18 also gives investment totals in mining, smeltering, refining, and petroleum for the 3-year period 1969-71 for purposes of comparison.

TRANSPORTATION

MARINE TRANSPORT

Three major classes of oceangoing vessels are employed in the transport of mineral commodities: tankers, bulk carriers, and freighters. Table 19, derived from a U.S. Maritime Commission report, lists these classes individually and summarizes the world's total merchant fleet in terms of number of vessels and tonnage. It can be seen from the table that only freighters as a class decreased in number from the previous year, but all categories, except for vessels classified as other, showed increases in both gross tonnage and deadweight tonnage. As in previous years, tankers accounted for the greatest percentage of total deadweight tonnage, nearly 48.3% in 1972. However, it should be remembered that in the case of each of these major classes, not all of the vessels listed are involved wholly or even partly in transporting mineral commodities. Tankers, though devoted mainly to trade in crude oil, natural gas, and refinery products, also move chemicals and products such as molten sulfur and whale oil. Bulk carriers are heavily engaged in the transfer of metal ores, cement, and fertilizers, but also move sizable quantities of bulk agricultural products. Freighters are not primarily engaged in mineral commodity shipment but nonetheless move substantial quantities of metal ingots and semimanufactures as well as some ores and concentrates.

World shipping of tanker and dry cargo by loadings and unloadings for the period 1968-72, as given in table 20, indicates that total world shipping in 1972 increased by 6.1% over that of 1971 for a record 2,861 million tons. Separately, tanker cargo loadings increased 7.0% and dry cargo loadings rose 4.9%.

Regional patterns of tanker and dry cargo movement are recorded in tables 21 and 22, respectively. The trends in world movement of tanker cargo, which were highlighted in 1971, continued to be reinforced. Unloadings of crude oil and refined products increased 18.4% for the United States in 1972, and unloadings of tanker cargo for Japan and Western Europe were up 8.1% and 6.0%, respectively. Western Europe also increased loadings of tanker cargo as refinery capacity expanded and port facilities were completed. Developing market economies increased loadings of tanker cargo in 1972 by 6.2%, with the major portion of this increase coming from the Near East. That region increased loadings 11.7% to 852 million tons, while the Far East and other Africa increased loadings by 13.8% and 15.7%, respectively, in 1972. Venezuela continued the downward movement begun in 1971, declining 9.5% in loadings of tanker cargo. North Africa also recorded a lower level of tanker loadings in 1972, declining 4.9%. Centrally planned economies, while showing little change in tanker loadings from the previous year, were up in tanker unloadings by 17.4%, though from a relatively small base. The developed market economies continued to increase dry cargo shipments as loadings were up 6.8%. Developing market economies increased loadings only 2.6%, while the U.S.S.R., relatively unchanged for the previous years, more than doubled the amount of dry cargo tonnage unloaded in its ports.

The share of world mineral commodity trade in total world commodity movement in 1972 is unavailable due to insufficient information. However, in 1972, 56.3% by weight of all cargo transiting the Panama Canal consisted of mineral commodities. On the basis of this figure and the substantially larger tonnages of crude oil and refinery products moving by tanker and bulk carriers from the Near East and elsewhere, it may be inferred that mineral commodities as a whole account for an even greater share of the total world movement of goods.

By yearend 1972 the world merchant fleet[7] totaled 21,009 vessels with a gross tonnage of 250,543,000 tons and a deadweight tonnage of 399,552,000 tons, increases of 2.3%, 8.8%, and 10.5%, respectively, over 1971 totals. These percentage increases for the total merchant fleet in 1972 are lower than those registered in 1971, although the number of vessels and tonnages indicated are the largest ever recorded.

The percentage increases among the various ship classes with regard to number of vessels and tonnage varied considerably. Tankers and bulk carriers again recorded

[7] Oceangoing steam and motor ships of 1,000 gross tons and over.

gains in both number of vessels and tonnage, with bulk carriers showing substantial percentage increases. Though the number of freighters declined for the first time since 1969, gross tonnage and deadweight tonnage increased slightly. Other vessels (passenger-cargo, passenger-refrigerated cargo, and refrigerated freighters) remained stable in number, but declined in both tonnage categories. In 1972 tankers and bulk carriers together again accounted for an increased share of the total in both numbers and tonnage.

Tankers.—In 1972 the world tanker first increased by 150 vessels over the 1971 total. Many of these vessels were in the supertanker class, indicating the continued rapid expansion of these vessels with prolonged closure of the Suez Canal. The total tanker fleet between yearend 1971 and yearend 1972 increased by 3.4% in number of vessels, 9.5% in gross tonnage, and 11.4% in deadweight tonnage; comparable figures for the previous corresponding period were 4.7%, 11.4%, and 13.1%, respectively.

The average gross tonnage of tankers in service increased from 22,366 tons in 1971 to 23,697 tons in 1972; in terms of deadweight tonnage the increase was from 39,087 to 42,107 tons. By way of comparison, in 1966 the average gross tonnage was 16,343 tons, and the average deadweight tonnage was 25,768 tons. The growing dependence on tankers is most noticeable when examined by various size groups, especially when data on existing vessels are compared with those for planned new construction. Table 23, compiled from a source other than the U.S. Maritime Commission (and therefore differing slightly in totals given by that source and appearing elsewhere in this section), indicates that the total world tanker fleet amounted to 193.9 million deadweight tons, with an additional 120.2 million tons in progress or on order at yearend 1972. Vessels in service over the 285,000-ton class accounted for 3.5 million tons, while those vessels in the same weight class in progress or on order totaled 20.9 million tons. Included among the latter are two 530,000-ton tankers to be built in France. These two supertankers, when completed will exceed the biggest ship now afloat by 260,000 tons, and will have a capacity of 3.7 million barrels of oil, with a draft of 93 feet. Vessels of this size will not be without problems, as the added capacity and draft may prevent their navigating waterways now used, such as the Malacca Strait and the Lombok and Makassar Straits, and thus increase travel time. Vessels in service in the 205,000-ton class amounted to 58.6 million tons, while those of the same class in progress or on order totaled 71.7 million tons. Completion of all vessels in progress or on order and their addition to the vessels in service will bring the total fleet to 314.1 million tons. Discounting reductions in tonnage due to scrapings, losses or other deletions from the fleet in service by yearend 1972, 56.8% of the tanker fleet will consist of ships over 125,000 tons.

The percentage of total tonnage, for the years 1971 and 1972, in terms of the year of completion of vessels classified as tankers is given in the following tabulation:

Year of completion	Percentage of total tonnage	
	1971	1972
Up to yearend 1945	3.1	2.7
1946-50	1.4	1.1
1951-55	9.5	6.5
1956-60	16.8	15.2
1961-65	20.1	18.2
1966-70	38.8	34.8
1971-72	10.3	21.5

Source: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry—1971 and 1972. Baynard Press, London, 1971, 1972, p. 14.

A breakdown of the world tanker fleet at yearend 1972 in terms of flag of registry ranked in order of national aggregate deadweight tonnage follows:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	809	50,273
United Kingdom	437	24,447
Japan	436	23,281
Norway	376	20,280
Greece	256	9,848
United States	280	8,193
France	132	8,152
Panama	198	7,313
Italy	208	5,613
U.S.S.R	444	5,437
Sweden	78	3,795
Denmark	58	3,624
Spain	109	3,515
Netherlands	82	3,200
Other	678	15,923
Total	4,581	192,894

Bulk Carriers.—In 1972, 321 vessels were added to the world bulk carrier fleet, raising the total to 3,539 vessels. This represents an increase of 8.9% between 1970 and 1971. The growth rate of bulk carriers was

considerably more substantial in both tonnage categories, increasing 17.8% in gross tonnage and 19.3% in deadweight tonnage. These figures compare with 16.5% and 17.9%, respectively, in 1971.

These percentage increases in bulk-carrier tonnage capacity are considerably greater than for any other class of vessel and may be attributed chiefly to the addition of ore carriers and large combination (ore-oil-other material) carriers which are noted for their versatility in changing market conditions. Maritime Commission data does not distinguish mineral-commodity oriented bulk carriers from those engaged in agricultural trade, but other sources indicate that at yearend 1972, 16.8 million deadweight tons of combined carriers were in building progress or on order. The absence of information prohibits the determination of the total number of these vessels currently in service; however, 21.5 million deadweight tons of combination carriers were in the building stage or on order by yearend 1971, and it may be assumed that a substantial number of these vessels were active by yearend 1972.

The average size of bulk carriers has continued to increase. The average gross tonnage of bulk carriers was 18,316 tons by yearend 1972, compared with 17,014 tons in 1971 and 10,967 tons in 1966. Comparable figures for deadweight tonnage in the same time periods are 30,662, 28,267, and 16,762 tons, respectively.

The total number of bulk carriers in service, as well as the total of the aggregate deadweight tonnage of such vessels under the major flags of registry for 1972 are indicated in the following tabulation:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	753	27,395
Japan	525	19,420
Norway	362	14,502
United Kingdom	326	10,787
Greece	293	7,499
Italy	136	4,388
Germany, West	78	3,277
Sweden	79	3,017
France	64	1,694
Panama	111	1,649
India	44	1,609
Spain	46	1,183
U.S.S.R	135	915
Poland	56	909
Denmark	29	860
United States	32	702
Other	470	8,706
Total	3,539	108,512

Freighters.—Though a smaller proportion of freighters is involved in the transport of mineral commodities than are tankers and bulk carriers, they are the prime class of ocean carrier moving processed mineral goods, particularly metal smelter and mill products. In 1972, freighters accounted for 52.8% of the total number of vessels of the world's merchant fleet, 26% of the aggregate gross tonnage, and 22.2% of the aggregate deadweight tonnage. Although the number of such vessels was down from the previous year, both gross weight and deadweight tonnage capacity increased, mainly because of increased construction of large container ships. Exemplary of the demand for freighters is the increased world shipment of finished and semifinished metal products, which increased by 12% in 1972 over 1971 figures through the Panama Canal alone. Aggregate gross tonnage increased by 1,141,000 tons, compared with 879,000 tons for the previous year. Deadweight tonnage amounted to 665,000 tons, compared with 877,000 tons in 1971.

Freighters showed a modest increase in tonnage size, from an average of 5,772 gross tons, and 7,959 deadweight tons in 1971 to 5,879 gross tons and 8,025 deadweight tons in 1972.

The following tabulation lists the principal nations of registry of freighters in order of their share in the aggregate deadweight tonnage of the total world freighter fleet at year end 1972:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Japan	1,148	9,210
Greece	903	8,123
United States	666	7,990
U.S.S.R	1,250	7,747
United Kingdom	700	6,610
Liberia	513	5,144
Germany, West	591	4,701
Norway	390	3,210
Panama	528	3,151
Netherlands	288	2,423
Cyprus	325	2,350
India	183	1,924
Other	3,602	26,387
Total	11,087	88,970

PANAMA AND SUEZ CANALS

In 1972 the Panama Canal registered a lower level of commodity transit than in 1971. Both total number of transits and cargo tonnage moved declined, although

toll revenues increased primarily because of increased use of large container ships. The grand total of 110,987,000 tons of cargo passing through the canal in vessels classified as commercial ocean traffic represented the first decline since 1963. Of this total, 56.3%, or 62,477,000 tons, consisted of mineral commodities, a decrease of 13.5% from the previous year's total of mineral commodity tonnage. The reduction in number of transits through the canal in 1972, down 254 from the previous year, and the lower level of cargo tonnage moved is attributed mainly to a slowdown in the Japanese economy as well as both east and gulf coast dock strikes in the United States and a Japanese seamen's strike. The Japanese recession, mainly keyed to the steel industry, greatly affected the flow of mineral commodities from Atlantic to Pacific. Mineral commodity movement and its importance in Panama Canal activity is summarized in the following tabulation:

	Fiscal years		
	1970	1971	1972
Number of transits:			
Commercial ocean traffic	13,658	14,020	13,766
Other traffic	1,865	1,328	1,432
Total	15,523	15,348	15,198
Cargo moved (million metric tons):			
Commercial ocean traffic:			
Mineral commodities	72.5	72.2	62.4
Other commodities	43.6	48.3	48.6
Subtotal	116.1	120.5	111.0
Other traffic, all commodities	4.7	2.4	1.8
Total	120.8	122.9	112.8

A detailed breakdown of commercial ocean traffic through the canal for the years 1971 and 1972, in terms of vessel type, cargo tonnage, number of transits, direction of movement (Atlantic to Pacific, Pacific to Atlantic), and by the status of the vessel (in ballast or laden) is given in table 24. A further detailed tabulation of specific mineral commodities and commodity groups by direction of movement over a 3-year period is listed in table 25.

The major movement of mineral commodities was from Atlantic to Pacific and amounted to 66% of total Panama Canal mineral commodity traffic in 1972, compared with 71.5% in 1971. This reduction, which was only slightly compensated for by increased shipments from the Pacific to the Atlantic, amounted to 10,426,000 tons of mineral commodities. Examination of table 25 indicates that coal, coke, and scrap metal shipments, primarily destined for the Japanese steel industry, fell sharply. Coal and coke declined by 7,840,000 tons, while scrap tonnage was nearly halved. An added factor in the transport of coal through the Panama Canal was the effect of adverse competition from large bulk carriers bypassing the canal to travel the Cape of Good Hope route to Japan. Bauxite, alumina, and crude petroleum showed increases in both transit directions, with crude petroleum from the west coast South American countries of Colombia and Ecuador bolstering traffic in this commodity. Coal and coke and petroleum (crude and refined) continued to be the dominant commodities in transit destined for the Pacific in 1972 despite the slowdown previously mentioned; in 1972 coal and coke together accounted for 34.8% of the total, and petroleum for 33.8%. Steel semimanufacturers continued to account for a growing proportion of Atlantic-bound mineral commodities—36.7% in 1972, compared with 31.5% in 1971. In terms of the previous year's Atlantic-bound shipments of steel semimanufactures, 1972 tonnage increased 1,299,000 tons, up 20%, with the bulk of this weight from Japan to the United States and Europe.

The Suez Canal remained closed throughout 1972, making it the fifth full year that the canal has had a negative influence on marine mineral transport patterns. Opening of the canal appeared to be one of the less pressing issues under consideration by Egypt and Israel, the combatants in the Middle East conflict. The prolonged closure of this waterway has resulted in the virtual creation of the mammoth tanker industry, and the threat of continued hostilities in the region has greatly lessened future dependence on the Suez Canal (barring any extensive expansion plans) for the movement of much needed crude oil. Deliveries from the Persian Gulf to European markets increased and, except for shipments moving overland by pipeline from the producing areas to Eastern Mediterranean ports, which are restricted by pipeline capacity, the entirety of such oil shipments reached their destinations by way of the Cape of Good Hope shipping route.

OCEAN FREIGHT RATES

Ocean freight rates in 1972 for selected countries appeared to be erratic in comparison with 1971 rates, but were generally on the down side and well below the record freight rates recorded in 1970. United Nations indexes, previously revised to permit more complete coverage of selected rates chosen for publication, were not complete for two categories. However, available information indicates generally depressed rates for the first quarter of 1972, with a steady climb through the second and third quarters, finishing the year with abruptly higher rates in the fourth quarter. Increased utilization of supertankers and container cargo vessels in 1972 may account in part for the reduced rates. United Nations indexes of selected ocean freight rates for 1969-72, including quarterly figures for 1971 and 1972, are presented in table 26.

PIPELINES

Because of the general unavailability of complete worldwide summaries of existing pipeline systems, detailed reporting of pipeline development on a worldwide basis is limited. However, mention of several major projects of international significance during 1972 is made in the following section.

In both western and eastern Europe, the inadequacy of existing crude oil and gas pipelines has necessitated the construction of additional capacity, usually incorporating larger diameter pipe parallel to existing lines. The Fos to Lyon 26-inch pipeline, part of the South European Pipeline system, was completed, with the Fos-Lyon section of the 40-inch line to Strasbourg well underway. Construction of the Druzhba II line, which is to parallel the present Druzhba system extending 2,796 miles, continued throughout the year. Work on the largest natural gas pipeline in Europe, consisting of 38-inch and 36-inch-diameter steel pipe, has begun. It will extend 507 miles from Bocholtz on the border of the Netherlands near Aachen to a terminal at Mortara in northern Italy. Construction of the line, scheduled for completion at the end of 1973, includes three river crossings, the Moselle river and the Rhone river twice, in the 302-mile section from the Dutch point to Switzerland. Yugoslavia has started development on two major crude oil pipelines, and Austria and Finland are considering construction of a product pipeline and a natural gas pipeline, respectively. Exploration of crude oil and natural gas from North Sea finds has resulted in considerable pipeline planning in that region. One plan calls for a pipeline system to bring oil from Cod, Tor, West Ekofisk, and Eldfisk on the Norwegian coast to Teeside on the United Kingdom's east coast. Construction of the gathering lines and 220 miles of 30-inch crude oil pipeline is to start in 1973. In the United Kingdom itself contracts have been awarded for creation of a 265-mile product pipeline from Milford Haven to Midlands and Manchester, for a 32-inch line extending 111 miles to Cruden Bay from the Forties Field, and a 36-inch line extending 130 miles from Cruden Bay to Grangemouth.

Studies on the construction of a sub-Mediterranean gas pipeline to Italy from Algeria continued. The most recent plans considered feasible involve a 553-mile line from Hassi R' Mel to Cap Bon in Tunisia, then 311 miles across the Mediterranean, Sicily and the Straits of Messina to Italy. Diameter of the pipe is to be decided when capacity of the line, originally put at 233 billion cubic feet per year, is finally determined.

In the Near East, the Suez Canal continued closed since no agreements for its reopening could be reached between Egypt and Israel. The Sumed line, a planned 205-mile 42-inch-diameter crude oil pipeline from Ain Soukhna to a point near Alexandria, came closer to realization as agreement in principle on the general financing of the project was reached. The line would serve as a bypass to the Suez Canal.

The U.S.S.R. appeared to be the main region of pipeline development in 1972, especially with regard to agreements with Japan, Afghanistan, Iran, Finland, and several eastern European nations. The first 508-mile section of the 48-inch crude oil pipeline from Tyumen in West Siberia to Nokhodka on the Sea of Japan was completed. Work started on a 900-mile section to Irkutsk, and was expected to be in operation by nearly 1973. The section from Anzhero-Sudzhensk to Irkutsk will run parallel to the existing trans-Siberian pipeline, and will have a capacity three times that of the older line. Plans for

extension of the line through Irkutsk to Nokhodka came closer to realization as Japan granted a loan request to the U.S.S.R. Construction was also in progress on the 1,140-mile crude oil pipeline from Ust Balyk via Tobolsk, Tyumen, Kurgan, Ufa, and Chelyabinsk to Almetyevsk, where it will link with the Druzhba system supplying Poland, East Germany, Czechoslovakia, and Hungary. The U.S.S.R. also completed a 311-mile diesel fuel line from Podolsk in Byelorussia to the Baltic port of Ventspils. Iran is on the second stage of the gas trunk line system to the Soviet frontier. The completed first stage consisted of 687 miles of 40-inch to 42-inch main line and 422 miles of branch lines to Shiraz, Kashan, Ghom, and Tehran. Gas pipelines were also planned between the U.S.S.R. and Finland and Afghanistan.

In Japan contracts were awarded for the first major Japanese oil products line. It will total 250 miles in two main branches from refineries in the Toyko area to inland terminals at Utsunomiya and Maebashi. Japan has also suggested the construction of a pipeline across the Isthmus of Kra in southern Thailand to link the Indian Ocean with the Gulf of Siam, but sensitive national interests may preclude its finalization. Australia plans to build an 850-mile, 34-inch gas pipeline from the Cooper Basin to Sydney, New South Wales.

In the Western Hemisphere, the oilfields at Alaska's north slope continued to be the focus of attention. The final report on environmental impact of the proposed pipeline was released, and the right-of-way for its construction was to be granted, but an appeal of the decision was expected to postpone activity for another 18 months. Stringent requirements to be met by the pipeline include antispill valves between pumping stations and continuous monitoring of seismic activity, as well as contingency plans in earthquake zones. Interest in having the pipeline constructed on Canadian territory is diminishing because of increased cost and hazard to the environment.

Discoveries of natural gas in the Arctic islands indicate a major gas reserve by world standards. The likelihood of a pipeline from that region is increasing, with a request for construction of a 48-inch line from the Mackenzie Delta expected shortly. Canada has several major project proposals underway, including the recovery and transport of natural gas liquids and condensate. Proposed is a plan for an extensive network of lines collecting ethane in Alberta and moving it along 1,000 miles of 8-inch to 16-inch main line to the United States-Saskatchewan border.

In South America, Argentina is planning construction of a 450-mile natural gas pipeline from fields in lower Patagonia to areas in and around Buenos Aires. Bolivia, after 4 years of delay, finally completed its 330-mile natural gas pipeline from the Santa Cruz fields to Yacuiba, making it South America's first major gas-exporting country. Under consideration now is a 1,242-mile line from Santa Cruz to Sao Paulo, Brazil. Ecuador initiated its first shipments of crude oil via 318 miles of pipeline from the Oriente region to a terminal at Balao for shipment through the Panama Canal.

PRICES

The average price of mineral commodities as a group advanced in 1972, despite declines in the average price of several major individual commodities. World production of raw steel in 1972 was up 8% over 1971 output, and price increases occurred in most major western steel producing countries. In the United States price increases for steel went into effect in January and were to remain frozen through the remainder of the year. The cost of installation of pollution control equipment continued to rise, resulting in a trend toward consolidation of plants and company mergers to reduce costs.

The average annual price of several major nonferrous metals for the United States, the United Kingdom, and Canada is given in tables 27, 28 and 29, with average monthly prices of these same commodities for 1972. Average zinc prices continued to climb strongly as in the previous year, with all three countries registering new highs. In the United States, zinc prices climbed steadily throughtout the year. In the United Kingdom prices were relatively erratic reaching a peak price in April. In Canada, average zinc prices rose consistently for the first half of the year, reaching a high in June, but fell off

slightly in the last 6 months. Lead prices finished up over the previous year's price, generally following the same price pattern for all three countries. In the United States, lead prices averaged up during the first 5 months, then declined gradually in the last 7 months. Canadian lead prices followed the U.S. price except for a slight increase in August. As in the case of zinc, lead prices in the United Kingdom were erratic, following no set pattern. The average price of tin increased sharply in the United Kingdom and moderately in the United States, with increases sufficient to surpass the previous price levels of 1970. Copper prices fell again in 1972 on all three markets, but the decline was considerably less than that taking place between 1970 and 1971. Aluminum, which was the only nonferrous metal in addition to zinc to increase in price in 1971, declined substantially on both U.S. and United Kingdom markets in 1972. In the United Kingdom, aluminum prices rose during the first quarter, but fell sharply in May and June, remaining at 25.000 cents per pound through the remainder of the year. As of May 1972, aluminum prices were no longer quoted in Canada. The price per ounce of silver, which dropped drastically in 1971 on all three markets, regained a substantial portion of the loss in 1972. All three markets also showed similar price fluctuations during identical periods, with prices climbing steadily throughout the year except for declines in June and September.

Mineral commodity export price indexes and an analysis of export price indexes as recorded by the United Nations are given in tables 30 and 31. The overall crude mineral export price index showed a gain of 14 index points in 1972 over 1971, reaching 141 (1963=100). Most of this increase occurred between the last quarter of 1971 and the first quarter of 1972. The price index of both metal ores and fuels gained, with the growth of the export price index of fuels twice that for metal ores. As with the total for crude minerals, the major portion of the increase for these two mineral commodity divisions took place between the final quarter of 1971 and the first quarter of 1972. The export price index of metal ores fell 1 index point in the second quarter, regained the loss in the third quarter, but then fell off 6 index points to close the year at an average of 134. Fuels increased gradually or remained stable through the year, ending at an annual average of 143 for 1972.

In the table analysis of export price indexes, the price index of total minerals rose to an annual average of 154, up 9 nine points from the previous year, for developed areas. The price index for developing areas rose 16 points from a lower base to an annual average of 135. The export price index of nonferrous base metals declined 1 index point for developed areas while increasing 1 point for developing areas. In both areas, the first quarter of 1972 showed considerably higher price levels than for the last three quarters.

The average prices and indexes of other individual mineral commodities in world export markets is not available in comparable form to those previously listed in this chapter. However, as crude oil and petroleum refinery products account for the greatest portion of total world mineral products value, and as demand for these commodities continued to increase strongly, it is reasonable to assume that these commodities also advanced in price in 1972.

STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR COMMODITIES

The final 30 tables in this chapter (tables 32 to 61) extend the statistical series that was started in the 1963 edition of the International Area Reports volume of the Minerals Yearbook and that was subsequently updated in the 1965, 1967, 1968, 1969, 1970, and 1971 editions. They are provided both as a supplement to other statistical data within this chapter and as a summary of international production and trade data for major commodities covered in greater detail on a commodity basis in Volume I of the 1972 Minerals Yearbook and on a country basis in Volume III.

The data presented here on production (tables 32 to 50) in most instances represent the most accurate figure available at the time of compilation of this chapter, which was subsequent to the completion

of all commodity and country chapters. Because of this, they may differ from data presented in this volume in the country chapters (where a more reliable figure became available after the country chapter was completed) and/or from the metric unit equivalent of data presented in Volume I (where a more reliable figure became available subsequent to the completion of the commodity chapter).

The data on world trade in major mineral commodities presented in this chapter (tables 51 to 61) may not correspond exactly to those presented elsewhere in the Minerals Yearbook because these summary tables are compiled from sources other than those used in the individual country chapters in order to obtain data on a consistent basis. The differences, however, are regarded as unimportant from the viewpoint of displaying the general pattern of trade in these commodities.

Table 1.—United Nations' indexes of world[1] mineral industry production

Industry sector and geographic area	1970	1971	1972	1972 by quarters 1st	2nd	3rd	4th
EXTRACTIVE INDUSTRIES							
Metals:							
Non-Communist world	147	144	141	133	142	140	150
Industrialized countries[2]	152	149	145	134	146	142	157
United States and Canada	136	132	128	122	134	122	133
Europe	121	124	126	121	134	115	133
European Economic Community[3]	90	86	82	83	83	76	84
European Free Trade Association[4]	138	144	148	145	163	123	161
Australia and New Zealand	192	206	214	193	202	234	227
Less industrialized countries[5]	196	206	211	206	206	213	220
Latin America[6]	140	141	140	134	140	139	146
Asia[7]	139	143	143	141	141	141	147
Communist Europe[8]	187	201	211	215	211	211	206
World	156	157	157	151	158	155	163
Coal:							
Non-Communist world	90	88	83	78	87	79	87
Industrialized countries[2]	87	85	80	74	85	76	84
United States and Canada	124	118	124	123	131	118	123
Europe	74	73	63	55	67	59	70
European Economic Community[3]	73	71	61	52	66	57	68
European Free Trade Association[4]	64	61	61	66	59	61	61
Australia and New Zealand	151	159	181	162	189	189	186
Less industrialized countries[5]	122	125	127	128	125	125	128
Latin America[6]	139	152	151	NA	NA	NA	NA
Asia[7]	121	121	123	123	123	120	125
Communist Europe[8]	124	128	130	133	127	127	133
World	104	105	103	101	104	100	106
Crude petroleum and natural gas:							
Non-Communist world	166	173	180	178	175	178	188
Industrialized countries[2]	137	141	149	149	144	145	156
United States and Canada	129	130	135	133	132	135	138
Europe	234	276	322	348	293	272	375
European Economic Community[3]	262	318	377	412	342	311	443
European Free Trade Association[4]	NA	NA	NA	NA	NA	NA	NA
Australia and New Zealand	NA	NA	NA	NA	NA	NA	NA
Less industrialized countries[5]	196	206	211	206	206	213	220
Latin America[6]	121	118	112	108	112	114	114
Asia[7]	192	218	229	221	222	230	243
Communist Europe[8]	175	187	199	205	202	195	191
World	168	177	184	184	181	182	189
Total extractive industry:							
Non-Communist world	152	155	165	160	165	161	175
Industrialized countries[2]	150	152	162	157	163	158	172
United States and Canada	140	141	152	146	153	152	158
Europe	148	152	160	158	161	147	172
European Economic Community[3]	144	147	154	153	155	142	166
European Free Trade Association[4]	122	125	126	126	133	112	135
Australia and New Zealand	165	176	187	168	185	200	195
Less industrialized countries[5]	166	178	189	181	188	191	198
Latin America[6]	160	171	182	NA	NA	NA	NA
Asia[7]	182	204	314	205	209	217	226
Communist Europe[8]	155	165	174	177	175	172	170
World	146	151	155	152	155	154	158
PROCESSING INDUSTRIES							
Base metals:							
Non-Communist world	149	144	157	150	159	152	166
Industrialized countries[2]	149	142	155	148	157	150	164
United States and Canada	128	120	134	128	139	127	141
Europe	147	141	149	145	152	144	157
European Economic Community[3]	142	135	140	136	143	136	146

See footnotes at end of table.

Table 1.—United Nations' indexes of world [1] mineral industry production—Continued

Industry sector and geographic area	1970	1971	1972	1972 by quarters 1st	2nd	3rd	4th
PROCESSING INDUSTRIES—Continued							
Base metals—Continued							
Non-Communist world—Continued							
Industrialized countries [2]—Continued							
Europe—Continued							
European Free Trade Association [4]	152	150	160	161	162	143	172
Australia and New Zealand	150	139	140	131	131	144	155
Less industrialized countries [5]	161	172	187	181	184	192	194
Latin America [6]	167	186	201	187	201	209	207
Asia [7]	157	152	171	175	161	169	178
Communist Europe [8]	164	174	184	187	183	184	183
World	154	153	164	161	166	162	171
Nonmetallic mineral products:							
Non-Communist world	140	147	157	140	160	161	164
Industrialized countries [2]	137	141	150	135	155	155	157
United States and Canada	118	123	131	119	134	138	134
Europe	144	150	159	139	167	162	167
European Economic Community [3]	139	143	152	132	160	155	159
European Free Trade Association [4]	149	153	160	145	169	157	168
Australia and New Zealand	141	143	150	131	154	157	158
Less industrialized countries [5]	170	191	206	187	205	213	220
Latin America [6]	173	193	210	194	207	217	221
Asia [7]	170	193	206	183	207	213	223
Communist Europe [8]	179	195	204	201	209	199	207
World	155	165	174	163	179	176	180
Chemicals, petroleum, and coal products:							
Non-Communist world	185	196	213	204	213	211	223
Industrialized countries [2]	186	196	213	205	214	211	223
United States and Canada	171	180	199	188	201	203	206
Europe	194	203	218	214	218	207	231
European Economic Community [3]	190	200	211	209	212	201	224
European Free Trade Association [4]	190	197	210	207	213	197	223
Australia and New Zealand	169	192	203	187	206	198	219
Less industrialized countries [5]	186	196	213	205	214	211	223
Latin America [6]	175	191	206	NA	NA	NA	NA
Asia [7]	187	201	224	220	225	218	232
Communist Europe [8]	213	234	258	255	261	256	259
World	191	203	222	215	223	220	230
OVERALL INDUSTRIAL PRODUCTION							
Non-Communist world	152	155	165	160	165	161	175
Industrialized countries [2]	150	152	162	157	163	158	172
United States and Canada	140	141	152	146	153	152	158
Europe	148	152	160	158	161	147	172
European Economic Community [3]	144	147	154	153	155	142	166
European Free Trade Association [4]	152	155	162	159	166	147	175
Australia and New Zealand	145	150	153	140	153	158	160
Less industrialized countries [5]	150	152	162	157	163	158	172
Latin America [6]	160	171	182	NA	NA	NA	NA
Asia [7]	164	178	191	185	185	192	201
Communist Europe [8]	177	191	205	208	207	201	203
World	159	165	176	173	177	172	183

NA Not available.

[1] Excludes Albania, the People's Republic of China, Mongolia, North Korea, and North Vietnam.

[2] Canada, the United States, all countries of Europe except those listed in footnotes 1 and 8, the Republic of South Africa, Israel, Japan, Australia, and New Zealand.

[3] Belgium, Denmark, France, West Germany, Ireland, Italy, Luxembourg, the Netherlands, and the United Kingdom. These numbers are not comparable to those given in previous editions of this chapter for the European Economic Community, which did not include data for Denmark, Ireland, and the United Kingdom, nations which joined the Community on January 1, 1973.

[4] Austria, Norway, Portugal, Sweden, and Switzerland. These numbers are not comparable to those given in previous editions of this chapter for the European Free Trade Association, which included data for Denmark and the United Kingdom.

[5] Countries not indicated in footnotes 1, 2, and 8.

[6] Corresponds to the United Nations classification "Caribbean, Central, and South America".

[7] Corresponds to the United Nations classification "Asia, excluding Israel and Japan".

[8] Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.

Source: United Nations. Monthly Bulletin of Statistics. August 1973, pp. xii-xxv.

Table 2.—World production[1] of major mineral commodities

Commodity		1970	1971	1972 p
METALS				
Aluminum:				
Bauxite	thousand metric tons	57,786	63,509	65,314
Alumina	do	20,765	22,642	23,233
Unalloyed ingot metal	do	9,653	10,319	11,031
Antimony	do	70	64	68
Arsenic, white[2]	do	50	50	43
Beryl[2]	metric tons	6,221	5,302	4,139
Bismuth[2]	do	3,716	3,289	4,078
Cadmium	do	16,535	15,531	16,758
Chromite	thousand metric tons	6,053	6,267	6,024
Cobalt:				
Mine[2]	metric tons	23,854	21,731	23,382
Refined	do	21,322	22,388	20,617
Columbium-tantalum concentrates[3]	do	20,479	10,893	15,840
Copper:				
Mine	thousand metric tons	6,022	6,036	6,631
Smelter	do	6,125	6,114	6,684
Gold	thousand troy ounces	47,522	46,491	44,809
Iron and steel:				
Iron ore	thousand metric tons	769,163	779,336	768,359
Pig iron[4]	do	430,702	429,928	455,578
Ferroalloys[4]	do	9,676	9,695	9,668
Crude steel	do	594,418	580,476	627,116
Lead:				
Mine	do	3,394	2,424	3,492
Smelter	do	3,292	3,176	3,367
Magnesium	do	220	232	234
Manganese ore	do	18,222	21,019	21,452
Mercury	thousand 76-pound flasks	284	299	276
Molybdenum	metric tons	82,295	77,492	79,737
Nickel	thousand metric tons	628	635	639
Platinum-group metals	thousand troy ounces	4,239	4,084	4,263
Selenium[5]	metric tons	1,308	1,146	1,303
Silver	thousand troy ounces	300,991	288,883	298,765
Tellurium	metric tons	166	154	191
Tin:				
Mine[2]	thousand long tons	229	232	240
Smelter	do	r2224	232	236
Titanium concentrates:				
Ilmenite[3]	thousand metric tons	3,595	3,361	3,258
Rutile[2 3]	do	417	384	323
Tungsten, mine output, metal content	metric tons	32,368	36,625	38,390
Uranium oxide (U_3O_8)[3]	do	21,918	21,701	23,310
Vanadium[3]	do	18,299	16,847	18,065
Zinc:				
Mine	thousand metric tons	5,464	5,584	5,551
Smelter	do	4,827	4,695	4,857
NONMETALS				
Asbestos	do	3,494	3,585	3,737
Barite	do	3,935	3,838	3,959
Cement, hydraulic	do	571,204	605,649	639,006
Diamond:				
Gem	thousand carats	13,297	12,351	12,192
Industrial	do	29,198	28,751	31,513
Diatomite	thousand metric tons	1,591	1,553	1,520
Feldspar	do	2,528	2,494	2,912
Fluorspar	do	4,192	4,757	4,396
Graphite[2]	do	393	390	358
Gypsum	do	51,590	53,118	57,963
Magnesite[2]	do	8,857	9,049	11,890
Mica	do	164	170	239
Nitrogen fertilizers, contained nitrogen[6]	do	30,265	32,935	35,102
Phosphate rock	do	84,944	87,126	93,612
Potash (marketable), K_2O equivalent	do	18,155	19,792	20,433
Pumice[3]	do	14,335	15,800	16,084
Pyrites, including cupreous, gross weight	do	22,334	21,801	20,406
Salt	do	146,130	144,180	147,210
Strontium minerals[3]	metric tons	59,947	110,189	105,802
Sulfur, elemental:				
Frasch and from ores	thousand metric tons	12,851	12,646	13,073
Byproduct	do	9,667	10,441	9,810
Talc, soapstone, and pyrophyllite	do	4,823	4,724	4,758
Vermiculite[3]	do	391	416	465

See footnotes at end of table.

Table 2.—World production[1] of major mineral commodities—Continued

Commodity		1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS				
Coal:[7]				
Anthracite	million metric tons	180	180	177
Bituminous	do	2,040	2,034	2,062
Lignite	do	789	800	802
Total	do	3,009	3,014	[8] 3,042
Coke:				
Metallurgical	thousand metric tons	350,453	338,361	340,456
Other types	do	25,778	22,397	18,375
Fuel briquets	do	125,549	91,136	77,999
Gas, natural, marketed	billion cubic feet	37,590	40,252	42,497
Peat	thousand metric tons	83,485	81,293	90,868
Petroleum, crude	million barrels	16,711	17,663	18,598

p Preliminary.

[1] Incorporates numerous revisions from world production tables and country production tables appearing in Volumes I and III, respectively, of the Minerals Yearbook as well as in the corresponding table in previous editions of this chapter.

[2] U.S. production data withheld to avoid disclosing individual company confidential data.

[3] Excludes production from Communist countries: Albania, Bulgaria, People's Republic of China, Cuba, Czechoslavakia, East Germany, Hungary, Mongolia, North Korea, North Vietnam, Poland, Romania, U.S.S.R., and Yugoslavia, except in the case of vanadium which includes a figure for the U.S.S.R. alone.

[4] Data presented for pig iron includes relatively small quantities of ferroalloys (not duplicating quantities reported under ferroalloys) produced in a few countries that do not report ferroalloy production separate from pig iron production.

[5] Excludes production from countries listed in footnote 3 except for Yugoslavia.

[6] Years ending June 30 of that stated.

[7] Production of coal by some countries is not reported divided into the three categories listed; such output has been distributed to the three listed grades according to best available information from supplementary sources relating to the quality of such coals.

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

Table 3.—Approximate percentage distribution of world mineral commodity production by major area in 1972 [1]

Commodity	Western Hemisphere			Eastern Hemisphere							World	
				Europe			Near East and Asia					
	North and Central America [2]	South America	Total	Non-Communist [3]	Communist [4]	Africa	Non-Communist	Communist [5]	Oceania	Total	Non-Communist [3]	Communist [2]
METALS												
Aluminum:												
Bauxite	24.3	17.2	41.5	12.2	11.3	5.6	6.5	.8	22.1	58.5	87.9	12.1
Alumina	41.3	7.5	48.8	12.8	13.1	2.9	8.9	1.2	12.3	51.2	85.7	14.3
Aluminum ingot	42.6	1.6	44.2	22.7	14.9	2.2	12.0	1.3	2.7	55.8	83.8	16.2
Antimony, mine output	7.1	20.7	27.8	5.6	11.1	24.4	11.5	17.6	2.0	72.2	71.3	28.7
Arsenic, white [6 7]	11.8	2.7	14.5	62.2	16.6	5.5	1.2	XX	--	85.5	83.4	16.6
Beryllium, beryl concentrate [6 7]	(8)	44.0	44.0	.4	32.6	23.0	--	XX	--	56.0	67.4	32.6
Bismuth, mine output [6 7]	19.9	38.2	58.1	5.1	3.3	(8)	24.2	XX	9.3	41.9	96.7	3.3
Cadmium, smelter output	28.8	1.3	30.1	23.5	19.7	3.0	18.2	1.2	4.3	69.9	79.1	20.9
Chromium, chromite [7]	--	.5	.5	2.5	40.2	31.2	25.6	XX	--	99.5	59.8	40.2
Cobalt:												
Mine [6 7]	14.5	--	14.5	5.6	7.0	69.7	--	XX	3.2	85.5	86.5	13.5
Smelter [7]	4.5	--	4.5	14.3	8.0	73.2	NA	XX	--	95.5	92.0	8.0
Columbium-tantalum, concentrate [9]	23.4	61.8	85.2	(8)	XX	13.2	.4	XX	1.2	14.8	100.0	XX
Copper:												
Mine	34.9	14.9	49.8	3.8	13.3	21.2	5.6	1.7	4.6	50.2	85.0	15.0
Smelter	30.1	13.0	43.1	6.9	13.4	20.5	12.2	1.7	2.2	56.9	84.9	15.1
Gold, mine output	8.5	1.5	10.0	.6	15.5	68.3	2.3	.5	2.8	90.0	84.0	16.0
Iron and steel:												
Iron ore	15.6	10.1	25.7	16.1	28.0	7.8	5.3	8.8	8.3	74.3	63.2	36.8
Pig iron	20.1	1.7	21.8	24.6	26.0	1.2	17.8	7.2	1.4	78.2	66.8	33.2
Ferroalloys [7]	26.9	1.9	28.8	29.0	15.9	5.1	20.4	XX	.8	71.2	84.1	15.9
Crude steel	21.9	1.7	23.6	26.2	27.2	.9	17.0	4.0	1.1	76.4	68.8	31.2
Lead:												
Mine	32.4	8.0	40.4	13.1	19.5	5.9	4.1	5.5	11.5	59.6	75.0	25.0
Smelter	29.0	4.5	33.5	20.5	20.8	3.4	7.1	5.2	9.5	66.5	74.0	26.0
Magnesium, smelter	49.0	--	49.0	22.9	23.0	--	4.7	.4	--	51.0	76.6	23.4
Manganese, ore, gross weight	1.4	12.3	13.7	.3	37.4	28.9	9.2	4.7	5.8	86.3	57.9	42.1
Mercury, mine output	16.1	1.4	17.5	41.8	20.5	4.9	5.9	9.4	(8)	82.5	70.1	29.9
Molybdenum, mine output	78.0	8.4	86.4	.7	10.5	--	.5	1.9	(8)	13.6	87.6	12.4
Nickel, mine output [7]	47.1	.6	47.7	3.9	19.8	3.7	3.6	XX	21.3	52.3	74.6	25.4
Platinum-group metals, mine output [7]	9.8	.6	10.4	(8)	55.1	34.1	.4	XX	(8)	89.6	44.9	55.1
Selenium, smelter output [9]	53.0	.6	53.6	18.2	XX	--	25.7	XX	2.5	46.4	100.0	XX
Silver, mine output	42.7	18.7	61.4	6.1	15.8	3.6	5.1	.5	7.5	38.6	83.7	16.3
Tellurium, smelter output [9]	72.3	9.4	81.7	--	XX	--	18.3	XX	--	18.3	100.0	XX
Tin:												
Mine [6]	.2	14.6	14.8	1.8	12.4	7.4	50.4	8.3	4.9	85.2	79.3	20.7
Smelter	1.8	4.2	6.0	12.9	12.6	4.3	52.7	8.6	2.9	94.0	78.8	21.2
Titanium concentrate:												
Ilmenite [9]	44.6	.1	44.7	24.0	XX	--	9.5	XX	21.8	55.3	100.0	XX
Rutile [6 9]	(8)	.1	.1	--	XX	--	1.6	XX	98.3	99.9	100.0	XX
Tungsten, mine output	15.3	11.7	27.0	5.9	18.8	2.4	18.4	24.7	2.8	73.0	56.5	43.5
Uranium oxide (U_3O_8) [9]	69.3	.4	69.7	8.2	XX	22.1	--	XX	--	30.3	100.0	XX
Vanadium [7]	24.6	3.6	28.2	13.2	14.4	44.2	--	XX	--	71.8	85.6	14.4
Zinc:												
Mine	35.1	8.2	43.3	13.2	17.8	4.8	7.5	4.3	9.1	56.7	77.9	22.1
Smelter	22.1	2.6	24.7	25.8	20.9	3.4	14.6	4.5	6.1	75.3	74.6	25.4

NONMETALS												
Asbestos	44.3	.9	45.2	4.0	32.7	11.5	1.8	4.3	.5	54.8	63.0	37.0
Barite	29.0	7.9	36.9	29.6	13.0	3.8	9.1	7.0	.6	63.1	80.0	20.0
Cement, hydraulic	15.3	4.2	19.5	30.7	23.7	3.1	19.0	3.1	.9	80.5	73.2	26.8
Diamond:												
Gem [7]	--	2.5	2.5	--	15.2	82.1	.2	XX	--	97.5	84.8	15.2
Industrial [7]	--	1.6	1.6	--	23.3	75.1	([8])	XX	--	98.4	76.7	23.3
Diatomite [7 10]	36.4	.9	37.3	36.6	25.0	.6	.1	XX	.4	62.7	75.0	25.0
Feldspar [7 11]	26.6	2.3	28.9	36.3	10.0	1.5	23.0	XX	.3	71.1	90.0	10.0
Fluorspar	27.7	2.6	30.3	32.8	14.0	6.1	8.6	8.2	([8])	69.7	77.8	22.2
Graphite [6]	15.4	.9	16.3	11.2	22.4	7.0	13.7	29.4	--	83.7	48.2	51.8
Gypsum	35.4	2.5	37.9	37.3	11.3	2.2	8.4	1.1	1.8	62.1	87.6	12.4
Magnesite [6]	23.7	2.1	25.8	26.3	18.3	.8	5.1	23.5	.2	74.2	58.2	41.8
Mica [7]	61.6	2.4	64.0	3.5	16.3	2.0	14.2	XX	--	36.0	83.7	16.3
Nitrogen fertilizers, contained nitrogen	27.2	1.0	28.2	24.5	27.6	1.3	12.6	5.3	.5	71.8	67.1	32.9
Phosphate rock	40.0	.2	40.2	.1	23.7	26.9	2.2	2.5	4.4	59.8	73.8	26.2
Potash, K_2O equivalent (marketable) [7]	30.1	.1	30.2	26.7	38.9	1.4	2.8	XX	--	69.8	61.1	38.9
Pumice [9]	22.7	1.1	23.8	75.3	XX	.1	([8])	XX	.8	76.2	100.0	XX
Pyrite, including cupreous	4.3	--	4.3	35.5	29.2	4.7	12.8	12.2	1.3	95.7	58.6	41.4
Salt	35.1	3.3	38.4	23.0	13.9	1.5	7.7	12.7	2.8	61.6	73.4	26.6
Strontium minerals [9]	78.8	2.1	80.9	16.8	XX	1.7	.6	XX	--	19.1	100.0	XX
Sulfur:												
Native	63.4	1.4	64.8	.7	31.6	--	1.9	1.0	--	35.2	67.4	32.6
Byproduct, elemental	56.7	.1	56.8	23.1	6.3	.3	12.3	1.2	--	43.2	92.5	7.5
Talc, soapstone, and pyrophyllite	22.7	3.7	26.4	15.7	9.7	.5	41.3	5.2	1.2	73.6	85.1	14.9
Vermiculite [9]	65.8	1.9	67.7	--	XX	32.0	.3	XX	--	32.3	100.0	XX
MINERAL FUELS AND RELATED MATERIALS												
Coal:												
Anthracite and bituminous	25.0	.4	25.4	12.5	31.1	2.9	5.7	19.6	2.8	74.6	49.3	50.7
Lignite	1.6	--	1.6	20.3	74.1	--	1.0	([8])	3.0	98.4	25.9	74.1
Coke:												
Metallurgical	.9	18.0	18.9	24.9	32.2	1.1	13.8	7.7	1.4	81.1	60.1	39.9
Other types	--	.3	.3	14.4	38.5	.7	44.9	--	1.2	99.7	61.5	38.5
Fuel briquets [7 12]	--	--	--	15.5	68.2	([8])	14.7	XX	1.6	100.0	31.8	68.2
Gas, natural, marketed	61.2	2.1	63.3	10.5	22.0	.5	3.2	.2	.3	36.7	77.8	22.2
Peat [7]	.9	([8])	.9	8.6	90.4	--	.1	XX	--	99.1	9.6	90.4
Petroleum, crude	22.8	8.3	31.1	.7	16.3	11.2	38.8	1.2	.7	68.9	82.5	17.5

NA Not available. XX Not applicable.

[1] Percentages in this table have been calculated from the most reliable data available through May 1, 1974.

[2] Includes Cuba.

[3] Includes Yugoslavia.

[4] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania and U.S.S.R.

[5] People's Republic of China, Mongolia, North Korea and North Vietnam.

[6] U.S. data withheld to avoid disclosing individual company confidential data and not included in total upon which percentages have been calculated.

[7] Percentages calculated from a total excluding data for countries listed in footnote 5 (Communist Near East and Asia) because output is unreported and no reliable basis for estimating output is available.

[8] Less than .05%.

[9] Percentages calculated from a total excluding data from countries listed in footnotes 4 and 5 (Communist Europe and Communist Near East and Asia) because quantity produced is unreported, and no reliable basis for estimating output is available.

[10] Includes moler (Denmark only), not included in total in previous editions.

[11] Includes aplite and saba (Japan only), not included in total in previous editions.

[12] Percentages calculated from a total excluding data for the U.S.S.R. and Poland, which were not available.

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

(Million U.S. dollars)

Commodity group	1967 r	1968 r	1969 r	1970 r	1971
Metals:					
All ores, concentrates, and scrap	5,030	5,590	6,340	8,010	7,370
Iron and steel	10,340	11,420	13,700	17,050	17,840
Nonferrous metals	8,010	9,440	10,870	12,200	10,400
Subtotal	23,380	26,450	30,910	37,260	35,610
Nonmetals (crude only)	2,000	2,170	2,260	2,390	2,500
Mineral fuels	20,870	23,020	24,860	28,610	35,780
Total	46,250	51,640	58,030	68,260	73,890
All commodities	213,870	238,150	271,880	311,510	348,110

r Revised.

[1] Data presented are for selected major commodity groups of the Standard International Trade Classification—Revised (SITC–R), and as such exclude some mineral commodities classified in that data array together with other (nonmineral) commodities. SITC–R categories included are as follows: Ores, concentrates, and scrap—SITC Division 28; iron and steel—SITC Division 67; nonferrous metals—SITC Division 68; nonmetals (crude only)—SITC Division 27; and mineral fuels—SITC Section 3. Major items not included are the metals, metalloids, and metal oxides of SITC Group 513; mineral tar and crude chemicals from coal, petroluem, and natural gas of SITC Division 52; manufactured fertilizers of SITC Division 56; and nonmetallic mineral manufactures of SITC Groups 661, 662, 663, and 667.

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

(Percent)

Commodity group	1967	1968	1969	1970	1971
Metals:					
All ores, concentrates, and scrap	10.9	10.8	10.9	11.7	10.0
Iron and steel	22.4	22.1	23.6	25.0	24.1
Nonferrous metals	17.3	18.3	18.8	17.9	14.1
Total	50.6	51.2	53.3	54.6	48.2
Nonmetals (crude only)	4.3	4.2	3.9	3.5	3.4
Mineral fuels	45.1	44.6	42.8	41.9	48.4
Grand total	100.0	100.0	100.0	100.0	100.0

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

Table 6.—Growth of value of export trade in major mineral commodity group, by group[1]

(Percent increase over previous year)

Commodity group	1967	1968	1969	1970	1971
Metals:					
All ores, concentrates, and scrap	5.5	11.1	13.4	26.3	−8.0
Iron and steel	6.9	10.4	20.0	24.5	4.6
Nonferrous metals	−.1	17.9	15.1	12.2	−14.8
All metals	4.1	13.1	16.9	20.5	−4.4
Nonmetals (crude only)	5.3	8.5	4.1	5.8	4.6
Mineral fuels	10.5	10.3	8.0	15.1	25.1
All major mineral commodity groups	6.9	11.7	12.4	17.6	8.2
All commodity groups	5.1	11.4	14.2	14.6	11.7

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

Table 7.—Significance of trade in major mineral commodity group [1] to total trade of various world areas, 1971

Area and country [2]	Value, million U.S. dollars				Major mineral commodities share of total (percent)	
	Major mineral commodity groups		All commodities			
	Exports from	Exports to	Exports from	Exports to	Exports from	Exports to
Northern North America:						
Canada	4,660	1,935	17,670	14,730	26.4	13.1
United States	3,730	8,785	43,490	45,550	8.6	19.3
Total	8,390	10,720	61,160	60,280	13.7	17.8
Latin America	[3] 5,300	2,052	12,540	12,900	[4] 42.3	15.9
Europe:						
Non-Communist:						
EEC	15,115	22,750	100,890	95,320	15.0	23.9
EFTA	5,425	10,290	48,330	51,380	11.2	21.3
Other	850	2,420	6,900	12,640	12.3	19.1
Subtotal	21,390	36,090	156,120	159,340	13.7	22.6
Communist	8,000	5,960	33,280	30,940	24.0	19.3
Total	29,390	42,050	189,400	190,280	15.5	22.1
Africa:						
Republic of South Africa	[5] 250	391	2,200	3,770	[4] 11.4	10.4
Other	[6] 7,015	1,713	12,840	13,720	[4] 54.6	12.5
Total	7,265	2,104	15,040	17,490	48.3	12.0
Near East	[7] 12,430	1,378	14,150	8,550	[4] 87.8	16.1
South Asia and Far East:						
Non-Communist:						
Japan	[8] 3,818	6,495	24,020	15,730	[4] 15.9	41.3
Other	[3] 2,475	3,095	14,020	19,120	[4] 17.7	16.2
Subtotal	6,293	9,590	38,040	34,850	16.5	27.5
Communist	[8] 244	1,016	4,630	4,960	[4] 5.3	20.5
Total	6,537	10,606	42,670	39,810	15.3	26.6
Australia and New Zealand	[3] 1,500	654	6,260	5,480	[4] 24.0	11.9
Not reported	3,078	4,326	6,890	13,320	44.7	32.5
Grand total	73,890	73,890	348,110	348,110	21.2	21.2

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

[2] Regional groupings generally conform to United Nations practice; modifications and special aspects of classification scheme are as follows: (1) Latin America includes Mexico, Central America, and South America, but excludes Caribbean Islands; (2) EEC consists of Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands; (3) EFTA consists of Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom; (4) Other non-Communist Europe consists of Finland, Greece, Iceland, Ireland, and Spain, as well as Yugoslavia (a Communist country); (5) Communist Europe includes Albania, Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and the U.S.S.R.; (6) Other Africa corresponds to the United Nations category "Developing Africa"; (7) Near East corresponds to the United Nations category "Asian Middle East"; (8) Other non-Communist South Asia and Far East refers to the United Nations category "Other Asia"; (9) Communist Far East consists of the People's Republic of China, North Korea, Mongolia, and North Vietnam; (10) The category "Not reported" is derived by subtracting all listed figures from reported totals, and includes the Caribbean and Pacific Islands.

[3] Partial figure; value of nonmetals excluded but presumably included under "Not reported."

[4] Percentage based on partial figure; see footnote to entry in "Exports from" value column.

[5] Partial figure; includes mineral fuels and nonmetals only; totals for other commodity groups presumably included under "Not reported."

[6] Partial figure; value of iron and steel excluded, but presumably included under "Not reported."

[7] Partial figure; value of mineral fuels only; totals for other commodity groups presumably included under "Not reported."

[8] Partial figure; value of metal ores, concentrates, and scrap as well as nonmetals excluded but presumably included under "Not reported."

Table 8.—Export origins and destinations for major mineral commodity group[1] shipments, by value, in 1971

(Million U.S. dollars)

Area and country[2]	Exports from					Exports to				
	Metal ores, concentrates, and scrap	Iron and steel	Nonferrous metals	Nonmetals	Mineral fuels	Metal ores, concentrates, and scrap	Iron and steel	Nonferrous metals	Nonmetals	Mineral fuels
Northern North America:										
Canada	1,370	395	1,320	315	1,260	195	540	205	85	910
United States	485	790	640	315	1,500	1,120	2,740	1,550	260	4,040
Total	1,855	1,185	1,960	630	2,760	1,315	3,280	1,755	345	4,950
Latin America	930	170	1,010	(3)	3,190	66	800	300	76	810
Europe:										
Non Communist:										
EEC	600	7,400	2,130	475	4,510	2,010	4,910	3,710	840	11,280
EFTA	465	2,250	1,600	230	880	1,020	2,020	1,930	390	5,560
Other[4]	105	210	290	75	170	180	690	300	100	1,140
Subtotal	1,170	9,860	4,020	780	5,560	3,210	7,620	5,940	1,330	17,980
Communist	690	2,370	940	400	3,600	770	2,400	660	310	1,820
Total[4]	1,860	12,230	4,960	1,180	9,160	3,980	10,020	6,600	1,640	19,800
Africa:										
Republic of South Africa	(3)	(3)	(3)	135	115	3	150	50	8	180
Other	475	(3)	1,190	230	5,120	17	660	135	41	860
Total[4]	475	(3)	1,190	365	5,235	20	810	185	49	1,040
Near East	(3)	(3)	(3)	(3)	12,430	9	550	100	19	700
South Asia and Far East:										
Non-Communist:										
Japan	(3)	3,550	205	(3)	63	1,770	110	590	185	3,840
Other	530	195	430	(3)	1,320	105	1,140	350	70	1,430
Subtotal[4]	530	3,745	635	(3)	1,383	1,875	1,250	940	255	5,270
Communist	(3)	135	66	(3)	43	68	580	170	23	175
Australia and New Zealand	530	3,880	701	(3)	1,426	1,943	1,830	1,110	278	5,445
Not reported[4]	740	115	320	(3)	325	8	240	63	38	305
Total	980	260	259	325	1,254	29	310	287	55	2,730
Grand total	7,370	17,840	10,400	2,500	35,780	7,370	17,840	10,400	2,500	35,780

[1] For detailed definitions of groups, see footnote 1, table 4.
[2] For detailed definitions of areas listed below, see footnote 2, table 7.
[3] Not reported separately for this area; presumably included under "Not reported."
[4] Not reported in source but derived from data therein.

Table 9.—Direction of trade in major mineral commodities[1] in 1971

(Million U.S. dollars)

Source[2]	Destination[2]									
	Northern North America			Latin America	Non-Communist Europe				Communist Europe	Near East
	United States	Canada	Total[3]		EEC	EFTA	Other[3]	Total[4]		
Northern North America:										
United States	XX	843	843	448	815	260	120	1,195	11	54
Canada	2,785	XX	2,785	88	395	779	43	1,217	10	12
Total[3]	2,785	843	3,628	536	1,210	1,039	163	2,412	21	66
Latin America[5]	1,693	401	2,094	379	801	537	76	1,414	17	3
Europe:										
Non-Communist:										
EEC	1,245	79	1,324	204	8,195	2,609	516	11,320	650	228
EFTA	462	89	551	90	1,775	1,757	323	3,855	240	80
Other[3]	97	3	100	12	320	164	41	525	129	22
Subtotal	1,804	171	1,975	306	10,290	4,530	880	15,700	1,019	330
Communist	46	13	59	27	1,180	944	391	2,515	4,365	99
Total[3]	1,850	184	2,034	333	11,470	5,474	1,271	18,215	5,384	429
Near East[6]	375	91	466	265	4,480	1,870	440	6,790	6	600
Africa:										
Republic of South Africa[7]	--	--	--	--	--	--	--	--	--	--
Other	441	50	491	91	3,826	1,303	276	5,405	85	13
Total[3]	441	50	491	91	3,826	1,303	276	5,405	85	13
Far East and South Asia:										
Non-Communist:										
Japan[8]	1,068	138	1,206	347	235	113	82	430	113	174
Other[5]	313	24	337	13	139	31	27	197	55	38
Subtotal[3]	1,381	162	1,543	360	374	144	109	627	168	212
Communist[8]	7	--	7	--	37	5	2	44	62	8
Total[3]	1,388	162	1,550	360	411	149	111	671	230	220
Australia and New Zealand[5]	90	22	112	6	159	166	20	336	5	5
Rest of world[3]	1,088	182	1,270	82	402	382	63	847	212	42
Grand total	9,710	1,935	11,645	2,052	22,750	10,920	2,420	36,090	5,960	1,378

See footnotes at end of table.

Table 9.—Direction of trade in major mineral commodities[1] in 1971—Continued

(Million U.S. dollars)

Source[2]	Destination[2]									
	Africa			Non-Communist Far East and South Asia			Communist Far East	Australia and New Zealand	Rest of world	Grand total[4]
	Republic of South Africa	Other	Total[3]	Japan	Other	Total[3]				
Northern North America:										
United States	21	51	72	666	270	936	33	40	98	3,730
Canada	13	6	19	380	62	442	14	35	38	4,660
Total[3]	34	57	91	1,046	332	1,378	47	75	136	8,390
Latin America[5]	--	9	9	384	11	395	8	--	981	5,300
Europe:										
Non-Communist:										
EEC	55	478	533	33	140	173	108	17	558	15,115
EFTA	60	126	186	59	164	223	44	70	86	5,425
Other[3]	2	28	30	2	3	5	6	--	21	850
Subtotal	117	632	749	94	307	401	158	87	665	21,390
Communist	--	160	160	164	78	242	160	--	373	8,000
Total[3]	117	792	909	258	385	643	318	87	1,028	29,390
Near East[6]	140	450	590	2,310	790	3,100	60	195	358	12,430
Africa:										
Republic of South Africa[7]	--	--	--	--	--	--	--	--	250	250
Other	18	144	162	268	50	318	83	1	366	7,015
Total[3]	18	144	162	268	50	318	83	1	616	7,265
Far East and South Asia:										
Non-Communist:										
Japan[8]	67	128	195	XX	722	722	427	140	64	3,818
Other[5]	--	26	26	1,074	578	1,652	22	66	69	2,475
Subtotal[3]	67	154	221	1,074	1,300	2,374	449	206	133	6,293
Communist[8]	--	7	7	33	74	107	--	2	7	244
Total[3]	67	161	228	1,107	1,374	2,481	449	208	140	6,537
Australia and New Zealand[5]	9	6	15	794	86	880	25	66	50	1,500
Rest of world[3]	6	94	100	328	67	395	26	22	82	3,078
Grand total	391	1,713	2,104	6,495	3,095	9,590	1,016	654	3,401	73,890

XX Not applicable.

[1] For detailed listing of commodities included, see footnote 1, table 4. It should be noted that certain commodities excluded for specific areas as indicated by footnotes are presumably included in grand total.

[2] For detailed definitions of areas listed, see footnote 2, table 7.

[3] Not reported in source; derived from data therein.

[4] As reported in source; detail may not add to listed figure.

[5] Excludes crude nonmetals.

[6] Includes mineral fuels only.

[7] Includes crude nonmetals and mineral fuels only.

[8] Excludes crude nonmetals and metal ores and scrap.

Table 10.—Iron ore consumption by selected major country

(Million metric tons)

Country	1970	1971	1972
European Economic Community:			
Belgium	18.7	15.5	20.2
France	45.4	42.4	44.9
Germany, West	47.2	42.3	44.1
Italy	10.2	r 10.2	e 11.5
Luxembourg	14.5	14.2	14.4
Netherlands	5.2	5.6	6.3
Total	141.2	r 130.2	141.4
European Free Trade Association:			
Austria	5.6	5.5	5.6
Norway	.9	1.1	1.1
Portugal	.3	.4	e.5
Sweden	r 8.7	7.7	4.0
United Kingdom	32.0	27.5	26.1
Total	r 47.5	42.2	37.3
Other non-Communist Europe:			
Finland	1.6	1.4	1.6
Spain	r 7.2	3.2	3.9
Total	r 8.8	4.6	5.5
Communist Europe:			
Czechoslovakia	e 13.2	3.4	e 3.3
Hungary	5.7	3.5	3.6
Poland	r 11.1	11.5	11.0
Romania	7.9	8.5	1.4
U.S.S.R	r 154.9	159.6	e 163.0
Yugoslavia	r 2.7	3.0	3.4
Total	r 195.5	189.5	185.7
Other:			
Japan	86.1	r 96.4	98.6
Turkey	e 1.2	r 2.0	e 2.0
United States	125.2	110.7	122.1
Total	212.5	r 209.1	222.7
Grand total	r 605.5	r 575.6	592.6

e Estimate. r Revised.

Source: United Nations Economic Commission for Europe. Quarterly Bulletin of Steel Statistics for Europe. V. 23, No. 4, New York, 1973.

Table 11.—Iron and steel scrap consumption by selected major country

(Thousand metric tons)

Country	1970	1971	1972
Europe Economic Community:			
Belgium [1 2]	3,487	3,467	4,360
France [2 3]	8,787	r 8,107	8,525
Germany, West [3]	23,684	21,176	22,713
Italy [2]	11,308	11,174	e 12,225
Luxembourg	1,663	1,545	1,634
Netherlands	2,281	2,227	2,242
Total	51,212	r 47,696	51,699
European Free Trade Association:			
Austria [2 3]	1,551	1,578	1,575
Denmark [2]	435	520	e 521
Norway	443	484	490
Portugal [1 2 3]	143	167	e 132
Sweden [1 2]	[4] 3,294	r 2,995	[3 4] 3,104
United Kingdom [1 3]	r 21,055	r 17,879	18,691
Total	r 26,921	r 23,623	24,513
Other non-Communist Europe:			
Finland	637	586	717
Spain [3]	4,775	e 5,116	e 6,008
Total	5,412	5,702	6,725
Communist Europe:			
Czechoslovakia	4,584	4,534	e 4,500
Hungary [1 3]	2,000	1,937	2,052
Poland	6,488	e 6,618	8,985
Romania [1 3 4]	r 3,720	2,995	2,830
U.S.S.R [5]	43,362	43,850	e 46,530
Yugoslavia [1 3]	1,482	1,546	1,535
Total	r 61,636	61,480	66,432
Other:			
Japan [3]	40,994	33,406	39,668
Turkey [1 2 3]	e 150	311	e 300
United States	77,619	e 75,000	e 75,000
Total	118,763	108,717	114,968
Grand total	r 263,944	247,218	264,337

e Estimate. r Revised.
[1] Excludes scrap consumption by rerollers.
[2] Excludes scrap consumption by iron foundries.
[3] Excludes scrap consumption by industry other than iron and steel.
[4] Excludes scrap consumption in blast furnaces.
[5] Consumption in blast furnaces and open hearth furnaces only (excludes consumption in other types of steel furnaces, rerolling mills, iron foundries, and industries other than the iron and steel industries).

Source: United Nations Economic Commission for Europe. Quarterly Bulletin of Steel Statistics for Europe. V. 23, No. 4, New York, 1973.

Table 12.—Estimated world [1] consumption of major nonferrous metals

Commodity		1970	1971 r	1972
Aluminum [2]	thousand metric tons	r 9,570	10,960	12,073
Copper [3]	do	r 7,178	7,239	7,772
Lead [4]	do	3,542	3,588	3,723
Zinc [5]	do	r 4,639	4,704	5,137
Tin [6]	thousand long tons	r 168	172	172

r Revised.
[1] In general, figures are totals for major consuming countries only; sum data included for Communist countries (except Yugoslavia) are listed as conjectural in source.
[2] Apparently includes secondary metal.
[3] Primary and secondary refined metal.
[4] Chiefly primary, but including some secondary.
[5] Primary and secondary slab.
[6] Primary only as reported by the International Tin Council. Communist countries (except Yugoslavia) are excluded; consumption of primary and secondary tin by these countries is estimated at about 60,000 long tons annually.

Source: Yearbook of the American Bureau of Metal Statistics. Fifty-second Annual Issue for the year 1972. New York, 1973, 152 pp.

Table 13.—World energy consumption,[1] by energy source

(Million metric tons of standard coal equivalent unless otherwise specified)

Area [2] and year	Solid fuels	Liquid fuels	Natural and imported gas	Hydro, nuclear, and imported electricity	Total energy: Aggregate [1]	Total energy: Per capita (kilograms)
Market economy:						
North America:						
1967	463	875	736	46	2,119	9,665
1968	481	930	790	47	2,249	10,148
1969	490	976	853	52	2,371	10,590
1970	495	1,026	897	54	2,472	10,918
1971	476	1,066	928	59	2,529	11,057
Other America:						
1967	7	67	11	5	90	619
1968	7	75	12	5	99	660
1969	8	82	13	6	107	700
1970	8	84	14	7	112	713
1971	8	91	16	7	122	757
Caribbean America:						
1967	5	74	34	2	115	1,031
1968	5	82	34	3	125	1,087
1969	6	84	36	3	129	1,090
1970	6	95	40	4	145	1,186
1971	7	100	41	4	151	1,201
Western Europe:						
1967	459	550	41	44	1,094	3,144
1968	456	602	58	45	1,161	3,317
1969	457	663	80	46	1,246	3,530
1970	441	755	108	48	1,352	3,802
1971	410	789	140	49	1,388	3,887
Africa:						
1967	54	37	2	2	94	290
1968	57	38	2	2	99	298
1969	57	40	2	2	102	298
1970	59	44	2	3	109	310
1971	63	53	2	3	122	340
Near East:						
1967	6	38	8	(3)	52	537
1968	6	40	11	1	58	585
1969	7	42	14	1	64	627
1970	7	49	25	1	81	776
1971	7	57	25	1	90	830
Far East:						
1967	159	202	10	12	384	369
1968	164	236	12	13	425	399
1969	175	273	12	14	474	435
1970	175	317	15	15	523	469
1971	167	347	15	16	545	478
Oceania:						
1967	33	30	(3)	2	66	3,634
1968	34	33	(3)	2	70	3,785
1969	35	35	(3)	3	73	3,885
1970	35	38	2	3	78	4,077
1971	36	38	3	3	81	4,128
Total market economy:						
1967	1,186	1,873	842	113	4,014	19,289
1968	1,210	2,036	919	118	4,286	20,279
1969	1,235	2,195	1,010	128	4,566	21,155
1970	1,226	2,408	1,103	135	4,872	22,251
1971	1,174	2,541	1,170	142	5,028	22,678
Centrally planned economy:						
Europe: [4]						
1967	737	325	242	13	1,316	3,883
1968	742	350	263	15	1,369	4,001
1969	762	378	284	16	1,441	4,175
1970	769	414	313	18	1,513	4,347
1971	786	445	342	18	1,590	4,531
Asia: [5]						
1967	253	20	(3)	5	278	369
1968	332	27	(3)	5	364	474
1969	364	28	(3)	5	398	509
1970	395	36	(3)	6	438	550
1971	428	43	(3)	6	478	580

See footnotes at end of table.

Table 13.—World energy consumption,[1] by energy source—Continued

(Million metric tons of standard coal equivalent unless otherwise specified)

Area[2] and year	Solid fuels	Liquid fuels	Natural and imported gas	Hydro, nuclear, and imported electricity	Total energy	
					Aggregate[1]	Per capita (kilograms)
Centrally planned economy—Continued						
Total centrally planned economy:						
1967	990	345	242	18	1,594	4,252
1968	1,074	377	263	20	1,733	4,475
1969	1,126	406	284	21	1,839	4,684
1970	1,164	450	313	24	1,951	4,897
1971	1,214	488	342	24	2,068	5,111
World total:						
1967	2,175	2,217	1,083	131	5,607	1,652
1968	2,284	2,413	1,182	138	6,018	1,740
1969	2,360	2,602	1,295	148	6,404	1,816
1970	2,390	2,858	1,417	157	6,822	1,898
1971	2,387	3,029	1,513	167	7,096	1,931

[1] In most cases data are aggregates of country figures representing apparent inland consumption—the purely arithmetic result of adding production and imports and subtracting from this sum the total of exports, bunker loadings, and additions to stocks (where the latter are known). All totals in this table are reported in source and may not represent the sum of listed parts owing to rounding and/or omission from detail of minor quantities not listed separately. A large number of the entries in this table have been revised from those appearing in previous editions of this chapter owing to revisions published in new edition of source; such revision have not been identified as such by footnotes.

[2] Areas listed are those appearing in source and have not been conformed in scope to standard terms used elsewhere in the Minerals Yearbook, except that the source term "Western Asia" has been converted to "Near East."

[3] Nil or less than ½ unit.

[4] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.

[5] People's Republic of China, North Vietnam, Mongolia, and North Korea.

Source: United Nations. World Energy Supplies 1961–70 and 1968–71. Statistical Papers, Series J, Nos. 15 and 16, New York, 1972 and 1973, pp. 6–9.

Table 14.—Reserves of major mineral commodities, 1972

(Thousand metric tons unless otherwise specified)

Commodity	World total	Market economy countries	Centrally planned economies	Country distribution of principal reserves in market economy countries
METALS				
Aluminum, bauxite, gross weight million metric tons	15,000	14,300	700	Australia 4,600; Guinea 4,100; Jamaica 800.
Chromite, gross weight	2,449,000	2,402,000	47,000	Republic of South Africa 1,814,000; Southern Rhodesia 544,000.
Cobalt, metal content	2,480	1,940	540	Zaire 680; New Caledonia and Australia 670; Zambia 350.
Copper, metal content	308,000	272,000	36,000	United States 73,000; Chile 51,000; Canada 27,000; Zambia 24,000; Peru 20,000.
Iron ore:				
Gross weight million metric tons	254,000	136,000	118,000	Canada 37,000; Brazil 27,000; Australia 16,000.
Metal content do	87,700	56,400	31,300	Brazil 13,400; Canada 10,600; Australia 9,100.
Lead, metal content	93,000	78,000	15,000	United States 33,000; Canada 13,000; Australia 12,000.
Molybdenum, metal content	4,264	4,264	--	United States 2,858; Chile 816; Canada 454.
Nickel, metal content	[1] 68,000	43,000	[1] 25,000	New Caledonia 15,000; Canada 9,000; United States 1,000.
Tin, metal content thousand long tons	4,181	3,466	715	Thailand 1,400; Malaysia 600; Indonesia 550.
Tungsten, metal content	1,248	281	967	United States 79; Republic of Korea 46; Bolivia 39.
Zinc, metal content	118,000	100,000	18,000	Canada 31,000; United States 27,000; Australia 9,000.
NONMETALS				
Phosphate rock million metric tons	61,008	50,008	11,000	Morocco 36,000; United States 7,000; Spanish Sahara 1,500.
Potash do	23,315	15,120	8,195	Canada 10,931; West Germany 2,731.
Sulfur	1,219,000	1,133,000	86,000	Canada 391,000; United States 76,000; Japan 41,000.
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous million metric tons	1,808,201	756,501	1,051,700	United States 543,585; West Germany 56,245; Republic of South Africa 33,112.
Lignite do	412,860	284,584	128,276	United States 202,937; West Germany 29,937; Australia 20,230.
Natural gas billion cubic feet	[2] 1,755,240	1,103,413	[2] 651,827	United States 278,806; Netherlands 88,210; Canada 55,462.
Petroleum million 42-gallon barrels	631,900	533,700	98,200	Saudi Arabia 145,300; Kuwait 66,000; Iran 55,500; United States 38,100.

[1] Includes 16,329 thousand metric tons in Cuba.
[2] Includes 636,000 billion cubic feet in the U.S.S.R.

Source: United States Bureau of Mines Commodity Data Summary, January 1973, 168 pp.

Table 15.—Annual investment expenditure in the steel industry for selected countries

(Million dollars)

Country or country group	1970 [r]	1971
European Economic Community (EEC)	1,706	2,182
European Free Trade Association (EFTA)[1]	466	743
Other countries:		
Canada	176	196
Finland	47	58
Ireland	(2)	(2)
Japan[3]	1,855	2,447
Spain	251	207
Turkey	31	NA
United States	1,735	1,449

[r] Revised. NA Not available.
[1] Totals given exclude expenditures in Denmark and Switzerland and any non-British Steel Corp. investment in the United Kingdom.
[2] Less than ½ unit.
[3] Japanese fiscal years.

Source: Organization for Economic Cooperation and Development. The Iron and Steel Industry in 1971 and Trends in 1972, p. 80.

Table 16.—Non-Communist world petroleum capital expenditures and exploration expenses by geographic area

(Million dollars)

	1970	1971	1972
United States:			
Capital expenditures	8,225	7,250	9,050
Exploration expenses	665	715	740
Total	8,890	7,965	9,790
Other Western Hemisphere:			
Capital expenditures	2,760	3,350	3,120
Exploration expenses	275	255	250
Total	3,035	3,605	3,370
Western Europe:			
Capital expenditures	3,260	4,150	4,450
Exploration expenses	100	75	125
Total	3,360	4,225	4,575
Africa:			
Capital expenditures	790	975	1,005
Exploration expenses	100	150	175
Total	890	1,125	1,180
Near East:			
Capital expenditures	565	825	975
Exploration expenses	50	50	50
Total	615	875	1,025
Far East:			
Capital expenditures	2,050	2,500	2,700
Exploration expenses	150	150	200
Total	2,200	2,650	2,900
Unspecified: Capital expenditures (no exploration expenses)	2,475	2,750	3,650
Total:			
Capital expenditures	20,125	21,800	24,950
Exploration expenses	1,340	1,395	1,540
Total	21,465	23,195	26,490

Source: Energy Division, Chase National Bank, N.A. Capital Investments of the World Petroleum Industry, 1972, pp. 24–31.

Table 17.—Non-Communist world petroleum industry capital expenditures by industry sector and exploration expenses

(Million dollars)

	1970	1971	1972
Capital expenditures:			
Production:			
Crude oil and natural gas	6,650	6,520	9,590
Natural gasoline plants	580	695	515
Pipelines	850	1,200	1,230
Marine	r 2,575	2,875	3,775
Refineries	4,000	4,755	4,955
Marketing	3,220	3,380	2,825
Chemical plants	1,525	1,535	1,350
Other	r 725	840	710
Total	20,125	21,800	24,950
Exploration expenses	1,340	1,395	1,540
Grand total	21,465	23,195	26,490

r Revised.

Source: Energy Division, Chase Manhattan Bank, N.A. Capital Investments of the World Petroleum Industry, 1972, pp. 24–25.

Table 18.—U.S. direct foreign investment in mineral industries: Value, earnings, and income

(Million dollars)

Area and country	Mining, smeltering, and refining			Petroleum		
	Value	Earnings [1]	Income [2]	Value	Earnings [1]	Income [2]
1969 total	5,676	782	664	19,882	2,452	2,638
1970 total	6,168	675	553	21,714	2,935	2,608
1971 total	6,685	499	482	24,152	3,856	3,442
1972: [p]						
Canada	3,490	139	131	5,311	453	158
Latin American and other Western Hemisphere:						
Latin American Republics:						
Chile	359	NA	NA	NA	NA	NA
Venezuela	NA	NA	NA	1,546	55	247
Other	941	64	74	1,699	222	−22
Subtotal [3]	1,300	64	74	3,245	277	225
Other Western Hemisphere	782	94	98	1,022	18	20
Total	2,082	158	172	4,267	295	245
Europe:						
European Economic Community	10	NA	NA	3,494	40	−17
United Kingdom	5	NA	NA	2,321	122	63
Other West Europe	64	NA	NA	1,177	−45	−18
Total	79	NA	NA	6,992	117	28
Africa:						
South Africa, Republic of	136	36	18	215	NA	NA
Other	425	24	13	2,254	527	454
Total	561	60	31	2,469	527	454
Near East	5	NA	NA	1,807	2,419	2,449
Far East and Pacific:						
Japan	--	--	--	796	51	9
Australia	707	68	61	NA	NA	NA
New Zealand	8	--	--	NA	NA	NA
Other	199	(4)	1	1,550	287	246
Total	914	68	62	2,346	338	255
International shipping	--	--	--	2,321	318	304
Grand total [5]	7,131	418	399	26,399	4,552	3,950

[p] Preliminary. NA Not available.
[1] Sum of U.S. share in net earnings of subsidiary and branch profits.
[2] Sum of interest, dividends, and branch earnings.
[3] Partial figure; excludes figures for detail indicated as not available.
[4] Less than ½ unit.
[5] Detail may not add to totals shown because of independent rounding and exclusion of some data in detail.

Source: U.S. Department of Commerce, Survey of Current Business. V. 53, No. 9, September 1973, pp. 24–26.

Table 19.—World merchant fleet distribution, by type [1]

	1968	1969	1970	1971	1972
Number of vessels:					
Tankers	3,895	4,071	4,232	4,431	4,581
Bulk carriers	2,609	2,748	2,954	3,218	3,539
Freighters	11,052	10,980	10,998	11,095	11,087
Other	1,805	1,771	1,796	1,800	1,802
Total	19,361	19,570	19,980	20,544	21,009
Gross tonnage:					
Tankers ---thousand tons	71,641	79,457	88,896	99,105	108,558
Bulk carriers ---do	37,596	41,746	47,199	55,009	64,822
Freighters ---do	62,559	62,960	63,159	64,038	65,179
Other ---do	12,446	12,084	12,147	12,150	11,984
Total ---do	184,242	196,247	211,401	230,302	250,543
Deadweight tonnage:					
Tankers ---do	117,135	133,421	153,075	173,196	192,894
Bulk carriers ---do	59,926	67,638	77,173	90,962	108,512
Freighters ---do	86,702	87,250	87,428	88,305	88,970
Other ---do	9,447	9,214	9,323	9,276	9,176
Total ---do	273,210	297,523	326,999	361,739	399,552

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

Table 20.—World shipping of tanker and dry cargo by loadings and unloadings

(Million metric tons)

	1968	1969	1970 r	1971 r	1972
Loaded:					
Tanker cargo	1,141	1,276	1,440	1,530	1,637
Dry cargo	966	1,036	1,165	1,167	1,224
Total	2,107	2,312	2,605	2,697	2,861
Unloaded:					
Tanker cargo	1,113	1,243	1,403	1,504	1,622
Dry cargo	972	1,024	1,127	1,144	1,225
Total	2,085	2,267	2,530	2,648	2,847

r Revised.

Source: United Nations. Monthly Bulletin of Statistics. V. XXXIII, January 1974, p. xxiii.

Table 21.—World shipping of tanker cargo by region

(Million metric tons)

Region	Loadings					Unloadings				
	1968	1969	1970	1971	1972	1968	1969	1970	1971	1972
Developed market economies:										
Australia, New Zealand	2	1	1	2	2	24	25	22	17	16
Canada	--	--	1	2	5	15	16	15	18	24
Japan	--	1	--	1	2	141	166	201	222	240
South Africa, Republic of	--	--	--	--	--	10	10	12	16	14
United States	4	4	5	3	3	145	156	162	174	206
Western Europe	70	79	100	98	111	554	620	705	737	781
Other	1	1	6	14	20	3	3	5	12	21
Total	77	86	113	120	143	892	996	1,122	1,196	1,302
Developing market economies:										
Caribbean	54	57	63	64	61	71	79	89	100	99
Far East	43	51	59	65	74	67	74	83	92	99
Near East	529	586	659	763	852	11	12	13	10	13
North Africa	177	210	226	185	176	16	17	18	18	17
Other Africa	12	35	63	83	96	14	14	14	14	15
Venezuela	176	178	181	168	152	--	--	--	--	--
Other Latin America	10	11	11	8	11	33	35	45	48	46
Other	--	--	--	2	--	1	3	--	2	3
Total	1,001	1,128	1,262	1,338	[1]1,421	213	234	262	284	292
Centrally planned economies:										
U.S.S.R	57	58	61	68	69	--	1	3	5	8
Other	5	4	4	3	3	8	13	16	18	19
Total	62	62	65	71	72	8	14	19	23	27

[1] As reported in source; detail adds to 1,422.

Source: United Nations. Monthly Bulletin of Statistics. V. XXVIII, January 1974, p. xxviii.

Table 22.—World shipping of dry cargo by region

(Million metric tons)

Region	Loadings					Unloadings				
	1968	1969	1970	1971	1972	1968	1969	1970	1971	1972
Developed market economies:										
Australia, New Zealand	51	72	93	115	121	16	16	15	16	16
Canada	78	70	95	94	94	34	36	38	37	38
Japan	30	40	42	51	51	179	204	235	239	277
South Africa, Republic of	14	12	15	15	18	4	4	6	8	7
United States	173	177	213	183	206	131	125	131	133	135
Western Europe	222	231	239	240	256	389	416	460	449	462
Other	2	3	2	3	3	3	5	6	5	4
Total	570	605	699	701	749	756	806	891	887	939
Developing market economies:										
Caribbean	25	27	32	28	30	11	11	13	13	13
Far East	76	85	94	95	98	66	68	69	77	83
Near East	8	8	9	8	10	17	19	19	25	28
North Africa	28	29	28	29	30	17	17	17	19	20
Other Africa	66	71	75	74	77	17	19	23	26	26
Venezuela	17	21	23	25	26	4	4	4	4	5
Other Latin America	84	93	105	110	106	29	31	32	33	40
Other	8	10	--	9	11	5	1	3	3	3
Total	312	344	366	378	388	166	170	180	200	218
Centrally planned economies:										
U.S.S.R	44	47	46	45	40	11	10	11	10	22
Other	40	40	44	44	48	38	37	45	47	47
Total	84	87	90	89	88	49	47	56	57	69

Source: United Nations. Monthly Bulletin of Statistics. V. XXVIII, January 1974, p. xxiii.

Table 23.—Distribution of world oil tanker tonnage, by size group [1]

Size group (deadweight tons)	1966		1972			
			In service		New building in progress or on order at yearend	
	Million deadweight tons	Percent of total	Million deadweight tons	Percent of total	Million deadweight tons [2]	Percent of total
Under 25,000	30.0	30.2	27.9	14.4	1.1	0.9
25,000-45,000	25.3	25.5	28.1	14.5	4.2	3.5
45,000-65,000	21.2	21.3	22.5	11.6	.4	.3
65,000-125,000	21.8	21.9	40.2	20.7	11.4	9.5
125,000-205,000	1.1	1.1	13.1	6.8	10.5	8.7
205,000-285,000	--	--	58.6	30.2	71.7	59.7
285,000 and over	--	--	3.5	1.8	20.9	17.4
Total	99.4	100.0	193.9	100.0	120.2	100.0

[1] Includes vessels 2,000 deadweight tons and over.
[2] Excludes 16.8 million deadweight tons in bulk (multiple-cargo) carriers.

Source: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry. Baynard Press, London, 1966, p. 15; 1972, p. 14.

Table 24.—Commercial ocean traffic through the Panama Canal in terms of number of transits and total cargo moved, by type of vessel

	Ore ships	Tankers	Combination carriers	Container cargo ships	Dry-bulk carriers	General cargo ships	Other	Total
1971								
Number of transits:								
In ballast:								
Atlantic to Pacific	1	39	5	1	100	162	566	874
Pacific to Atlantic	--	780	1	--	115	160	138	1,194
Total	--	819	6	1	215	322	704	2,068
Laden:								
Atlantic to Pacific	--	946	59	121	1,314	3,328	544	6,312
Pacific to Atlantic	2	198	5	109	1,060	3,139	1,126	5,639
Total	2	1,144	64	230	2,374	6,467	1,670	11,951
In ballast and laden:								
Atlantic to Pacific	1	985	64	122	1,414	3,490	1,110	7,186
Pacific to Atlantic	2	978	6	109	1,175	3,299	1,264	6,833
Grand total	3	1,963	70	231	2,589	6,789	2,374	14,019
Cargo moved (thousand metric tons):								
Atlantic to Pacific	--	14,848	2,985	709	34,856	21,000	1,141	75,539
Pacific to Atlantic	84	3,329	187	694	19,001	18,772	2,928	44,995
Total	84	18,177	3,172	1,403	53,857	39,772	4,069	120,534
1972								
Number of transits:								
In ballast:								
Atlantic to Pacific	1	53	9	1	350	260	592	1,266
Pacific to Atlantic	--	667	1	--	70	129	130	997
Total	1	720	10	1	420	389	722	2,263
Laden:								
Atlantic to Pacific	3	906	44	185	1,155	2,766	630	5,689
Pacific to Atlantic	3	256	9	170	1,304	2,892	1,180	5,814
Total	6	1,162	53	355	2,459	5,658	1,810	11,503
In ballast and laden:								
Atlantic to Pacific	4	959	53	186	1,505	3,026	1,222	6,955
Pacific to Atlantic	3	923	10	170	1,374	3,021	1,310	6,811
Grand total	7	1,882	63	356	2,879	6,047	2,532	13,766
Cargo moved (thousand metric tons):								
Atlantic to Pacific	115	15,096	2,030	1,180	28,605	15,487	1,144	63,657
Pacific to Atlantic	106	4,150	382	1,281	21,806	16,789	2,816	47,330
Total	221	19,246	2,412	2,461	50,411	32,276	3,960	110,987

Source: Panama Canal Co. Annual Reports for 1971 and 1972.

Table 25.—Movement of mineral commodities through the Panama Canal, by commodity type and direction of movement

(Thousand metric tons)

Commodity	Atlantic to Pacific			Pacific to Atlantic			Total		
	1970	1971	1972	1970	1971	1972	1970	1971	1972
METALS									
Aluminum:									
Bauxite and alumina	1,615	1,256	1,518	157	450	781	1,772	1,706	2,299
Metal, except scrap	65	76	76	183	94	67	248	170	143
Chromium, chromite	2	10	42	161	209	110	163	219	152
Copper:									
Ore and concentrate	101	46	28	187	249	252	288	295	280
Metal, except scrap	12	15	18	666	765	598	678	780	616
Iron and steel:									
Iron ore	289	575	478	3,993	3,557	1,830	4,282	4,132	2,308
Pig iron, steel ingots and other crude forms, except scrap	1,325	293	77	19	37	71	1,344	330	148
Semimanufactures (excluding tinplate)	2,002	1,890	1,499	6,243	6,494	7,793	8,245	8,384	9,292
Lead:									
Ore and concentrate	12	6	1	170	193	165	182	199	166
Metal, except scrap	5	6	9	183	253	209	188	259	218
Manganese ore and concentrate	99	208	184	76	122	142	175	330	326
Tin:									
Ore and concentrate	2	6	2	78	85	70	80	91	72
Metal (including tinplate)	134	129	110	90	103	109	224	232	219
Zinc:									
Ore and concentrate	140	165	168	216	349	347	356	514	515
Metal, except scrap	11	8	10	153	144	126	164	152	136
Other and unclassified:									
Ore and concentrate	54	115	97	623	789	621	677	904	718
Metal, except scrap	31	49	33	118	172	172	149	221	205
Metal scrap, all metals	3,975	2,689	1,415	34	18	57	4,009	2,707	1,472
NONMETALS									
Asbestos	229	262	183	50	55	49	279	317	232
Borax	8	10	12	456	398	392	464	408	404
Cement	169	170	152	15	15	15	184	185	167
Clays and clays products:									
Fire clay and kaolin	301	328	291	35	35	37	336	363	328
Brick and tile	77	79	75	151	131	176	228	210	251
Diatomaceous earth	4	4	14	52	52	30	56	56	44
Fertilizer materials:									
Nitrogenous:									
Ammonium compounds	350	350	400	58	26	13	408	376	413
Sodium nitrate	23	23	8	388	466	358	411	489	366
Phosphatic	3,792	4,544	4,276	6	2	2	3,798	4,546	4,278
Potassic	186	305	276	509	429	605	695	734	881
Unclassified	794	891	824	184	82	84	978	973	908
Sodium compounds:									
Salt	144	117	112	512	505	593	656	622	705
Other	77	118	105	29	23	22	106	141	127
Sulfur	213	172	101	306	428	687	519	600	788
MINERAL FUELS AND RELATED MATERIALS									
Coal and coke	21,648	22,181	14,341	26	382	509	21,674	22,563	14,850
Petrochemicals	354	324	369	237	294	383	591	618	752
Petroleum:									
Crude	4,199	4,712	5,172	1,710	1,330	1,821	5,909	6,042	6,993
Refinery products	10,526	9,514	8,744	1,513	1,859	1,961	12,039	11,373	10,705
Total	52,968	51,646	41,220	19,587	20,595	21,257	72,555	72,241	62,477

Source: Panama Canal Co. Annual Report, 1972, pp. 50–53.

Table 26.—Indexes of ocean freight rates

(1963=100, unless otherwise specified)

Year and quarter	Trip charter						Time charter				
	London tanker brokers panel	West Germany		Italy (general)	Norway		United Kingdom [1]				Norway (dry cargo)
		Dry cargo	Tankers		Dry cargo	Tankers	General	9,000-16,000 deadweight tons	20,000-40,000 deadweight tons	Over 40,000 deadweight tons	
1969	90	100	127	96	94	119	100	99	98	103	114
1970	119	146	250	142	122	243	181	134	168	181	166
1971: [2]											
First quarter	120	113	198	96	97	173	135	111	126	157	156
Second quarter	119	92	109	79	82	99	87	94	89	81	145
Third quarter	113	85	95	76	83	88	75	81	82	67	114
Fourth quarter	107	91	135	74	77	134	75	82	73	72	100
Annual average	118	99	144	87	90	133	93	92	93	94	132
1972: [2]											
First quarter	105	83	69	66	73	71	79	81	79	78	112
Second quarter	98	86	108	66	76	95	82	90	75	83	110
Third quarter	NA	102	117	85	85	120	95	87	93	101	119
Fourth quarter	NA	132	151	113	103	164	134	115	134	141	152
Annual average	NA	98	103	NA	82	104	98	93	95	101	119

NA Not available.
[1] The United Kingdom figures are shown with original base 1968=100. Table is further subdivided into vessel tonnage classes of deadweight tons, rather than commodity class.
[2] Quarterly figures are for the last month in the quarter except for the United Kingdom figures that are average for the quarter indicated.

Source: United Nations Monthly Bulletin of Statistics. June 1972, p. xxii; September 1973, p. xviii.

Table 27.—Nonferrous metal prices in the United States

(Average, cents per pound, except where otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [4]	Tin [5]	Silver [6]
1970	28.716	57.700	[7] 15.419	15.319	174.205	177.082
1971	29.000	51.433	[8] 13.815	16.128	167.348	154.564
1972:						
January	29.000	49.699	14.000	17.000	171.310	146.963
February	29.000	49.980	14.600	17.000	172.000	150.355
March	29.000	51.949	15.500	17.304	179.795	153.084
April	29.000	51.949	15.569	17.741	181.975	157.200
May	25.909	51.949	15.599	17.872	170.739	158.305
June	25.000	51.949	15.501	18.000	175.034	156.900
July	25.000	50.004	15.500	18.000	176.588	173.575
August	25.000	49.985	15.413	18.000	179.120	184.609
September	25.000	49.985	15.000	18.000	181.988	177.665
October	25.000	49.985	14.667	18.000	180.432	181.060
November	25.000	49.985	14.500	18.000	177.274	183.247
December	25.000	49.985	14.500	18.108	176.250	197.595
Annual average	26.409	50.617	15.029	17.752	176.875	168.380

[1] Unalloyed ingot 99.5%, delivered United States.
[2] Electrolytic copper, domestic refineries, on Atlantic seaboard.
[3] Refined lead, nationwide, except as noted.
[4] Prime western slab, f.o.b., East St. Louis.
[5] Straits tin, New York.
[6] Cents per troy ounce, 99.9 fine, New York.
[7] Refined lead, St. Louis.
[8] Separate St. Louis and New York prices discontinued December 13, 1971. Effective December 13, 1971, one delivered price, nationwide, replaced delivered New York basis quotations. Figure given here is nationwide monthly average for December 1971 only.

Source: Yearbook of the American Bureau of Metal Statistics. Fifty-second Annual Issue for the year 1972. New York, 1973, 152 pp.

Table 28.—Nonferrous metal prices in the United Kingdom

(Average, U.S. dollar equivalent per metric ton, unless otherwise noted) [1]

Year and month	Aluminum [2]	Copper [3]	Lead [4]	Zinc	Tin [5]	Silver [6]
1970	613.029	1,408.554	302.906	294.983	3,608.736	176.746
1971	628.648	1,086.276	253.684	310.316	3,515.003	154.195
1972:						
January	661.133	1,077.399	251.395	379.329	3,630.780	146.287
February	661.861	1,112.327	293.854	389.331	3,681.502	150.606
March	665.521	1,158.326	319.879	396.590	3,864.447	152.818
April	663.513	1,132.279	315.599	394.688	3,908.983	156.696
May	599.807	1,106.639	317.563	386.008	3,832.992	158.288
June	565.202	1,060.216	310.784	369.719	3,743.872	156.867
July	537.834	1,035.282	303.730	363.625	3,740.733	171.816
August	539.044	1,046.799	297.577	363.316	3,753.927	183.721
September	537.020	1,069.663	302.171	367.981	3,802.028	177.995
October	538.444	1,027.249	296.716	363.339	3,764.290	179.943
November	540.615	1,006.061	297.056	378.313	3,705.234	182.248
December	539.304	1,022.262	308.083	374.699	3,732.429	195.106
Annual average	586.488	1,070.242	301.546	377.371	3,767.680	168.569

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

Table 29.—Nonferrous metal prices in Canada

(Average, U.S. cents per pound, unless otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [3]	Silver [4]
1970	28.26	55.629	15.149	14.172	177.142
1971	29.21	52.202	13.368	15.962	154.573
1972:					
January	29.33	50.078	13.694	16.900	147.740
February	29.36	50.350	14.526	16.920	150.287
March	29.54	52.705	15.524	17.884	153.619
April	29.63	52.851	15.793	18.077	157.188
May	(5)	53.214	16.179	19.213	158.197
June	(5)	52.796	16.335	19.397	156.883
July	(5)	50.731	16.261	19.310	173.554
August	(5)	50.640	16.286	19.340	184.587
September	(5)	50.611	16.277	19.329	177.641
October	(5)	50.624	15.797	19.334	181.227
November	(5)	50.386	15.192	19.243	183.351
December	(5)	50.495	15.049	19.115	197.199
Annual average	(5)	51.292	15.572	18.666	168.401

[1] Ingot 99.5% f.o.b. delivered basis Canadian points.
[2] Electrolytic wirebar, f.o.b. delivered Canadian points.
[3] Pig lead, prime western zinc; producers' prices, carload quantities, communicated by Cominco, Ltd.
[4] United States cents per troy ounce, average price of Cominco, Ltd.
[5] Canadian aluminum producers ceased quoting a "published" price effective May 8, 1972.

Source: Yearbook of the American Bureau of Metal Statistics. Fifty-second Annual Issue for the Year 1972. New York, 1973, 152 pp.

Table 30.—Mineral commodity export price indexes

(1963=100)

Year and quarter	Metal ores	Fuels	All crude minerals
1970	122	r 108	r 111
1971	126	127	127
1972:			
First quarter	136	141	140
Second quarter	135	143	141
Third quarter	136	143	141
Fourth quarter	130	144	140
Annual average	134	143	141

r Revised.

Source: United Nations, Monthly Bulletin of Statistics. New York, September 1973, p. xv.

Table 31.—Analysis of export price indexes

(1963=100)

Year and quarter	Developed areas		Developing areas	
	Total minerals	Nonferrous base metals	Total minerals	Nonferrous base metals
1970	122	167	104	191
1971	145	151	119	160
1972:				
First quarter	153	156	134	167
Second quarter	153	151	135	166
Third quarter	155	146	136	158
Fourth quarter	155	146	134	154
Annual average	154	150	135	161

Source: United Nations. Monthly Bulletin of Statistics. New York, September 1973, p. xv.

Table 32.—Leading world producers of bauxite

(Gross weight, thousand metric tons)

Country	1970	1971	1972 p
Australia	9,256	12,541	14,433
Jamaica	12,010	12,441	12,114
Surinam	r 6,022	6,718	e 6,902
U.S.S.R.e 1	r 4,300	4,500	4,700
Guyana	r 4,417	4,234	3,727
France	2,992	3,184	3,254
Guinea	2,490	2,630	e 2,600
Greece	2,292	2,861	2,408
Hungary	2,022	2,090	2,358
Yugoslavia	2,099	1,959	2,197
United States	2,115	2,020	1,841
Total	r 50,015	55,178	56,534
All others	r 7,771	8,331	8,780
Grand total	r 57,786	63,509	65,314

e Estimate. p Preliminary. r Revised.
1 Excludes nepheline concentrates and alunite ore.

Table 33.—Leading world producers of aluminum

(Thousand metric tons)

Country	1970	1971	1972 p
United States	3,607	3,561	3,739
U.S.S.R.e	1,100	1,180	1,250
Japan	r 733	893	1,015
Canada	972	1,017	925
Norway	r 522	530	548
Germany, West	309	428	445
France	381	384	392
Australia	206	223	206
India	161	178	179
United Kingdom	40	119	171
Netherlands	75	116	166
Ghana	113	111	144
Spain	120	127	140
China, People's Republic of e	130	140	140
Total	r 8,469	9,007	9,460
All others	r 1,184	1,312	1,571
Grand total	r 9,653	10,319	11,031

e Estimate. p Preliminary. r Revised.

Table 34.—Leading world producers of mine copper

(Copper content of ore, thousand metric tons)

Country	1970	1971	1972 p
United States [1]	1,560	1,381	1,510
Canada [1]	610	654	726
Chile	711	717	725
Zambia	684	652	718
U.S.S.R. e	570	620	665
Zaire	386	406	437
Peru	220	213	225
Philippines	160	198	185
Australia	158	174	180
South Africa, Republic of	149	157	162
Papua New Guinea	--	--	124
Poland	72	90	123
Japan e	r 120	121	114
Total	r 5,400	5,383	5,894
All others	r 622	653	737
Grand total	r 6,022	6,036	6,631

e Estimate. p Preliminary. r Revised.
[1] Recoverable.

Table 35.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates

(Thousand metric tons)

Country	1970	1971	1972 p
U.S.S.R	195,492	203,008	208,000
United States	91,201	82,058	76,644
Australia	51,189	62,100	63,870
France	56,805	55,862	54,253
China, People's Republic of e	44,000	45,000	46,000
Brazil e	40,200	42,700	42,100
Canada	47,459	43,976	40,165
India	31,366	34,261	35,036
Sweden	r 31,509	34,367	33,124
Liberia	r 23,661	24,634	24,594
Venezuela	22,100	20,300	18,465
South Africa, Republic of	7,728	10,678	11,323
Peru	9,713	8,831	9,414
Mauritania	9,103	8,457	9,298
United Kingdom	12,018	10,229	9,048
Total	r 673,544	686,461	681,334
All others	r 95,619	92,875	87,025
Grand total	r 769,163	779,336	768,359

e Estimate. p Preliminary. r Revised.

Table 36.—Leading world producers of crude steel [1]

(Thousand metric tons)

Country	1970	1971	1972 p
U.S.S.R	r 115,886	120,637	126,000
United States	119,308	109,264	120,874
Japan	93,322	88,557	96,900
Germany, West	45,041	40,314	43,705
United Kingdom	28,316	24,175	25,321
France	23,773	22,859	24,089
China, People's Republic of e	18,000	21,000	23,000
Italy	17,277	17,452	19,815
Belgium	12,607	12,444	14,532
Poland	11,795	12,738	13,471
Czechoslovakia	11,480	12,069	12,727
Canada	11,200	11,040	11,859
Spain	7,429	7,759	9,530
Romania	6,517	6,803	7,401
Australia	6,822	6,736	6,744
Total	r 528,773	513,847	555,968
All others	r 65,645	66,629	71,148
Grand total	r 594,418	580,476	627,116

e Estimate. p Preliminary. r Revised.
[1] Steel ingots and castings.

Table 37.—Leading world producers of mine lead

(Lead content of ore, thousand metric tons)

Country	1970	1971	1972 p
United States [1]	519	525	561
U.S.S.R.e	440	450	460
Australia	457	403	399
Canada	r 353	393	380
Peru [1]	157	178	189
Yugoslavia	127	124	123
Mexico [1]	177	157	161
China, People's Republic of e	100	110	110
Bulgaria	96	100	102
Total	r 2,426	2,440	2,485
All others	r 968	984	1,007
Grand total	r 3,394	3,424	3,492

e Estimate. p Preliminary. r Revised.
[1] Recoverable.

Table 38.—Leading world producers of manganese ore

(Gross weight, thousand metric tons)

Country	1970	1971	1972 p
U.S.S.R	6,841	7,318	7,800
South Africa, Republic of	2,679	3,237	3,271
Gabon	1,453	1,866	1,937
Brazil	1,879	2,602	2,608
India	1,651	1,841	1,624
Australia	751	1,050	1,207
China, People's Republic of e	1,000	1,000	1,000
Ghana	r 405	599	498
Zaire	347	387	369
Mexico	274	267	296
Japan	270	285	261
Total	r 17,550	20,452	20,871
All others	r 672	567	581
Grand total	r 18,222	21,019	21,452

e Estimate. p Preliminary. r Revised.

Table 39.—Leading world producers of mine tin

(Tin content of ore, long tons)

Country	1970	1971	1972 p
Malaysia	72,630	74,253	75,617
Bolivia	r 28,944	29,533	31,056
U.S.S.R.e	27,000	28,000	28,000
Thailand	21,435	21,346	21,717
Indonesia	18,761	19,411	20,992
China, People's Republic of e	20,000	20,000	20,000
Australia	8,689	9,639	11,765
Nigeria	7,833	7,210	6,625
Total	r 205,292	209,392	215,772
All others	r 23,208	22,840	23,830
Grand total	r 228,500	232,232	239,602

e Estimate. p Preliminary. r Revised.

Table 40.—Leading world producers of mine zinc

(Zinc content of ore, thousand metric tons)

Country	1970	1971	1972 p
Canada	r 1,239	1,268	1,201
U.S.S.R.e	610	650	650
Australia	487	450	502
United States [1]	485	456	434
Peru [1]	299	387	358
Japan	280	294	281
Mexico [1]	266	265	272
Poland	187	194	195
Korea, North e	130	135	140
Germany, West	129	132	122
Zaire	105	131	112
Sweden	93	99	110
Italy	111	106	103
China, People's Republic of e	100	100	100
Yugoslavia	101	99	97
Total	r 4,622	4,766	4,677
All others	r 842	818	874
Grand total	r 5,464	5,584	5,551

e Estimate. p Preliminary. r Revised.
[1] Recoverable.

Table 41.—Leading world producers of hydraulic cement

(Thousand metric tons)

Country	1970	1971	1972 p
U.S.S.R	r 95,248	100,296	104,040
United States (including Puerto Rico)	r 67,693	73,684	75,929
Japan	57,189	59,463	60,637
Germany, West	38,325	41,013	43,146
Italy	r 33,076	31,793	33,459
France	r 29,009	28,948	30,288
Spain (including the Canary Islands)	r 16,702	16,993	19,440
United Kingdom	17,057	17,896	18,048
India	13,543	14,894	15,700
China, People's Republic of e	10,000	12,000	14,000
Poland	12,180	13,082	13,986
Brazil	9,002	9,803	11,381
Romania	8,127	8,523	9,212
Canada	7,208	8,225	9,081
Mexico	r 7,180	7,362	8,602
Germany, East	7,987	8,473	8,950
Turkey	6,372	7,548	8,424
Czechoslovakia	r 7,402	7,956	8,045
Total	r 443,300	467,952	492,368
All others	r 127,904	137,697	146,638
Grand total	r 571,204	605,649	639,006

e Estimate. p Preliminary. r Revised.

Table 42.—Leading world producers of nitrogen fertilizer compounds

(Thousand metric tons of contained nitrogen)

Country	1970 [1]	1971 [1]	1972 [1] p
United States (including Puerto Rico)	7,632	8,161	8,318
U.S.S.R	4,509	5,423	6,055
Japan	2,131	2,105	2,121
China, People's Republic of e	1,040	1,230	1,650
France	1,313	1,351	1,401
Germany, West	1,574	1,505	1,321
Poland	938	1,030	1,081
Italy	960	956	1,034
Netherlands	893	930	1,004
India e	r 731	846	978
United Kingdom	710	748	773
Total	r 22,431	24,285	25,736
All others	r 7,834	8,650	9,366
Grand total	r 30,265	32,935	35,102

e Estimate. p Preliminary. r Revised.
[1] Year ending June 30 of that stated.

Table 43.—Leading world producers of phosphate rock [1]

(Thousand metric tons)

Country	1970	1971	1972 [p]
United States	35,143	35,277	37,041
U.S.S.R. [e 2]	20,800	21,650	22,000
Morocco	11,399	12,008	15,034
Tunisia	3,016	3,162	3,387
China, People's Republic of [e]	1,700	2,200	2,600
Nauru [3]	2,114	1,867	2,000
Total	74,172	76,164	82,062
All others	[r] 10,772	10,962	11,550
Grand total	[r] 84,944	87,126	93,612

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Includes output of all major crude mineral sources of phosphate.
[2] Includes material described as sedimentary rock in Soviet sources.
[3] Exports.

Table 44.—Leading world producers of marketable potash

(Thousand metric tons K_2O equivalent)

Country	1970	1971	1972 [p]
U.S.S.R	4,087	4,807	[e] 5,500
Canada	3,103	3,629	3,747
Germany, West	2,645	2,915	2,845
Germany, East	2,419	2,426	[e] 2,458
United States	2,476	2,347	2,412
France	1,904	2,000	[e] 1,750
Total	16,634	18,124	18,712
All others	[r] 1,521	1,668	1,721
Grand total	[r] 18,155	19,792	20,433

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

Table 45.—Leading world producers of pyrite

(Gross weight, thousand metric tons)

Country	1970	1971	1972 [p]
U.S.S.R. [e]	4,000	4,250	4,500
China, People's Republic of [e]	2,000	2,000	2,000
Spain	[r] 2,103	2,021	2,166
Japan	2,764	2,343	1,579
Italy	1,518	1,504	1,382
Finland	963	866	857
Romania	807	[e] 840	[e] 840
Norway	[r] 740	781	795
United States	859	821	753
Cyprus	[r] 940	830	638
Korea, North	500	500	500
Germany, West	575	592	486
Sweden	[r] 573	495	[e] 490
South Africa, Republic of	868	750	439
Total	[r] 19,210	18,593	17,425
All others	[r] 3,124	3,208	2,981
Grand total	[r] 22,334	21,801	20,406

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

Table 46.—Leading world producers of salt

(Thousand metric tons)

Country	1970	1971	1972 p
United States (including Puerto Rico)	41,665	40,012	40,869
China, People's Republic of e	16,000	16,500	18,000
U.S.S.R	12,400	12,000	e 12,000
Germany, West	10,447	8,921	e 9,181
United Kingdom	9,188	9,245	8,778
India (including Goa)	5,588	5,430	6,500
France	5,664	5,495	5,206
Canada	4,862	5,028	5,021
Mexico	4,153	4,360	4,558
Italy	r 4,383	4,576	4,079
Australia	3,071	3,787	e 4,000
Netherlands	r 2,871	3,167	2,803
Poland	r 2,903	2,959	3,010
Romania	r 2,862	2,948	e 2,950
Germany, East	2,180	2,221	2,250
Brazil	r 1,826	1,477	2,177
Spain	r 2,054	1,960	1,800
Total	r 132,117	130,086	133,182
All others	r 14,013	14,094	14,028
Grand total	r 146,130	144,180	147,210

e Estimate. p Preliminary. r Revised.

Table 47.—Leading world producers of elemental sulfur

(Thousand metric tons)

Country	1970	1971	1972 p
United States	8,676	8,758	9,366
Canada	4,439	4,796	3,539
Poland	2,683	2,713	2,935
France	1,735	1,806	1,730
U.S.S.R.e	1,600	1,700	1,700
Mexico	1,381	1,178	944
Japan	342	409	499
China, People's Republic of e	250	250	250
Germany, West	176	184	219
Italy	143	146	167
Total	21,425	21,940	21,349
All others	r 1,093	1,147	1,534
Grand total	r 22,518	23,087	22,883

e Estimate. p Preliminary. r Revised.

Table 48.—Leading world producers of coal (all grades)

(Million metric tons)

Country	1970			1971			1972 p		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
U.S.S.R.[1]	148	476	624	153	488	641	e 155	e 500	655
United States	5	550	[2] 556	6	503	509	10	537	547
China, People's Republic of	(3)	r 380	r 380	(3)	410	410	(3)	420	420
Germany, East	261	1	262	263	1	264	248	1	249
Germany, West	108	r [4] 117	r 225	104	[4] 117	221	110	103	213
Poland	33	140	173	35	145	180	38	152	190
United Kingdom	--	r 145	r 145	--	147	147	--	120	120
Czechoslovakia	82	28	110	85	29	[2] 113	86	28	[2] 113
Australia	24	49	73	23	49	72	24	60	[2] 83
India	4	74	[2] 77	4	71	75	3	75	78
South Africa, Republic of	--	55	55	--	59	59	--	58	58
Korea, North e	(5)	27	[2] 28	(5)	30	[2] 31	(5)	34	34
France	3	37	40	3	33	36	3	e 30	33
Yugoslavia	28	1	[2] 28	30	1	31	30	1	31
Bulgaria	29	(5)	29	27	(5)	27	28	(5)	28
Japan	(5)	r 44	r 44	(5)	33	[2] 34	(5)	28	28
Hungary	24	r 3	r 27	23	4	27	22	4	26
Total	749	r 2,127	r 2,876	756	2,120	[2] 2,877	757	2,151	[2] 2,906
All others	40	r 93	r 133	44	94	[2] 137	45	89	134
Grand total	789	r 2,220	r 3,009	800	2,214	3,014	802	2,240	[2] 3,042

e Estimate. p Preliminary. r Revised.

[1] Excludes output from the U.S.S.R. controlled portion of Svalbard (Spitzbergen).

[2] Detail for separate grades (lignite and anthracite plus bituminous) does not add to listed total for all grades because of independent rounding.

[3] Output small, included under anthracite and bituminous.

[4] Includes pech coal.

[5] Less than ½ unit.

Table 49.—Leading world producers of marketed natural gas

(Billion cubic feet)

Country	1970	1971	1972 p
United States	21,921	22,493	22,532
U.S.S.R	6,990	7,501	7,800
Canada	2,277	2,499	2,914
Netherlands	1,107	1,536	2,052
Romania	884	944	954
United Kingdom	r 398	661	953
Germany, West	r 460	555	636
Italy	r 465	473	499
Mexico	481	479	496
Iran	r 71	299	448
Venezuela	349	368	388
France	243	252	265
Argentina	212	229	218
Poland	183	190	206
Kuwait	r 180	158	180
Total	r 36,221	38,637	40,541
All others	r1,369	1,615	1,956
Grand total	r 37,590	40,252	42,497

p Preliminary. r Revised.

Table 50.—Leading world producers of crude oil

(Million 42-gallon barrels)

Country	1970	1971	1972 p
United States	3,517	3,454	3,455
U.S.S.R	2,595	2,778	2,896
Saudi Arabia	1,387	1,741	2,202
Iran	1,397	1,662	1,844
Kuwait	1,090	1,167	1,201
Venezuela	1,353	1,295	1,178
Libya	1,209	1,008	820
Nigeria	396	558	665
Canada	461	492	561
Iraq	570	624	529
United Arab Emirates [1]	284	387	440
Indonesia	312	326	396
Algeria	372	280	385
China, People's Republic of e	146	186	216
Mexico	r 178	177	185
Qatar	132	157	177
Argentina	143	155	158
Australia	65	113	120
Romania	102	102	105
Oman	121	107	103
Egypt, Arab Republic of	119	107	78
Total	r 15,949	16,876	17,714
All others	r 762	787	884
Grand total	r 16,711	17,663	18,598

e Estimate. p Preliminary. r Revised.
[1] Abu Dhabi and Dubai, formerly listed under Trucial States.

Table 51.—Major world trade in bauxite and alumina [1]

(Thousand metric tons)

Source country	1971 production by source country [2]	1971 export by source country [2]	Recipient country [3]											
			United States	Canada	Austria	France	West Germany	Italy	Norway	Sweden	United Kingdom	U.S.S.R.	Japan	Selected others [4]
Bauxite:														
Australia	12,541	NA	141	259	--	325	1,459	2	--	--	16	--	2,632	222
Dominican Republic	1,311	NA	1,112	--	--	--	--	--	--	--	--	--	--	--
France	3,184	109	--	(5)	--	XX	43	14	--	--	50	--	--	5
Ghana	330	NA	--	15	--	--	33	--	--	--	300	--	--	--
Greece	2,861	952	35	--	--	94	69	--	5	17	62	526	3	118
Guinea	2,630	NA	16	--	--	--	--	127	--	--	--	211	--	3
Guyana	4,234	2,785	527	2,130	--	46	45	20	--	6	3	--	18	84
Haiti	643	589	586	--	--	--	--	--	--	--	--	--	--	--
Hungary	2,090	700	--	--	--	--	77	--	--	--	--	--	--	--
India	1,517	54	--	--	--	--	2	13	--	--	--	--	30	--
Indonesia	1,238	NA	--	--	--	--	--	11	--	--	--	--	1,103	--
Jamaica	12,440	7,712	9,106	335	--	--	--	--	--	--	--	--	--	--
Malaysia	978	984	--	--	--	--	--	--	--	--	--	--	835	--
Sierra Leone	590	561	--	58	--	--	414	78	--	--	--	--	--	--
Surinam	6,718	3,597	2,946	299	20	32	48	18	--	--	14	--	12	93
United States	2,020	34	XX	292	--	--	13	--	--	2	--	--	22	--
Yugoslavia	1,959	1,883	--	--	--	--	607	236	--	--	--	600	--	2
Other and not specified	6,257	NA	16	1	4	8	21	29	1	9	2	63	14	39
Total	63,541	NA	14,485	3,389	24	505	2,831	548	6	34	447	1,400	4,699	566
Alumina:														
Australia	2,671	NA	1,125	259	--	--	--	--	--	--	--	--	498	62
Canada	1,140	19	130	XX	--	2	--	2	--	--	--	--	--	--
France	1,215	347	76	--	--	XX	25	45	29	--	2	--	--	177
Germany, West	826	233	2	--	75	5	XX	3	2	23	2	--	1	101
Greece	464	218	57	--	--	--	--	14	--	--	--	161	--	7
Guinea	665	NA	--	--	3	--	129	--	173	--	--	--	--	177
Guyana	310	307	12	55	--	--	--	--	146	42	13	--	--	26
Hungary	467	428	--	--	86	--	--	--	--	--	--	--	--	9
Jamaica	1,812	1,779	416	335	--	--	--	--	391	116	250	20	--	60
Japan	1,603	250	62	--	--	--	--	--	--	--	--	--	XX	19
Surinam	1,276	1,167	420	--	--	--	180	--	175	--	--	--	--	226
United States	6,544	980	XX	275	--	2	16	3	194	14	--	447	1	1
Yugoslavia	123	24	--	--	21	--	--	--	--	--	--	--	--	--
Other and not specified	3,527	NA	1	1	8	1	--	3	46	2	5	127	6	20
Total	22,643	NA	2,301	925	193	10	350	70	1,156	197	272	755	506	885

NA Not available. XX Not applicable.

[1] Data presented are compiled from import statistics of countries listed as recipient countries and, as such, are incomplete, but are believed to account for the overwhelming share of total world movement of bauxite and alumina.

[2] As reported in latest country chapter of Volume III, Minerals Yearbook. Data on bauxite production is on dry equivalent basis for a number of countries, and as such may be reported on a different basis from bauxite exports, which almost universally are on a gross weight basis and which were obtained from the Statistical Office of the United Nations and other sources. Data on alumina production are generally for output prior to calcination, while data on alumina exports, also from the Statistical Office of the United Nations and official country source data, include aluminum hydroxide and thus may not be exactly comparable.

[3] Countries selected are most of the world's significant aluminum producers that depend upon imports of bauxite and/or alumina for a significant share of their raw material requirements, plus a few minor countries for which data were readily available. Data are from Statistical Office of the United Nations except for the U.S.S.R. figures and Canadian alumina figures which are from official Soviet and Canadian sources.

[4] Countries included are as follows: Bauxite—Belgium, Denmark, Finland, Iceland, Luxembourg, the Netherlands, Spain, Switzerland, and Yugoslavia; alumina—Australia, Belgium, Denmark, Finland, Greece, Israel, Luxembourg, the Netherlands, New Zealand, Portugal, Spain, Switzerland, and Yugoslavia.

[5] Less than ½ unit.

Table 52.—Major world trade [1] in unrefined and refined unwrought copper in 1971

(Thousand metric tons)

Source country	Destination							
	Belgium-Luxembourg	Brazil	Czechoslovakia	France	Germany East	Germany West	Italy	Japan
Belgium-Luxembourg	XX	--	--	106	--	65	24	--
Canada	7	3	--	11	--	31	8	--
Chile	15	11	1	47	--	167	66	113
Germany, West	12	5	6	10	--	XX	4	--
Peru	20	3	--	--	--	17	(2)	9
U.S.S.R	--	--	37	--	--	1	--	--
United Kingdom	(2)	1	(2)	3	--	10	13	6
United States	16	17	--	20	--	53	22	9
Zaire [3]	267	--	--	33	--	3	43	16
Zambia	17	19	--	59	--	45	70	142
Other and unspecified [4]	6	--	(2)	27	2	70	9	16
Total	360	59	44	316	2	462	259	311

Source country	Destination							
	Netherlands	Spain	Sweden	Switzerland	United Kingdom	United States	Other and unspecified	Total
Belgium-Luxembourg	21	--	--	--	--	--	59	275
Canada	(2)	2	4	3	99	107	8	283
Chile	7	14	22	3	101	52	65	684
Germany, West	3	6	1	9	11	3	41	111
Peru	12	1	--	--	--	66	16	144
U.S.S.R	57	--	--	--	3	--	76	174
United Kingdom	8	2	2	1	XX	3	19	68
United States	6	(2)	2	2	12	XX	34	193
Zaire [3]	7	--	--	--	5	--	--	374
Zambia	7	6	15	11	102	6	130	629
Other and unspecified [4]	12	5	4	3	61	8	21	244
Total	140	36	50	32	394	245	469	3,179

XX Not applicable.

[1] Unless otherwise specified, data are compiled from export statistics for countries listed as source countries in stub of table.

[2] Less than ½ unit.

[3] Compiled from import statistics of selected trading partners.

[4] Includes the following countries (total exports in thousand tons in parentheses following country name): Australia (57); Austria (7); Denmark (3); Finland (8); France (13); Israel (18); Italy (4); Japan (11); the Netherlands (5); New Zealand (2); Norway (34); Spain (34); Switzerland (3); and Yugoslavia (46).

Table 53.—Major world trade in iron ores, concentrates, and agglomerates (excluding roasted pyrite) [1] in 1971

(Thousand metric tons)

Source country	Recorded total 1971 export of source country [3]	Recorded imports of principal recipient country [2]						
		Canada	United States	Belgium-Luxembourg	Czechoslovakia	France	Germany, West	Hungary
Algeria	1,834	--	--	393	--	--	--	--
Angola	5,498	--	--	114	--	683	1,125	--
Australia	52,034	--	1,023	1,088	--	803	1,786	--
Brazil	31,020	91	1,801	1,455	198	2,221	6,913	--
Canada	34,164	XX	20,668	--	--	85	2,033	--
Chile	10,304	--	892	--	--	--	131	--
France	18,304	--	--	13,873	--	XX	4,308	--
India	21,484	--	--	264	651	2	117	--
Liberia	21,235	--	1,868	942	--	1,297	6,881	--
Malaysia	879	--	--	--	--	--	--	--
Mauritania	8,601	--	--	1,291	--	1,937	1,094	--
Norway	2,742	--	--	[4] 5	25	1	[4] 1,455	--
Peru	9,120	--	1,079	--	--	305	--	--
Philippines	2,213	--	20	--	--	--	--	--
Sierra Leone	2,610	--	--	--	--	63	556	--
South Africa, Republic of [5]	5,545	--	--	--	--	--	116	--
Spain	2,345	--	--	60	--	426	754	--
Sweden	26,179	--	181	8,110	402	1,322	10,378	--
U.S.S.R	36,500	--	--	85	10,968	--	120	3,001
United States	3,090	1,292	XX	--	--	--	22	--
Venezuela	19,162	--	13,161	425	--	162	2,302	--
Other countries and origin unreported [6]	2,356	--	74	39	[7] 348	62	222	--
Total	317,219	1,383	40,767	28,144	12,592	9,369	40,313	3,001

See footnotes at end of table.

Table 53.—Major world trade in iron ores, concentrates, and agglomerates (excluding roasted pyrite) [1] in 1971—Continued

(Thousand metric tons)

Source country	Recorded imports of principal recipient country [2]							
	Italy	Netherlands	Poland	Romania	United Kingdom	Other Europe [3]	Japan	Total of listed imports
Algeria	154	--	512	--	--	--	--	1,059
Angola	--	--	--	--	415	384	3,473	6,194
Australia	1,519	74	--	--	637	369	46,287	53,586
Brazil	1,025	593	--	--	1,560	2,766	8,997	[9] 27,620
Canada	1,257	1,181	--	--	4,980	658	2,685	33,547
Chile	--	--	--	--	--	--	9,036	10,059
France	--	--	--	--	--	--	--	18,181
India	36	--	--	--	76	229	16,795	[10] 18,170
Liberia	2,781	1,863	--	--	960	461	2,854	19,907
Malaysia	--	--	--	--	--	--	894	894
Mauritania	950	--	--	--	1,602	763	845	8,482
Norway	([4])	([4])	235	--	[4] 811	324	([4])	2,856
Peru	54	--	--	--	--	--	7,415	8,853
Philippines	--	--	--	--	--	--	2,334	2,354
Sierra Leone	--	638	--	--	12	--	1,150	2,419
South Africa, Republic of [5]	--	--	--	--	18	--	6,125	6,259
Spain	63	28	--	--	535	25	--	1,891
Sweden	511	1,612	675	--	2,487	751	790	27,219
U.S.S.R	800	--	10,312	[11] 4,300	1,277	340	1,502	[12] 32,705
United States	--	--	--	--	--	9	1,955	3,278
Venezuela	1,385	--	--	--	1,752	--	--	19,187
Other countries and origin unreported [6]	585	--	696	[13] 2,639	344	34	1,811	6,854
Total	11,120	5,989	12,430	6,939	17,466	7,113	114,948	311,574

XX Not applicable.

[1] Disparities between recorded exports of source countries and totals of recorded imports of recipient countries are generally due to (1) time lag between shipment and receipt, and (2) the fact that the latter totals are incomplete, representing only the imports of the nations listed in the column heads and in footnote 8.

[2] Source: Statistical Office of the United Nations. 1971 World Trade Annual. V. I, Walker and Co., New York, 1973, except for data on Czechoslavakia, East Germany, Hungary, Poland, and Romania which are from official trade returns of the respective countries, supplemented by export data from the U.S.S.R.

[3] Source: Official trade returns of the countries listed, except for Angola and Mauritania (data from Annales des Mines, October 1973, pp. 89–122) and Australia and India (data from government publications of the respective countries other than official trade returns).

[4] Figures adjusted from those reported in official import statistics of Belgium-Luxembourg, West Germany, Italy, the Netherlands, the United Kingdom, and Japan to adjust for ores originating in Sweden but shipped through Narvik, Norway, and apparently credited in those sources to Norway.

[5] Includes exports from Swaziland.

[6] Recorded 1971 export total is a total of exports from the following countries (exports for each follow the country name in parentheses in thousand metric tons): Austria (1); Belgium-Luxembourg (75); Bolivia (4); Finland (27); Germany, West (9); Hong Kong (18); Korea, North (450-Japanese imports only); Korea, Republic of (South) (421); Libya (1); Morocco (457); the Netherlands (21); Poland (1); Portugal (26); Thailand (5); Tunisia (719); and Yugoslavia (121).

[7] Figure represents difference between total reported Czechoslovakian imports and detail of recorded receipts; origin unreported.

[8] Includes the following countries with recorded total imports as indicated in parentheses in thousand tons: Austria (1,842); Denmark (1); Finland (900); Greece (432); Norway (10); Portugal (340); Spain (3,248); Sweden (2); Switzerland (43); and Yugoslavia (195).

[9] Excludes 1,272,000 metric tons to Argentina (reported in Argentine import statistics).

[10] Excludes 1,380,000 metric tons to Romania and 380,000 metric tons to Poland (reported in Indian trade statistics).

[11] Reported U.S.S.R. exports to Romania.

[12] Excludes 2,759,000 metric tons to East Germany and 1,032,000 metric tons to Bulgaria (reported in U.S.S.R. trade statistics).

[13] Figure represents difference between total reported Romanian imports and the U.S.S.R. export to Romania; origin unreported.

Table 54.—Major world trade in steel ingots and semimanufactures in 1971, by area

(Thousand metric tons)

Exporting country and area	Destination [1]						
	North America			Europe			
	Canada	United States	Latin America [2]	European Economic Community	European Free Trade Association	Other non-Communist	Communist [3]
North America:							
Canada	XX	1,214.8	158.4	37.5	40.6	6.4	2.2
United States	698.8	XX	533.3	379.5	62.8	56.3	19.4
Total	698.8	1,214.8	691.7	417.0	103.4	62.7	21.6
Europe:							
European Economic Community:							
Belgium-Luxembourg	89.0	1,583.0	211.0	8,326.0	904.0	229.0	219.0
France	105.1	1,404.2	270.2	3,341.0	925.5	253.8	214.9
Germany, West	175.8	2,293.5	287.2	5,310.3	1,974.3	523.6	1,521.6
Italy	2.5	517.8	92.4	1,174.0	258.7	111.8	396.6
Netherlands	--	486.0	43.0	2,119.0	729.0	164.0	90.0
Subtotal	372.4	6,284.5	903.8	20,270.3	4,791.5	1,282.2	2,442.1
European Free Trade Association:							
Austria	6.0	10.5	10.8	774.0	281.1	37.5	242.8
Denmark	--	.2	.3	85.2	164.1	8.8	.1
Norway	--	7.2	.8	136.3	287.5	47.3	1.0
Portugal	--	.1	.2	3.6	1.1	4.4	--
Sweden	16.0	81.0	21.0	450.0	568.0	116.0	88.0
Switzerland	1.1	8.8	.6	53.0	32.2	5.9	1.4
United Kingdom	150.2	1,269.5	253.4	475.1	590.6	673.9	157.8
Subtotal	173.3	1,377.3	287.1	1,977.2	1,924.6	893.8	491.1
Other non-Communist Europe:							
Finland	--	33.1	19.9	141.6	179.8	2.8	4.1
Greece	--	34.6	--	3.0	1.4	.1	69.4
Spain	2.6	185.1	67.8	309.9	60.2	36.5	56.5
Subtotal	2.6	252.8	87.7	454.5	241.4	39.4	130.0
European Communist Countries:							
Bulgaria	--	--	--	220.0	58.6	30.8	388.1
Czechoslovakia	113.6	43.5	4.5	694.4	311.6	90.7	1,048.3
Germany, East [6]	.5	--	--	18.6	3.5	15.6	44.2
Hungary	--	--	6.1	153.4	136.5	199.0	260.1
Poland	7.8	174.3	125.7	129.6	163.6	30.4	666.2
Romania [6]	--	--	--	305.8	24.2	26.0	105.2
U.S.S.R	--	--	181.3	104.5	59.3	110.4	5,882.6
Yugoslavia	.6	1.6	--	58.9	12.5	4.6	219.5
Subtotal	122.5	219.4	317.6	1,685.2	769.8	507.5	8,614.2
Total	670.8	8,134.0	1,596.2	24,387.2	7,727.3	2,722.9	11,677.4
Africa: South Africa, Republic of	.1	17.9	2.4	18.2	9.1	6.1	--
South Asia and Far East:							
India [7]	1.7	8.5	9.6	.6	.6	1.0	71.5
Japan	888.0	5,787.0	2,743.0	1,653.0	672.0	490.0	797.0
Subtotal	889.7	5,795.5	2,752.6	1,653.6	672.6	491.0	868.5
Oceania: Australia	4.5	51.8	17.8	4.5	3.4	2.7	.4
Grand total	2,263.9	15,214.0	5,060.7	26,480.5	8,518.8	3,285.4	12,567.9

See footnotes at end of table.

Table 54.—Major world trade in steel ingots and semimanufactures in 1971, by area—Continued

(Thousand metric tons)

Exporting country and area	Destination [1]							
			South Asia and Far East					
	Africa	Near East [4]	Japan	Other non-Communist	Communist [5]	Oceania	Unallocated	Total
North America:								
Canada	3.6	13.3	0.4	39.0	--	12.2	--	1,528.4
United States	71.4	143.8	12.5	584.9	11.5	15.0	0.8	2,590.0
Total	75.0	157.1	12.9	623.9	11.5	27.2	.8	4,118.4
Europe:								
European Economic Community:								
Belgium-Luxembourg	293.0	167.0	--	104.0	12.0	10.0	--	12,147.0
France	688.1	293.4	.1	118.6	37.7	22.2	13.0	7,687.8
Germany, West	320.1	320.7	1.9	255.2	196.8	21.5	--	13,202.5
Italy	247.6	218.6	--	39.2	62.4	3.3	6.3	3,131.2
Netherlands	44.0	18.0	--	23.0	1.0	3.0	6.0	3,726.0
Subtotal	1,592.8	1,017.7	2.0	540.0	309.9	60.0	25.3	39,894.5
European Free Trade Association:								
Austria	4.1	36.8	--	2.9	2.6	4.0	2.2	1,415.3
Denmark	.3	.1	--	.3	--	--	--	259.4
Norway	7.5	2.0	--	13.8	--	--	--	503.4
Portugal	18.7	1.1	--	3.9	--	--	.1	33.2
Sweden	21.0	7.0	3.0	18.0	42.0	7.0	--	1,438.0
Switzerland	2.2	1.2	--	.4	--	--	.2	107.0
United Kingdom	422.4	217.2	.5	595.0	44.6	123.8	2.0	4,976.0
Subtotal	476.2	265.4	3.5	634.3	89.2	134.8	4.5	8.732.3
Other non-Communist Europe:								
Finland	--	18.0	--	.5	6.0	--	--	405.8
Greece	4.3	12.8	--	--	--	--	--	125.6
Spain	81.1	110.7	--	.5	--	6.3	.8	918.0
Subtotal	85.4	141.5	--	1.0	6.0	6.3	.8	1,449.4
European Communist Countries:								
Bulgaria	1.4	115.2	3.1	4.6	4.3	--	--	826.1
Czechoslovakia	21.8	332.3	--	32.5	52.7	--	--	2,745.9
Germany, East [6]	--	--	--	--	--	--	--	82.4
Hungary	10.2	120.9	--	52.7	10.7	--	--	949.6
Poland	25.9	62.5	--	60.5	38.7	--	.4	1,485.6
Romania [6]	--	55.5	--	--	--	--	--	516.7
U.S.S.R	58.4	458.4	--	132.2	87.4	--	369.8	7,444.3
Yugoslavia	2.8	1.1	--	1.8	3.2	--	--	306.6
Subtotal	120.5	1,145.9	3.1	284.3	197.0	--	370.2	14.357.2
Total	2,274.9	2,570.5	8.6	1,459.6	602.1	201.1	400.8	64,433.4
Africa: South Africa, Republic of	--	.2	.5	.7	--	1.5	224.2	280.9
South Asia and Far East:								
India [7]	29.7	36.0	11.7	39.1	--	3.9	1.7	215.6
Japan	1,153.0	1,258.0	XX	4,336.0	2,483.0	934.0	--	23,194.0
Subtotal	1,182.7	1,294.0	11.7	4,375.1	2,483.0	937.9	1.7	23,409.6
Oceania: Australia	11.3	3.2	13.8	180.8	16.4	222.2	--	532.8
Grand total	3,543.9	4,025.0	47.5	6,640.1	3,113.0	1,389.9	627.5	92,775.1

XX Not applicable.

[1] Because some countries do not report destinations for a portion of exports (see unallocated column), figures given for distribution of those countries' exports by Continental Area are not exactly correct. However, such unallocated quantities are sizable only in the case of the U.S.S.R. and the Republic of South Africa.

[2] All Western Hemisphere areas except the United States and Canada.

[3] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, the U.S.S.R., and Yugoslavia.

[4] Bahrain, Iran, Iraq, Jordan, Kuwait, Lebanon, Muscat and Oman, Qatar, Saudi Arabia, Southern Yemen, Syria, United Arab Emirates, Turkey, and Yemen.

[5] Consists of the People's Republic of China, North Korea, and North Vietnam; Mongolia is included under other non-Communist Asia and Far East owing to its inseparability from this group in source.

[6] Partial figure; derived from import data of partner countries. Source: Statistical Office of the United Nations. 1971 World Trade Annual. V. III, Walker and Co., New York, 1973, 540 pp.

[7] Data are for calendar year 1971, and are derived from country source data.

Source: Except where otherwise noted: United Nations Economic Commission for Europe. Statistics of World Trade in Steel, 1971, 61 pp.

Table 55.—Major world trade in lead ores and concentrates [1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting region: North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1971									
United States	20.3	31.5	--	--	--	--	8.1	--	59.9
Western Europe:									
Belgium-Luxembourg [5]	34.5	24.6	13.5	--	--	--	--	13.2	85.8
France	3.0	6.9	41.7	--	38.4	0.5	14.3	--	104.8
Germany, West	42.1	36.0	39.5	0.1	8.8	.3	--	--	126.8
United Kingdom	2.3	6.2	6.2	--	9.8	--	18.4	--	42.9
Other [6]	6.2	--	15.1	--	--	--	--	.2	21.5
Total	88.1	73.7	116.0	.1	57.0	.8	32.7	13.4	381.8
Japan	93.8	14.2	--	--	.7	17.4	12.4	1.3	139.8
Grand total	202.2	119.4	116.0	.1	57.7	18.2	53.2	14.7	581.5
1972									
United States	27.4	45.1	--	--	.4	--	18.8	--	91.7
Western Europe:									
Belgium-Luxembourg [5]	26.2	15.5	10.4	--	10.7	--	--	18.2	81.0
France	7.1	4.1	43.6	--	46.7	--	7.7	2.7	111.9
Germany, West	17.7	28.1	57.8	--	6.8	.3	3.3	--	114.0
United Kingdom	5.0	12.4	5.3	--	--	--	--	--	22.7
Other [7]	--	--	--	--	--	--	--	--	--
Total	56.0	60.1	117.1	--	64.2	.3	11.0	20.9	329.6
Japan	88.9	16.3	--	--	--	13.0	4.3	1.2	123.7
Grand total	172.3	121.5	117.1	--	64.6	13.3	34.1	22.1	545.0

[1] Imports of countries other than those listed believed smaller.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.
[5] Gross weight of ore January through October.
[6] Includes Italy gross weight of ore, January through October and Austria for January through June.
[7] None reported in 1972.

Source: Monthly Bulletin of Statistics of the International Lead and Zinc Study Group. Lead and Zinc Statistics, April 1972, v. 12, No. 4, p. 24; April 1973, v. 13, No. 4, p. 24.

Table 56.—Major world trade in lead bullion and refined lead[1]

(Thousand metric tons)

Destination	Exporting region								
	North America	Latin America[2]	Western Europe[3]	Eastern Europe[4]	Africa	Asia	Oceania	Origin not reported by continent	Total[5]
1971									
United States	51.5	59.9	11.9	--	12.3	--	41.9	--	177.5
Western Europe:									
Belgium-Luxembourg[6]	--	--	17.0	--	--	--	--	2.3	19.3
France	.1	--	24.9	1.1	15.5	--	--	--	41.6
Germany, West	2.8	1.9	92.5	.4	1.6	4.6	19.6	--	123.4
Italy[7]	--	26.4	40.6	--	22.3	7.8	--	15.5	112.6
Netherlands	--	6.4	25.2	2.2	--	--	23.2	--	57.0
Switzerland	2.0	3.9	14.9	.4	.3	--	1.2	.3	23.0
United Kingdom	42.6	.2	--	--	9.6	--	177.8	--	230.2
Other[8]	1.2	5.1	27.7	7.0	5.1	--	--	--	46.1
Total	48.7	43.9	242.8	11.1	54.4	12.4	221.8	18.1	653.2
Japan	.5	.6	--	--	.9	1.5	--	.1	3.6
Grand total	100.7	104.4	254.7	11.1	67.6	13.9	263.7	18.2	834.3
1972									
United States	75.8	76.9	26.4	--	8.0	.2	35.0	1.0	223.2
Western Europe:									
Belgium-Luxembourg[6]	.5	--	13.9	--	--	--	--	2.2	16.6
France	--	--	28.5	2.0	6.7	--	--	.9	38.1
Germany, West	4.9	2.1	73.8	.6	1.5	10.4	23.9	--	117.2
Italy[9]	--	23.7	39.5	.5	14.6	13.3	--	22.4	114.0
Netherlands	--	7.1	25.2	2.8	--	1.0	9.3	--	45.4
Switzerland	2.0	3.0	15.7	.3	--	--	.9	.5	22.4
United Kingdom	46.4	--	--	--	5.9	--	153.0	.4	205.7
Other[10]	.6	3.4	33.6	9.8	3.2	--	--	.2	50.7
Total	54.4	39.3	230.2	16.0	31.9	24.7	187.1	26.6	610.1
Japan	.3	1.9	--	--	.8	1.2	--	.2	4.4
Grand total	130.5	118.1	256.6	16.0	40.7	26.1	222.1	27.8	837.7

[1] Imports of countries other than those listed are generally small individually (except for Eastern European nations listed in footnote 4) but in aggregate apparently total about 125,000 tons per year. Total lead imports by East European countries including trade between the countries of this group apparently total 70,000 tons or more per year.

[2] Includes Mexico.

[3] Includes Yugoslavia.

[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.

[5] Reported totals.

[6] January through November.

[7] January through June.

[8] Includes Austria, January through June; and Norway, Denmark, Finland, Ireland, and Sweden, January through December.

[9] January through September.

[10] Includes Austria, Denmark, Finland, Norway, and Sweden, January through December.

Source: Monthly Bulletin of International Lead and Zinc Study Group. Lead and Zinc Statistics, May 1972, v. 12, No. 5, pp. 24–25; May 1973, v. 13, No. 5, pp. 24–25.

Table 57.—Major world trade in zinc ores and concentrates[1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting region								
	North America	Latin America[2]	Western Europe[3]	Eastern Europe[4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1971									
United States	189.8	114.7	3.6	--	0.1	--	2.6	--	310.8
Western Europe:									
Belgium-Luxembourg[5]	265.8	--	39.7	--	39.6	--	--	85.9	431.0
France	79.6	48.0	71.6	--	20.4	3.7	--	--	223.3
Germany, West	95.4	12.5	46.3	4.7	1.0	6.2	7.4	--	173.5
United Kingdom	23.7	9.8	12.2	--	--	--	87.0	3.3	136.0
Other[6]	36.1	5.9	41.3	--	.6	1.0	10.3	--	95.2
Total	500.6	76.2	211.1	4.7	61.6	10.9	104.7	89.2	1,059.0
Japan	155.6	222.9	--	--	1.2	34.7	62.9	--	477.3
Grand total	846.0	413.8	214.7	4.7	62.9	45.6	170.2	89.2	1,847.1
1972									
United States	123.0	92.2	6.4	--	4.3	--	5.3	--	231.2
Western Europe:									
Belgium-Luxembourg[7]	307.5	15.5	71.2	--	32.5	--	--	40.6	467.3
France[8]	77.9	47.4	30.7	--	24.8	8.8	2.2	--	191.8
Germany, West	117.3	47.3	64.3	2.8	--	6.3	6.4	--	244.4
United Kingdom	8.2	6.1	15.3	--	--	--	21.3	8.4	59.3
Other[9]	31.7	13.8	89.4	--	--	1.2	28.1	--	164.2
Total	542.6	130.1	270.9	2.8	57.3	16.3	58.0	49.0	1,127.0
Japan	139.4	261.1	--	--	--	55.7	60.0	1.6	517.8
Grand total	805.0	483.4	277.3	2.8	61.6	72.0	123.3	50.6	1,876.0

[1] Imports of countries other than those listed believed small.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.
[5] January through October.
[6] Includes Austria, January through June; Norway and the Netherlands, January through December.
[7] Gross weight of ore, January through October.
[8] January through September.
[9] Includes the Netherlands and Norway, January through December. Norway data is gross weight of ore.

Source: Monthly Bulletin of the International Lead and Zinc Study Group. Lead and Zinc Statistics, April 1972, v. 12, No. 4, p. 25; and April 1973, v. 13, No. 4, p. 25.

Table 58.—Major world trade in refined zinc

(Thousand metric tons)

Destination	Exporting region								
	North America	Latin America [1]	Western Europe [2]	Eastern Europe [3]	Africa	Asia	Oceania	Origin not reported by continent	Total [4]
1971									
United States	136.9	30.9	62.2	3.5	12.7	7.9	35.0	0.8	289.9
Western Europe:									
Belgium-Luxembourg [5]	3.9	--	4.1	--	8.5	5.4	3.3	6.4	31.5
France	1.2	--	14.5	5.3	1.2	7.1	.2	--	29.5
Germany, West	8.9	.8	127.8	10.6	12.1	1.9	--	--	162.1
Italy [5]	2.8	.2	23.6	5.7	1.9	--	--	3.1	37.3
Netherlands	--	.5	8.4	4.3	--	6.3	--	--	19.5
Sweden	1.5	--	26.6	6.1	--	--	--	--	34.2
Switzerland	.1	.1	20.2	.9	1.6	3.2	--	--	25.9
United Kingdom	73.7	1.9	22.3	39.5	1.2	--	31.8	.1	171.7
Other [6]	.2	--	11.4	2.5	1.1	--	--	--	15.2
Total	92.3	3.5	258.9	74.9	27.6	23.9	35.3	9.6	526.9
Hong Kong	2.3	--	.5	--	--	2.0	2.7	1.0	8.5
Japan	2.4	.5	--	--	--	8.6	1.8	--	13.3
Grand total	233.9	34.9	321.6	78.4	40.3	42.4	74.8	11.4	838.6
1972									
United States	246.0	35.4	97.7	8.8	21.2	27.3	35.9	1.7	474.1
Western Europe:									
Belgium-Luxembourg [5]	1.8	--	1.3	5.2	10.7	6.7	1.9	5.6	33.2
France	.8	--	22.7	9.1	1.0	16.7	--	.5	50.8
Germany, West	5.6	--	113.5	6.6	6.3	1.1	--	--	133.1
Italy [7]	3.1	--	18.1	2.5	6.6	--	1.0	--	33.7
Netherlands	--	--	10.4	3.2	2.0	3.0	--	.3	18.9
Sweden	1.0	--	32.9	4.9	--	--	--	--	38.8
Switzerland	--	--	26.9	1.4	1.8	2.7	--	--	32.8
United Kingdom	67.5	.6	67.1	25.7	10.6	.5	41.1	11.5	224.7
Other [8]	.2	--	14.4	3.5	1.6	--	--	--	19.7
Total	80.0	.6	307.3	62.1	40.6	30.7	44.0	17.9	585.7
Hong Kong	--	--	--	--	--	--	--	--	--
Japan	--	.2	--	--	--	7.2	--	--	7.4
Grand total	326.0	36.2	405.0	70.9	61.8	65.2	79.9	19.6	1,067.2

[1] Includes Mexico.
[2] Includes Yugoslavia.
[3] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.
[4] Reported totals; detail may not add horizontally owing to rounding.
[5] January through November.
[6] Includes Austria, January through June; and Denmark, Finland, and Ireland, January through December.
[7] January through September.
[8] Includes Austria, Denmark, and Finland, January through December.

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics. May 1972, v. 12, No. 5, pp. 26–27, May 1973, v. 13, No. 5, pp. 26–27.

Table 59.—World movement of solid fuels in 1971 [1]

(Thousand metric tons, standard coal equivalent)

Source area	Destination					
	North America [2]	Caribbean America [3]	Other America [4]	Western Europe [5]	Africa	Near East
North America [2]	16,965	450	2,570	15,705	45	--
Western Europe [5]	150	25	65	31,620	355	--
Africa	15	--	--	925	905	--
Far East	--	150	20	--	--	--
Oceania	--	5	45	3,165	--	--
Other countries [6]	--	125	145	25.920	660	--
Total [7]	17,130	715	2,850	77,370	1,955	--

	Destination				
	Far East	Oceania	Other countries [6]	Destination unspecified [8]	World [7]
North America [2]	24,725	5	115	10	60,590
Western Europe [5]	45	--	660	40	32,950
Africa	220	15	--	430	2,505
Far East	740	--	--	5	875
Oceania	16,670	345	30	5	20,275
Other countries [6]	4,870	--	39,910	190	71,820
Total [7]	47,265	365	40,720	690	189,070

[1] Data based on the general trade system; lignite briquets are reduced to standard coal equivalent (SCE) before inclusion; bunker loadings are excluded.
[2] Bermuda, Canada, Greenland, St. Pierre, and the United States.
[3] Mexico, all areas of Central America, all islands of the Caribbean, Colombia, and Venezuela.
[4] All South America except Colombia and Venezuela.
[5] All non-Communist nations of Europe, including Yugoslavia.
[6] Chiefly the Communist nations of Europe and Asia, but apparently including some other countries not identified separately.
[7] Reported totals; detail does not add to listed total as shown because of (1) inclusion of quantities shipped to or received from areas not listed separately or not identified in original sources and (2) rounding.
[8] As reported in source.

Source: Statistical Office of the United Nations. World Energy Supplies 1968–71. Statistical Papers, Series J, No. 16, New York, 1973, pp. 41-47.

Table 60.—World movement of crude petroleum in 1970–71 [1]

(Thousand metric tons)

Source area [2]	Destination: North America	Caribbean America	Other America	Western Europe	Africa	Near East
1970						
North America	32,950	570	--	30	--	--
Caribbean America	35,300	71,440	5,700	22,080	180	--
Other America	--	130	520	90	--	--
Western Europe	160	--	--	1,440	30	--
Africa	8,390	15,730	5,280	241,220	3,060	530
Near East	16,320	4,160	10,560	307,790	15,830	22,820
Far East	3,580	950	--	--	--	--
Other countries	--	4,500	--	25,820	2,070	--
Total [3]	96,340	97,480	22,060	598,470	21,170	23,350
1971						
North America	36,590	20	--	20	--	--
Caribbean America	38,300	61,890	6,550	20,600	30	--
Other America	140	820	1,000	110	--	--
Western Europe	--	--	--	2,060	--	--
Africa	13,120	26,050	5,650	203,160	3,750	720
Near East	26,210	10,690	14,350	367,250	20,570	22,050
Far East	5,600	590	--	100	--	--
Other countries	--	4,600	--	26,950	2,270	--
Total [3]	120,360	104,660	27,550	620,320	26,620	22,770

Source area [2]	Destination: Far East	Oceania	Other countries	Destination unspecified	World [3]
1970					
North America	30	--	--	--	33,220
Caribbean America	600	--	--	--	135,300
Other America	--	--	--	--	740
Western Europe	--	--	--	--	1,630
Africa	2,430	--	4,370	--	281,010
Near East	193,170	13,670	7,270	13,750	604,540
Far East	33,700	3,350	140	--	41,720
Other countries	500	--	34,440	--	67,330
Total [3]	230,430	17,020	46,220	13,750	1,165,310
1971					
North America	20	--	--	--	36,650
Caribbean America	460	--	--	40	127,870
Other America	--	--	--	--	2,070
Western Europe	--	--	--	10	2,070
Africa	3,120	80	4,750	10	260,410
Near East	217,230	12,110	11,400	15,620	717,480
Far East	38,240	1,270	150	--	45,950
Other countries	1,500	--	38,870	860	75,050
Total [3]	260,800	13,460	55,170	16,510	1,268,220

[1] Data are based on general trade system.
[2] For details on countries included in each area, see footnotes to table 59.
[3] Reported totals; details may not add to totals shown because of (1) inclusions in totals of quantities shipped to or received from areas not listed separately or identified in original sources and (2) rounding.

Source: Statistical Office of the United Nations. World Energy Supplies 1968–71. Statistical Papers J, No. 16, New York, 1973, pp. 61–69.

Table 61.—Refined petroleum fuel trade, by Continental area[1]

(Million metric tons)

Continental area[2]	Exports		Imports		Bunkers	
	1970	1971	1970	1971	1970	1971
North America	7.93	8.01	112.69	116.10	17.81	17.67
Caribbean America	132.32	133.66	14.02	15.06	15.83	15.54
Other America	1.10	.69	4.57	4.26	1.60	1.75
Western Europe	101.50	97.25	120.91	123.13	46.11	48.41
Eastern Europe	37.37	37.70	7.62	6.65	NA	NA
Africa	4.35	4.61	13.91	13.15	8.21	8.09
Near East	65.50	57.52	2.54	2.25	20.11	23.16
Far East	20.50	23.64	50.43	48.54	25.09	27.37
Oceania	1.63	2.26	4.66	5.49	3.63	3.88
Not specified[3]	.14	.07	1.41	1.39	.78	.73
Total	372.34	365.41	332.76	336.02	139.17	146.60

NA Not available.

[1] Figures given are for fuel commodities only, excluding lubricants and other refinery products not normally used as energy sources. Apparent discrepancies between export, import, and bunker totals evidently result from quantities of material en route at yearend, from incomplete data, and from differing practices from country to country in the method of reporting bunkering materials.

[2] Continental areas are the same as those used in table 59 except that Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R. are reported under the group term Eastern Europe.

[3] Derived figure; difference between listed detail and reported total.

Sources: Statistical Office of the United Nations. World Energy Supplies 1968–71. Statistical Papers. Series J, No. 16, New York, 1973, pp. 70–81.

The Mineral Industry of Algeria

By Richard F. Zaffarano [1]

At yearend, Algeria's total output of crude oil and natural gas was committed, with additional buyers seeking to obtain immediate and long-term contracts to counter the tight world petroleum supply situation. The Algerian state-owned company Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH entered an agreement with Commonwealth Oil refining Co. (Corco), U.S.-owned and based in Puerto Rico, which involved delivery of 2,660 million barrels of crude and other hydrocarbon materials, over a 25-year period commencing in 1972. Deliveries are to stabilize at 400,000 barrels per day in 1975 and continue for the balance of of the contract. SONATRACH negotiated a series of contracts for the sale of liquefied natural gas (LNG), equivalent to 4,400 million cubic feet per day of natural gas. LNG exports are forecast to peak at 8,000 million cubic feet per day in 1980. Although Algeria's oil industry netted $1.1 billion in 1972, future natural gas sales to the United States and West European countries are expected to exceed oil revenue. Consideration continued on a submarine pipeline across the floor of the Mediterranean to Italy, via Sicily, to add from 600 to 1,000 million cubic feet per day to Italy's natural gas supply.

In May 1972, Algeria paid to Compagnie Française des Pétroles (Algerie) (CFP) the first $8.7 million installment of a $61 million indemnity for nationalization of CFP properties in 1971. Essence et Lubrifiant de France-Entreprise de Recherches et d'Activité Pétrolières (Elf-ERAP) received a $50 million reimbursement for the 1967–71 exploration advance and $2 million for LNG marketing interests.

Low world mineral prices and the inability to overcome transportation problems within Algeria were the principle deterrents to further mineral development. At this time the major mine development activities were focused on the Ouenza and Gara Djebilet iron ore deposits.

PRODUCTION

Following the partial nationalization of French holdings in February, 1971, Algerian crude oil production during 1972 rose to a record output level, 384.8 million barrels, a 38% increase above the previous year. During 1972, natural gas production was estimated at 350 billion cubic feet, an increase of 34.6% from the previous year, and condensate production was 8.7 million barrels. Plans are to reinject dry gas at Hassi R'Mel to substantially increase the field's capacity.

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[1] Physical scientist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Algeria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Antimony concentrate:				
Gross weight [e]		[r] 380	150	150
Metal content [e]		[r] 154	60	60
Copper concentrate:				
Gross weight		2,406	2,167	1,615
Metal content		574	514	[e] 428
Iron and steel:				
Iron ore, gross weight	thousand tons	2,863	3,147	3,669
Pig iron	do	409	333	[e] 350
Crude steel	do	39	[r e] 40	[e] 40
Lead concentrate:				
Gross weight		[r] 9,439	7,216	7,400
Metal content		[r] 6,525	4,669	4,800
Mercury	76-pound flasks	---	246	13,361
Silver	thousand troy ounces	210	[r e] 200	[e] 190
Zinc concentrate:				
Gross weight		30,556	30,097	28,300
Metal content		[r] 16,966	15,794	14,900
NONMETALS				
Barite:				
Crude		[r] 73,396	46,000	52,528
Powder		51,643	36,500	35,200
Cement, hydraulic	thousand tons	[r] 928	968	[e] 970
Clays, bentonitic		[e] 10,000	9,516	19,910
Diatomite		[e] 7,000	4,428	4,564
Fertilizer materials:				
Phosphate rock	thousand tons	492	491	490
Ammonium nitrate	do	70	117	NA
Gypsum [2]	do	8	8	[e] 10
Lime [2]	do	43	40	[e] 40
Pyrite:				
Gross weight		32,504	27,422	27,900
Sulfur content		14,952	12,614	12,800
Salt	thousand tons	74	116	108
Sand and gravel: [2]				
Sand	thousand cubic meters [3]	90	88	NA
Gravel	do	55	55	NA
Stone, crushed [2]	do	1,091	1,301	NA
Strontium mineral, celestite, gross weight		---	360	1,800
Sulfur, elemental [e]		[r] 20,000	[r] 20,000	20,000
MINERAL FUELS AND RELATED MATERIALS				
Coal	thousand tons	13	14	12
Gas, natural:				
Gross production [e]	million cubic feet	340,000	260,000	350,000
Marketable (including liquefied)	do	[r] 105,872	105,096	126,362
Natural gas liquids (condensate)	thousand 42-gallon barrels	10,602	[r e] 8,000	8,666
Petroleum:				
Crude	do	376,024	279,627	384,858
Refinery products:				
Gasoline	do	4,372	4,845	5,087
Jet fuel and kerosine	do	1,579	1,814	2,086
Distillate fuel oil	do	6,948	6,938	7,064
Residual fuel oil	do	3,330	3,963	3,916
Other	do	1,250	1,809	1,391
Refinery fuel and losses	do	907	[e] 968	1,794
Total	do	18,386	[e] 20,337	21,338

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

[1] In addition to the commodities listed, secondary aluminum, secondary lead, and copper may be produced in small quantities and additional crude construction materials (common clays and stone) presumably are produced for local consumption, but output is unreported and available information is inadequate to make reliable estimates of output levels.

[2] Partial figure; production by firms employing 20 or more persons only.

[3] Source indicates unit of measure to be square meters, but this appears to be incorrect.

TRADE

Tables 2 and 3 indicate foreign trade in minerals for 1970 and 1971 the latest years for which information was available.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms	[2] 336	495	All to France.
Copper:			
Ore and concentrate	[3] 1,206	3,432	Bulgaria 2,032; Japan 1,400.
Copper sulfate	NA	131	Cuba 63; North Korea 20; Arab Republic of Egypt 20.
Metal, including alloys, all forms	[2] 1,004	2,425	France 1,940; Spain 260; Italy 124.
Iron and steel:			
Ore and concentrate—thousand tons	[3] 1,928	1,779	Romania 760; Poland 506; Belgium-Luxembourg 404.
Roasted pyrite	NA	11,500	All to Poland.
Metal:			
Pig iron, ferroalloys and similar materials	[2] 323,043	297,737	People's Republic of China 149,495; Italy 89,915; Spain 19,858.
Semimanufactures	NA	125	Spain 99; France 26.
Lead:			
Ore and concentrate	[3] 10,915	7,421	Spain 2,250; Bulgaria 2,093; France 1,679.
Metal, including alloys:			
Scrap	[2] 988	644	Italy 545; France 99.
Semimanufactures		3	All to France.
Nickel metal, including alloys, scrap	[2] 38	3	Do.
Zinc:			
Ore and concentrate	[3] 35,610	25,070	Italy 9,870; Finland 6,000; Bulgaria 3,600.
Ash and residue	NA	2,100	Italy 1,500; Spain 600.
Metal, including alloys:			
Scrap	[2] 142	981	Spain 610; France 371.
Semimanufactures		67	All to France.
Other ore and concentrate, n.e.s.	NA	1,580	All to Spain.
NONMETALS			
Clays, crude, n.e.s.:			
Bentonite		1,760	Saudi Arabia 1,250; Nigeria 500; France 10.
Kaolin	[2] 1,483	1,460	Cuba 634; Arab Republic of Egypt 242; North Korea 230.
Other		4,000	All to Morocco.
Diatomite and other infusorial earth	[2] 2,527	2,719	United Kingdom 1,657; Morocco 634; France 405.
Fertilizer materials:			
Crude, phosphatic	[2] 148,494	435,181	Romania 84,700; People's Republic of China 82,675; France 78,285.
Manufactured, nitrogenous	NA	8,180	All to Arab Republic of Egypt.
Ammonia	NA	6,200	Spain 5,377; Greece 823.
Fluorspar	[2 4] 17,439	61,750	All to Italy.
Salt	[e] 23,500	38,000	France 30,000; Dahomey 5,000; Nigeria 3,000.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	NA	234	All to Libya.
Sand, excluding metal bearing	NA	165	Cuba 162.
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, liquefied—million cubic feet	[2] 58,000	57,003	United Kingdom 36,594; France 18,445; United States 1,963.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	[5] 315,625	248,906	West Germany 77,820; France 56,835; Italy 21,641.
Refinery products:			
Gasoline—do	[5] 985	510	Netherlands 277; Italy 233.
Kerosine—do	[5] 268	74	Netherlands 55; Nigeria 17.
Distillate fuel oil—do	[5] 1,219	896	Netherlands 547; United Kingdom 98; West Germany 76.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products—Continued			
Residual			
thousand 42-gallon barrels	[5] 1,952	1,339	United States 695; Greece 175; Liberia 103.
Lubricants ——do——	NA	(6)	
Other ——do——	312	—	
Total ——do——	[5] 4,736	2,819	

NA Not available.
[1] Data in this table, unless otherwise noted, are from official trade returns of Algeria.
[2] Partial figure; compiled from import data of selected trading partner countries. Source: Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Co., New York, 1972, pp. 150–154.
[3] Unofficial export figure reported in Bureau de Documentation Minière (France). Annales des Mines, October 1971, p. 48.
[4] Reported as feldspar, fluorspar, and nepheline syenite, but believed to be entirely fluorspar.
[5] Source: U.S. Bureau of Mines, International Petroleum Annual, 1970.
[6] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	NA	574	People's Republic of China 310; France 210.
Metal, including alloys, all forms	[2] 4,725	4,052	France 1,362; Canada 798; Belgium-Luxembourg 494.
Antimony metal, including alloys, all forms	NA	[3] 14	Belgium-Luxembourg 13; West Germany 1.
Arsenic, oxide and acid	NA	40	All from France.
Cadmium metal, including alloys, all forms ——kilograms——	NA	[3] 104	Do.
Chromium:			
Oxides and hydroxides	NA	19	West Germany 9; France 9.
Metal, including alloys, all forms kilograms	NA	20	All from Italy.
Copper:			
Copper sulfate	NA	246	France 184; West Germany 30; Belgium-Luxembourg 21.
Metal, including alloys, all forms	[2] 2,687	4,627	West Germany 1,806; Peru 1,008; France 1,000.
Germanium metal, including alloys, all forms ——kilograms——	NA	[3] 76	United States 70; Netherlands 6.
Iron and steel:			
Roasted pyrite	NA	11	All from Morocco.
Metal:			
Scrap	NA	458	France 448.
Pig iron, ferroalloys, and similar materials	[2] 1,835	2,760	United Kingdom 1,012; West Germany 484; France 435.
Steel, primary forms	[2] 45,370	16,383	West Germany 5,960; France 5,250; Norway 5,000.
Semimanufactures:			
Rails and accessories	(4)	8,981	France 8,566; Belgium-Luxembourg 207; West Germany 180.
Tubes, pipes, and fittings	150,898	119,961	France 44,244; Japan 27,968; United Kingdom 25,623.
Other	298,392	342,936	West Germany 126,175; France 77,113; Belgium-Luxembourg 39,947.
Lead:			
Ore and concentrate	NA	24	All from Morocco.
Oxides	[2] 379	210	Netherlands 126; West Germany 84.
Metal, including alloys, all forms	[2] 2,229	1,997	Tunisia 829; France 722; Bulgaria 200.
Magnesium metal, including alloys, all forms	NA	2	Mainly from United Kingdom.
Manganese:			
Ore and concentrate	NA	6	All from Morocco.
Oxides	NA	1	All from France.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities[1]—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Mercury ---76-pound flasks--	NA	39	France 20; West Germany 15.
Molybdenum ore and concentrate kilograms--	NA	6	All from France.
Nickel metal, including alloys, all forms	[2] 12	26	France 12; Czechoslovakia 9; West Germany 4.
Platinum-group metals and silver:			
Metals, including alloys:			
Platinum group ---troy ounces--	(5)	514	All from France.
Silver ---do---	(5)	386	Do.
Rare-earth metals:			
Oxides ---kilograms--	NA	187	Do.
Metals, including alloys ---do---	NA	54	France 50; Japan 4.
Tin metal, including alloys, all forms long tons--	[2] 28	64	France 27; Malaysia 22; Netherlands 12.
Titanium:			
Ore and concentrate	NA	124	Australia 100; Senegal 24.
Oxides	[2] 258	515	United Kingdom 211; West Germany 186; France 86.
Metal, including alloys, all forms	NA	1	All from France.
Tungsten metal, including alloys, all forms ---kilograms--	NA	[3] 48	France 22; Switzerland 16; United Kingdom 10.
Zinc:			
Oxide	NA	192	France 136; Italy 30; West Germany 14.
Metal, including alloys, all forms	[2] 1,509	1,131	Spain 400; France 307; Switzerland 200.
Other:			
Ore and concentrate ---kilograms--	NA	80	All from France.
Oxides, hydroxides and peroxides, n.e.s	NA	50	France 26; West Germany 13; Norway 6.
Metals, including alloys, all forms:			
Metalloids	NA	22	U.S.S.R. 11; West Germany 7.
Pyrophoric alloys---kilograms--	NA	124	All from West Germany.
Scrap, n.e.s	[2] 15	---	
Other metals and alloys, all forms	[2] 6	---	
NONMETALS			
Abrasives, natural, n.e.s:			
Pumice, emery, natural corundum, etc	[2] 28,146	40,835	Italy 40,797; France 34.
Grinding and polishing wheels and stones	[2] 243	309	West Germany 96; France 69; Italy 62.
Asbestos	[2] 934	4,837	U.S.S.R. 2,470; Canada 1,842; Mozambique 500.
Barite and witherite	NA	12,549	Italy 12,544.
Boron materials:			
Crude natural borates --kilograms--	NA	604	U.S.S.R. 500; France 104.
Oxide and acid ---do---	NA	3,212	France 3,210.
Bromine ---do---	NA	118	West Germany 81; France 37.
Cement	[2] 93,533	544,796	Turkey 241,425; Libya 136,410; Italy 56,093.
Chalk	[2] 8,143	4,203	France 2,867; Belgium-Luxembourg 655; Italy 331.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s:			
Kaolin	[2] 6,180	5,741	United Kingdom 5,630; France 86.
Other		1,412	Morocco 714; France 386.
Products:			
Refractory (including nonclay bricks)	[2] 6,741	10,012	France 2,755; U.S.S.R. 1,634; Austria 1,374.
Nonrefractory	[2] 6,291	6,623	Italy 2,833; Tunisia 1,100; Bulgaria 884.
Cryolite and chiolite	NA	2	All from West Germany.
Diatomite and other infusorial earth	NA	3	United Kingdom 2.
Feldspar	NA	1,344	People's Republic of China 1,250; Netherlands 50; France 44.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Fertilizer materials:			
Crude and manufactured:			
Nitrogenous	[2] 34,875	96,252	Bulgaria 34,327; Italy 34,285; France 16,437.
Phosphatic	[2] 79,879	214,466	Spain 90,713; United States 47,000; Morocco 40,000.
Potassic	[2] 55,402	69,178	Spain 35,210; United States 27,968.
Other, including mixed	NA	1	All from France.
Ammonia	NA	55,519	United States 48,635; Netherlands 6,807.
Fluorspar	NA	563	Tunisia 554.
Gypsum and plasters	NA	304	All from France.
Iodine	NA	3	Mainly from West Germany.
Lime	[2] 5,267	8,283	France 3,673; Spain 1,750; Greece 1,690.
Magnesite	[2] 392	125	Austria 120.
Mica, crude, including splittings and waste	NA	130	United States 60; United Kingdom 50.
Pigments, mineral:			
Natural, crude	NA	216	France 136; West Germany 80.
Iron oxides, processed	[2] 1,060	193	West Germany 149; France 42.
Precious and semiprecious stones, except diamond, manufactured kilograms	NA	505	Switzerland 500.
Quartz crystal ——do	NA	23	France 15; United States 4; United Kingdom 4.
Salt and brine	NA	3	Mainly from France.
Sodium and potassium compounds, n.e.s	[2] 8,919	9,253	Italy 8,185.
Stone, sand and gravel:			
Dimension stone;			
Crude and partly worked	[2] 1,272	1,990	Italy 1,950.
Worked		33	Spain 26; France 6.
Dolomite, chiefly refractory grade	NA	491	Spain 400; France 91.
Gravel and crushed rock	[2] 13,761	19,050	Italy 15,821; France 3,079.
Quartz and quartzite	NA	581	People's Republic of China 450; West Germany 131.
Sand, excluding metal bearing	NA	278	France 176; People's Republic of China 102.
Sulfur:			
Elemental:			
Other than colloidal	[2] 10,431	38,892	All from France.
Colloidal		5,701	Mainly from France.
Sulfur dioxide	NA	399	Spain 218; West Germany 155.
Sulfuric acid	NA	13	France 6; West Germany 6.
Talc, steatite, soapstone, pyrophyllite	[2] 4,930	3,191	France 3,129.
Other nonmetals, n.e.s.:			
Crude:			
Pozzolan and santorin earth	NA	2	All from France.
Vermiculite, perlite, chlorite	NA	919	France 780; Italy 127.
Other	NA	163	West Germany 119; France 44.
Oxides and hydroxides of magnesium, strontium and barium	NA	7	France 5.
Buildling materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	NA	315	France 308; Morocco 6.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	NA	20	All from United States.
Carbon black	[2] 1,721	2,095	France 637; Netherlands 530; Spain 404.
Coal, all grades, including briquets	[2] 51,654	42,996	Morocco 19,868; West Germany 10,340; Romania 6,370.
Coke and semicoke	[2] 247,431	275,406	Netherlands 153,896; West Germany 44,571; France 25,148.
Hydrogen, helium and rare gases	NA	39	France 35.
Peat ——kilograms	NA	700	All from France.
Petroleum:			
Crude ——thousand 42-gallon barrels	NA	10	All from Netherlands.

See footnotes at end of table.

Table 3.—Algeria: Imports of mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products:			
Gasoline:			
Aviation			
thousand 42-gallon barrels	[2] 39	17	Mainly from Netherlands.
Motor ---do---	NA	2	Venezuela 1; Netherlands 1.
Kerosine ---do---	[2] 25	1	Mainly from France.
Distillate fuel oil ---do---	[2] 1	180	Mainly from Spain.
Residual fuel oil ---do---	NA	113	Spain 106; France 7.
Mineral jelly and wax ---do---	NA	67	West Germany 58; France 7.
Lubricants ---do---	[2] 289	296	Italy 199; France 56; Belgium-Luxembourg 31.
Other:			
Liquefied petroleum gas ---do---	[2] 999	1,184	Italy 637; France 488; Spain 40.
Asphalt and road oil ---do---		366	Italy 236; France 120; United Kingdom 10.
Other ---do---		29	Netherlands 18; France 6; Italy 4.
Total ---do---	[2] 1,353	2,255	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	[2] 6,206	1,372	Netherlands 580; Italy 500; France 199.

NA Not available.
[1] Data in this table, unless otherwise noted, are from official trade returns of Algeria.
[2] Partial figure; compiled from export data of selected trading partner countries. Source Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Co., New York, 1972, pp. 155–175.
[3] May include some manufactures not normally listed among mineral commodities.
[4] Included with "Other."
[5] Quantity not available; value reported from selected trading partner countries, in U.S. dollars was: Platinum-group—$2,000; Silver—$99,000.

METALS

The country wide aero-geomagnetic survey for Société Nationale de Recherche et d'Exploitation Miniére (SONAREM) conducted by Aero Service Corp., a division of Litton Industries, continued throughout the year. Results of the survey should provide technical data to help evaluate the country's mineral resources. SONAREM stressed exploration of the southern sector of the country, with three base camps in operation. Gold, and uranium deposits have been discovered to date. Mineral laboratories were built at Tamanrasset and Bou Merdes during 1972. Uranium deposits, discovered in the Timgaouine-Aban Kov region reportedly created considerable optimism. Reserves were estimated at 12,000 tons of uranium metal (14,000 tons of oxide), grading an average 0.20% U_3O_8, but up to 2.5% in some areas.

Iron Ore.—Approximately 95% (3.5 million tons) of Algerian iron ore mined (3.7 million tons) in 1972 came from three mines grouped near Ouenza. In addition, three small mines, 'Aïn Torki, Beni Saf, and Timezerit, were still in production. Once the local steel industry is in operation, a turnaround in exports will occur. Plans call for production to increase by about 500,000 tons per year until a level of 5 million tons annually is reached by about 1977. All present mining has been open pit; however, long-range plans call for the introduction of tunneling, so that about 30% of the extraction will be underground.

SONAREM was evaluating means of developing iron ore deposits, estimated at 2 billion tons, at Gara Djebilet, near the Moroccan border. An agreement between Algeria and Morocco was signed establishing a 50–50 basis for a joint Algerian-Moroccan company to market 700 million tons of iron ore from Gara Djebilet mines in southwestern Algeria over the next 60 years. The firm will conduct the necessary preliminary project studies, and handle ore enrichment, marketing, and sea transport. Transporting the ore from the production site will pose a major problem. Three possible routes were under consideration: shipping the ore about 1,600 kilometers north by rail, through Algeria to the Mediterranean; west, across Morocco, to the coast near Gouraya; southwest, through Mauritania to Nouadibou.

Lead and Zinc.—A $7 million contract was awarded to construct and equip a 457-meter production shaft at the El Abed mine. The mine is located about 80 kilometers west

of Tlemcen near the Moroccan border. The contract also includes installation of all surface facilities, hoists, and underground loading equipment. The new shaft will be constructed about 1.6 kilometers from an existing shaft, and mine development will progress laterally during construction to tie into the new shaft. The El Abed zinc flotation plant built by the U.S.S.R. was completed during the year and scheduled for operation at the beginning of 1973. The iron and steel companies are building an electrolytic zinc plant near Ghazaouet that will take full production of zinc ore from the El Abed mine.

Mercury.—SONAREM'S mercury plant at Ismail was completed and produced at full capacity of 13,361 flasks (34.5 kilograms each) during 1972.

NONMETALS

Cement.—Production of cement in Algeria is under the direction of the state-owned corporation Société Nationale des Matériaux de Construction (SNMC). This company operates plants Meftah, Point Pescade, and Zahana, having a combined capacity of nearly 1 million tons per year. Three new cement plants were under construction in 1972 with a total capacity of 2.3 million tons. The 550,000-ton-per-year plant at Hadjar-Sound near Annaba is expected to be the first to be completed early in 1974.

Clays.—The kaolin mine at Djebel Debagh produced at capacity in 1972, supplying the raw material for the El Milia ceramic plant and the Guelma china factory.

Fertilizer Materials.—Algeria had two working phosphate mines, Djebel Onk and El Kouif. SONAREM took over the production and sales at the Djebel Onk mine that produced 547,000 tons in 1972 and had reserves of 200 million tons. The major portion of the 1973 Djebel Onk output will be directed to the SONATRACH triphosphate plant at Annaba. In 1972, almost 200,000 tons of Djebel Onk phosphate were shipped to the new Annaba phosphate fertilizer plant. This plant will manufacture diammonium phosphate and triple superphosphate to meet domestic requirements and produce finished fertilizers or possibly phosphoric acid for export. Algeria plans to increase production of phosphate rock to 2.4 million tons per year by 1980.

Pyrite.—Algerian output of pyrite was derived from the Ain-ben-Merrouane mine in the northeast near Annaba. The old 13,000-ton-per-year sulfuric acid plant at Annaba provided the outlet for this production. A 495,000-ton-per-year acid plant was recently started up as part of the new SONATRACH fertilizer complex.

Other Nonmetals.—Barite production approximated 52,500 tons in 1972, 14% above that of the previous year. Production from the new barite mine and plant at Mezab in the Aurès Mountains was used to meet local demand for oil and gas well drilling mud. The Khenchla barite grinding plant began production during the year. The plant has a capacity of 50,000 tons per year; plans are to expand it to 65,000 tons per year, making Algeria the largest producer in Africa.

Algerian consumption of marble continued to increase. The quarry of Filfila near Skikda was the principal producer. In 1972, total production reached 90,000 square meters of blocks.

MINERAL FUELS

Coal.—Coal production during the year was 12,000 tons, down 14% from the 14,000 tons of the previous year. This output came mostly from the Kenadza mines near Bechar. SONAREM was investigating the possibility of mining 40 centimeter seams of coal in this region. Some U.S. coal production has been mined from coalbeds of similar thickness in Alabama.

Petroleum and Natural Gas.—SONATRACH assumed virtual control of the petroleum industry during 1971. Approximately 77% of the 1972 petroleum production, 100% of natural gas production, and 100% of pipelines were controlled by SONATRACH.

Petroleum.—SONATRACH completed an agreement with the French State Oil Group, Elf-ERAP, concerning past disputes and to establish a new basis for future activity in Algeria. Algeria agreed to give the French company 5.5 million tons of Saharan crude oil in 1972, about one-third the oil Elf-ERAP would have received prior to nationalization in February 1971. Elf-ERAP entitlement to Algerian crude oil will amount to 5 million tons per year over the next 5 years, at an agreed price. Financial conditions of future operations were similar to those in respect to CFP, with Elf-ERAP required to fulfill its obligations and undertaking a specified investment program for the development of oilfields and gasfields it operates. Under the agreement, Elf-ERAP

in effect renounced compensation claim for its nationalized property and agreed to divest itself of a number of continuing interests in Algeria and set up a new local company. In return, the Algerians agreed to drop their claims for arrear taxes.

Two new pipelines were completed in 1972 to the Port of Skikda, a 100-centimeter natural gasline from the Hassi R'Mel gasfield and an 86-centimeter crude oil pipeline from Haoud el Hamra (near the Hassi Messaoud oilfield). The $111 million gasline has an initial capacity of 6 billion cubic meters per year (212 billion cubic feet per year) with a potential capacity of 12.7 billion cubic meters per year. The $160 million crude oil pipeline has an initial capacity of 12 million tons per year (84 million barrels per year), with ultimate capacity of 30 million tons per year. The increase in capacity will be required to feed the fourth liquefaction line under construction at the new Skikda LNG plant and to supply domestic demand in eastern Algeria.

Getty Petroleum Co., the sole U.S. controlled petroleum company active in Algeria, renegotiated its 1968 agreement with SONATRACH in June 1972, bringing Getty Petroleum under the purview of the 1971 Fundamental Laws on Hydrocarbons and making its activities conform to those of the French oil companies. For Getty Petroleum the modification (retroactive to January 1, 1972) means that taxes and royalties will be based on the f.o.b. posted price rather than on the realized exfield price (a figure actually set by Getty-SONATRACH agreement). Getty received the compensation of lumping total expenditures and concentrating them where it sees fit rather than spending specific minimum amounts on each drilling permit. Furthermore, expenditures on these permits were authorized for use to offset obligations arising from Getty's producing interests. Another compensation involved the per-barrel "repatriation price" on which remittances to Algeria are calculated, which were fixed at 55% of the posted price rather than at the flat $2.75 required of CFP and Elf-ERAP.

SONATRACH invited international bids for the construction of a 177,000-barrel-per-stream-day refinery at Skikda, terminus of its newly inaugurated major oil and gas pipelines. In conjunction with the refinery are plans to develop a petrochemical complex at Skikda. The first phase of the petrochemical facility will concern the output of petroleum products from a benzene stream, a toluene stream, and a xylene cut, which will also be produced following the separation of paraffins from the aromatics stream.[2] The benzene stream will be the largest, and probably all available benzene will be recovered, a potential of about 100,000 tons per year. Chemical utilization of the aromatics will come in the second phase of the project. Among the downstream plants believed to be under consideration are styrene and styrene-butadiene rubber (SBR). Ethylene for styrene manufacture will be readily available from the Skikda ethane cracker under construction in 1972, but butadiene for SBR will have to await Algeria's decision on the utilization of the propane and butane found in the Hassi R'Mel gasfield. The gasses could be used either to add calorific value to LNG or as a base for chemical production. It is likely that in either case the ethane, propane, and butane would be moved with methane to Arzew, where new liquefaction facilities will be constructed.

Chemical production could be based on cracking a mixture of the three gases or by treating each of the individual materials separately: using ethane for ethylene production, propane for propylene, and butane for butadiene.

Algeria should have more than 1 million tons annually of liquefied petroleum gases (LPG) for export in 1973. Two butane and propane recovery units were under construction at the north and south sectors of the Hassi Messaoud oilfield that will have an aggregate capacity of 950,000 tons per year, with LPG output planned in March 1973. Additional LPG production will be derived from the Arzew refinery and new liquefaction facilities at Skikda for a total of 1.5-million-tons-annually. Approximately 300,000 tons will be required to meet local demand in 1973; the remainder will be exported.

Liquefied Natural Gas (LNG).—Completion of authorization and financial arrangements between representatives of the Algerian Government and the United States failed to materialize in 1972. However, a final go-ahead is anticipated early in 1973 that will enable the United Kingdom subsidiary of Chemical Construction Corp. (Chemico) to initiate construction of the world's largest overall project for the import of LNG. Arzew was selected for the site of the first base load plant designed to serve

[2] BTX-European Chemical News. Algeria plans refinery. V. 23, No. 570, Feb. 9, 1973, p. 10.

the United States natural gas market. During the year, major portions of the engineering phase of the work were completed, and the facility is expected to begin limited production by April 1976. Full capacity of 1 billion cubic feet of gas per day will be reached by mid-1977. The LNG facility will be comprised of six liquefaction trains, three 650,000-barrel storage tanks, a 900,000-gallon-per-minute cooling system, and extensive offsite support elements. Algeria's second LNG liquefaction plant at Skikda went on-stream in November 1972. The plant had three liquefaction lines with a total annual capacity of 3,700 million cubic meters (35.8 million cubic feet per day), while a fourth line with an annual capacity of 1,500 million cubic meters (14.5 million cubic feet per day) was under construction. Algeria's first plant at Arzew has a 2,000-million-cubic-meter-per-year capacity, which since 1964 has been supplying 1,000 million-cubic-meters-per-year to the United Kingdom and 500 million to France. Gas for both plants originate in the Hassi R'Mel Field.

The Skikda plant will supply 1,500 million cubic meters to Gaz de France in 1973, 2,500 million in 1974, 3,000 million in 1975, and 3,500 million in 1976 and for each of the following 11 years. The LNG will be delivered to a regasification plant at Fos-sur-Mer in southern France, where nitrogen will be injected into the gas to make it comparable with the composition of Gaz de France's other supplies.

The Algerian Government announced the purchase of seven LNG tankers at a cost of $600 million. The tankers, each with a capacity of 125,000 cubic meters, will be operated by the state-owned National Algerian Navigation Co.

The world's largest LNG export contract was signed on December 15, 1972, between SONATRACH and a five-company European consortium. The agreement involves some 260 billion cubic meters of gas over a 20-year period to Gaz de France, Belgium's Distrigaz, West Germany's Bayerische Ferngas (Munich), Gasversorgung Süddeutschland (Stuttgart) and Saar Ferngas (Saarbrucken), and eventually to Luxembourg and Switzerland. Deliveries at the rate of 13 billion cubic meters annually are scheduled to start in 1977–78. The base f.o.b. price was reported to be 40 cents per million British thermal units (Btu), which is to be automatically and periodically adjusted to reflect inflation and any monetary fluctuations. SONATRACH is responsible for all necessary facilities in Algeria, including the liquefaction plant, which will probably be built near Algiers, the country's fifth such installation. The consortium granted SONATRACH the option to supply up to half the methane tankers to transport the LNG. The number of ships required will depend both on their individual capacity and location of the European delivery port.

A contract was signed in December 1972 between SONATRACH and Panhandle Eastern Pipe Line Co. of the United States, for 4.5 billion cubic meters of gas per year for 20 years, beginning in 1979. In addition to SONATRACH's responsibility for all Algerian facilities, it will furnish half of the LNG tankers required to transport the gas to the United States.

The U.S. Federal Power Commission (FPC) on June 29, 1972, after a delay of 2 years, approved the El Paso-SONATRACH LNG agreement whereby 1 billion cubic feet per day of Algerian natural gas will be exported to the United States over a 25-year period. The original agreement of July 1969 covered this amount of LNG, and El Paso has since signed two other contracts for an additional 1 billion cubic feet per day over a similar period. El Paso had not received FPC approval at yearend. El Paso has signed agreements for the sale of all the original volumes of LNG with three domestic U.S. firms and has sold an additional 250 million cubic feet per day of Algerian gas to Transco Energy of the United States.

A group of four United States companies—Philadelphia Gas Works, Algonquin Gas Transmission Co., New England LNG Co., and the Public Service Electricity and Gas Co.—was negotiating with SONATRACH for initial deliveries of 300 million cubic feet per day to begin in the fall of 1975. These deliveries would increase to 600 million cubic feet per day after a period of several years. This group expects to receive gas from a fifth and sixth LNG train to be built at Skikda by late 1975.

Table 4.—Algeria: Crude oil production, by company [1]
(Thousand barrels per day)

Company	1970	1971	1972
SONATRACH	230.8	546.1	817.3
Total—Algerie [2]	[3] 793.9	132.0	144.2
Elf-ERAP	---	104.7	97.0
Getty Petroleum Co	4.4	2.6	3.8
Total	1,029.1	785.4	1,062.3

[1] Source: Organization of the Petroleum Exporting Countries, Annual Statistical Bulletin 1972. Totals in this tabulation differ slightly from those appearing in table 1 of this chapter owing to difference in source.
[2] Compagnie Française des Pétroles (Algerie).
[3] French companies' production under old agreements.

Table 5.—Algeria: Crude oil exports [1]
(Thousand barrels per day)

	1970	1971	1972
North America	7.0	1.1	82.9
Latin America	38.6	40.9	40.1
Western Europe	878.9	604.8	829.2
Eastern Europe	14.8	21.1	23.7
Africa	35.0	19.7	20.9
Total	974.3	687.6	996.8

[1] Source: Organization of the Petroleum Exporting Countries, Annual Statistical Bulletin 1972. Exports for 1970 and 1971 differ slightly from those appearing in table 2 of this chapter owing to difference in source.

Table 6.—Algeria: Crude oil production [1]
(Thousand barrels)

Year	Daily average	Total	Cumulative	Change in daily production (%)
1970	1,029.1	375,622	2,569,410	+ 8.7
1971	785.4	286,671	2,856,081	—23.7
1972	1,062.3	388,802	3,244,898	+35.5

[1] Production figures differ slightly from those appearing in table 1 of this chapter owing to difference in source.

Table 7.—Wildcats drilled in Algeria, 1972

Company	Well	Permit	Total depth meters (feet)	Formation
SONATRACH	Hassi R'Mel Sud	Oued Sebseb	2,298 (7,538)	Ordovician.
Do	Draa el Tamra	Ex D 10	3,948 (12,953)	Do.
Do	Bou Khezana	do	4,207 (13,802)	Do.
Do	Tiguentour 1	Tiguentour	4,112 (13,492)	Do.
Do	Rhourde Yacoub 1	Ex 1 b	4,340 (14,239)	Devonian.
Do	El Ksar 1	Hassi Timoulaye	3,262 (10,704)	Ordovician IV-2.
Do	Haniet el Mokta 1	Ex D 10	3,954 (12,972)	Gothlandian.
Do	Guellala NE 1	do	3,981 (13,061)	Do.
Do	El Hachana 1	Oued Sebseb	Drilling	---.
Getty Petroleum	Bou Settach 1	Hassi Brahim	3,563 (11,690)	Cambrian RA.

Source: The American Association of Petroleum Geologists.

Table 8.—Algeria: Producing wells [1] and wells drilling at yearend

Year	Flowing	Artificial lift	Total	Wells drilling
1970	547	257	804	21
1971	551	244	795	---
1972	574	224	798	53

[1] Excluding wells shut-in.

Table 9.—Algeria: Consumption of refined products
(Thousand barrels per day)

	1970	1971	1972
Gasoline	9.8	10.6	14.1
Kerosine	3.5	2.8	1.8
Distillate fuels	14.4	7.1	17.6
Residual fuels	4.7	13.0	6.6
Others	7.1	7.1	6.9
Total	39.5	40.6	47.0

Table 10.—Algeria: Refinery capacity and production of refined products[1]

(Thousand barrels per day)

	1970	1971	1972
Production:			
Gasoline	12.0	13.3	13.9
Kerosine	4.3	5.0	5.7
Distillate fuels	19.0	19.0	19.3
Residual fuels	9.0	10.0	10.7
Others	3.4	5.0	3.8
Total production	47.7	53.2	53.4
Capacity	57.5	57.5	115.8

[1] See table 1 for annual production totals, refinery fuel, and losses.

Table 11.—Algeria: Refinery crude throughput

(Thousand barrels per calendar day)

	1970	1971	1972
Société de la Raffinage d'Alger	48.4	53.4	52.2
Cie. Raffinage en Afrique du Nord Hassi Messaoud	2.0	2.3	2.2
Arzew[1]	---	---	4.0
Total	50.4	55.7	58.4

[1] Went onstream in December 1972.

The Mineral Industry of Angola, Mozambique, and Portuguese Guinea

By Henry E. Stipp [1]

ANGOLA

Angola's mineral industry in 1972 generated about the same total value as in 1971, despite a decrease in iron ore and diamond production. Production and export of crude oil increased substantially to retain first place for mineral exports among Angola's principal foreign exchange earners. In 1972 the export of minerals provided about 44% ($235 million) [2] of total export income.

The government-controlled iron ore producer, Companhia Mineira do Lobito (CML) announced plans to begin pelletizing its low-grade ore in 1977. High-grade reserves are expected to be depleted by 1978 or 1979. A consortium of South African, West German, French, and United States companies will assist CML in exploiting its low-grade reserves. Johannesburg Consolidated Investments of South Africa applied to the Angolan Government for three concession areas to explore for fluorite and other minerals. Two of the areas are located near Gabela, running north to the ninth parallel, and the other area is northeast of Sa de Bandeira.[3] The Government was petitioned for a concession in the Porto Amboim to Novo Redondo and inland areas by International Nickel Co. Ltd. of Canada, Shell Petroleum Co. Ltd., and the United States Steel Corp. The consortium planned to explore for minerals other than diamonds, hydrocarbons, and radioactive materials. Companhia de Diamantes de Angola (DIAMANG) applied for a permit to explore for copper deposits and other minerals exclusive of diamonds in the Cuanza River Valley. Carlsburg Resources Co. of Los Angeles requested a concession to search for crude oil on and offshore near Benguela.

PRODUCTION AND TRADE

Angola's principal mineral commodity produced in 1972 was crude oil, which increased 56% in value to $131.9 million compared with $84.4 million in 1971. Production of diamond (based on 9-month statistics) increased in value 1% to $62.8 million in 1972 compared with $62.1 million in 1971. Although quantity of output decreased in 1972, value increased due to higher prices for diamond in the world market. Production of iron ore decreased both in quantity and value in 1972 compared with 1971 owing to a reduction in demand, mainly in the Japanese market. Angola ships about half its iron ore output to Japan. Statistics on production are shown in table 1.

Export of mineral commodities in 1972 increased about 22% in value to $235 million compared with a value of $192 million in 1971. Although diamond exports decreased 4.4% in quantity to 2,199,860 carats, value increased 12.4% above that of 1971 to $63.4 million due to a rise in diamond price in world markets. All diamonds produced are exported to metropolitan Portugal. Iron ore exports in 1972 were down 7.7% to 5,073,318 tons valued at $40.4 million, a 8.2% decrease in value from that of 1971. The chief consumers of Angolan iron ore were Japan, West Germany, France, the United Kingdom, and Metropolitan Portugal. Petroleum exports

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from Angola escudo (A. Esc) to U.S. dollars at the rate of A. Escl=US$0.040.

[3] U.S. Consulate, Luanda, Angola. State Department Airgram A-41, June 7, 1973, 5 pp.

increased 32% in 1972 to 46.6 million barrels, and export value increased 55.3% to $118.8 million compared with that of 1971. Principal destination of exports were Canada (16.5 million barrels), the United States and Trinidad (13.5 million barrels), and Japan (9.9 million barrels).

Other mineral commodity exports of importance in 1972 were 38,981 tons of manganese ore and concentrate valued at $560,000; cement valued at $1.9 million; and 31,938 tons of salt valued at $680,000.

Imports of mineral commodities consisted mainly of iron and steel semimanufactures, coal, and fertilizer materials, as shown in table 3.

Table 1.—Angola: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Beryllium, beryl, gross weight		--	90	175
Copper, mine output, metal content		36	--	--
Gold, mine output, metal content	troy ounces	--	44	NA
Iron ore and concentrate, gross weight	thousand tons	6,052	6,165	4,831
Manganese ore and concentrate, gross weight		23,000	23,000	37,700
NONMETALS				
Cement, hydraulic	thousand tons	450	530	624
Clays, kaolin		[r] 2,091	1,040	416
Diamond:				
Gem [e]	thousand carats	1,797	1,810	1,616
Industrial [e]	do	599	603	539
Total	do	2,396	2,413	2,155
Gypsum		18,200	25,842	34,787
Salt, marine		87,743	90,284	125,302
Stone:				
Granite blocks	cubic meters	3,184	5,650	8,497
Marble blocks	do	927	953	1,381
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		36,953	56,098	55,517
Natural gas:				
Gross production [e]	million cubic feet	[r] 340,000	[r] 316,000	350,000
Marketable production [e]	do	1,500	1,500	2,000
Petroleum:				
Crude	thousand 42-gallon barrels	[r] 36,499	33,922	51,405
Refinery products:				
Gasoline	do	477	445	296
Jet fuel	do	587	558	441
Kerosine	do	137	143	
Distillate fuel oil	do	734	752	559
Residual fuel oil	do	2,609	2,590	1,907
Other	do	175	195	158
Refinery fuel and losses	do	283	281	202
Total	do	5,002	4,964	3,563

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

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

Table 2.—Angola: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, scrap	357	252	Republic of South Africa 115; Italy 85; Belgium-Luxembourg 41.
Beryl ore and concentrate	20	50	All to United States.
Copper ore and concentrate	90	7	All to West Germany.
Iron and steel:			
Ore and concentrate	[r] 6,334,914	5,497,791	Japan 3,156,005; West Germany 770,418; France 632,033; United Kingdom 374,765.
Metal:			
Scrap	150	--	
Semimanufactures	1,292	1,187	Mozambique 112; Nigeria 99; Zaire 56.
Lead:			
Metal, including alloys:			
Scrap	304	74	All to Republic of South Africa.
Semimanufactures	50	(1)	All to Mozambique.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Manganese ore and concentrate	r 20,591	11,262	Japan 10,262; West Germany 1,000.
Zinc, including alloys, all forms	37	122	Republic of South Africa 73; France 49.
Other base metals, including alloys, all forms, n.e.s.	--	1	Mainly to St. Thomas and Principe.
NONMETALS			
Cement	74,636	86,316	Zaire 20,758; Nigeria 14,600; St. Thomas and Principe 9,588.
Diamond—thousand carats	r 2,480	2,340	All to Portugal.
Fertilizer materials, mineral	2,118	298	West Germany 50.
Gypsum and anhydrite	5,343	10,963	All to Mozambique.
Salt	33,309	25,259	Zaire 15,711; Zambia 4,382.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous (marble)	139	63	Mainly to Mozambique.
Other (granite)	11,956	19,036	West Germany 8,673; Belgium-Luxembourg 5,954; Netherlands 2,708.
Worked	1	11	Mainly to Zaire.
Gravel and crushed rock	77	367	Mozambique 275; Zaire 50.
Sand, excluding metal bearing	15	1	Mainly to ships stores.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	309	303	Mainly to St. Thomas and Principe.
Coal and coke, including briquets	38	(1)	All to ships stores.
Hydrogen, helium and rare gases	16	10	Bunkers 6; Zaire 3.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	30,765	34,207	Japan 9,855; Canada 7,073; Denmark 5,980; Trinidad and Tobago 4,065.
Refinery products:			
Gasoline—do	4	1	Mainly to aircraft stores.
Kerosine and jet fuel—do	516	492	All to bunkers.
Distillate fuel oil—do	236	234	Mainly to bunkers.
Residual fuel oil—do	1,920	1,790	Bunkers 1,456; Spain 203; Greece 120.
Lubricants—do	2	5	Mainly to bunkers.
Liquefied petroleum gas—do	1	1	Mainly to St. Thomas and Principe.
Total—do	2,679	2,523	

r Revised.
1 Less than ½ unit.

Table 3.—Angola: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum, including alloys, all forms	r 1,149	1,106
Copper:		
Matte	111	43
Metal, including alloys, all forms	407	439
Iron and steel:		
Oxide and hydroxide	218	238
Metal:		
Scrap	263	1,188
Pig iron, including cast iron	1,956	2,617
Sponge iron, powder and shot	121	64
Ferroalloys	1,772	3,898
Steel, primary forms	11,084	6,370
Semimanufactures	82,676	103,434
Lead:		
Oxide	37	55
Metal, including alloys, all forms	404	553
Magnesium and beryllium, all forms—kilograms	5	2,005
Mercury—76-pound flasks	22	38
Nickel, including alloys, all forms	3	6
Silver, including alloys—troy ounces	9,200	10,225
Tin, including alloys, all forms—long tons	42	46
Titanium oxides	269	413
Zinc:		
Oxide	130	171
Metal, including alloys, all forms	628	660
Other metals, all forms	2	4

See footnote at end of table.

Table 3.—Angola: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc		15	19
Grinding and polishing wheels and stones		113	116
Asbestos		1,076	1,312
Barite and witherite		7	15
Boron materials:			
Crude natural borates		4	38
Oxide and acid		7	8
Cement		r 4,257	5,519
Chalk		615	635
Clays and products (including all refractory brick):			
Crude, n.e.s		1,974	1,711
Products, refractory (including nonclay bricks)		2,154	4,286
Diatomite and other infusorial earth		391	356
Feldspar		90	--
Fertilizer materials:			
Crude, phosphatic		100	130
Manufactured:			
Nitrogenous		r 14,053	23,616
Phosphatic:			
Thomas (basic) slag		409	100
Other		5,582	6,650
Potassic		2,991	9,427
Other, including mixed		22,707	37,119
Ammonia		177	276
Graphite, natural		6	3
Gypsum and plasters		107	124
Lime and limestone		121	81
Magnesite		4	1
Mica, all forms		32	54
Pigments, mineral		68	37
Quartz and quartzite		14	16
Salt and brine		1,570	300
Sodium and potassium compounds, n.e.s		2,806	3,017
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked		1,328	1,357
Worked		124	307
Dolomite, chiefly refractory grade		364	388
Gravel and crushed rock		265	45
Sand, excluding metal bearing		107	217
Sulfur:			
Elemental, all forms		834	722
Sulfur dioxide		7	8
Sulfuric acid		1,107	1,069
Talc, steatite, soapstone, pyrophyllite		246	288
Other, n.e.s		1,325	422
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		31	21
Carbon black and gas carbon		958	1,273
Coal and coke, including briquets		17,751	12,268
Hydrogen, helium and rare gases		160	5
Petroleum:			
Refinery products:			
Gasoline	thousand 42-gallon barrels	r 78	114
Kerosine and jet fuel	do	44	37
Distillate fuel oil	do	1,773	1,453
Lubricants	do	145	107
Liquefied petroleum gas	do	79	109
Mineral jelly and wax	do	2	5
Other	do	4	8
Total	do	r 2,125	1,833
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		313	295

r Revised.

COMMODITY REVIEW

Metals.—*Copper.*—Sociedade de Investigações Mineiras (SIMEIRA), a joint subsidiary of Companhia União Fabril of Portugal and Société Anonyme du Chrome, a Swiss firm, planned to begin producing copper concentrate in 1973 at an annual rate of 20,000 tons. The company has been exploring for minerals at the Mavoio-Tetelo copper mines near Maquela do Zombo, reportedly with promising results. A main shaft and several exploratory lateral drifts have been opened.

Gold.—CML planned to prospect for gold at the Mussopo mine located 31 miles from Jamutete. A geologist from the Bureau de Recherches Géologiques et Minières has been employed to advise the firm on the economic viability of the project.

Iron Ore.—Companhia do Manganés de Angola, operator of the Cassala mines, planned to begin installation of a pelletizing plant having an annual capacity of 2 million tons in 1973. Economic feasibility studies have been completed on the pelletizing project. Reportedly, taconite deposits estimated at 156 million tons have been located near Luanda, of which 33 million tons are amenable to pelletizing to a grade of 64% to 68% iron. In addition to the cost for plant installation, about $72 million will be required for constructing 31 miles of railway and upgrading an additional 22 miles; an additional $70 million will be required for constructing a 3,600-ton-per-hour loading facility at the port of Luanda.[4] Companhia do Manganés was negotiating with Japanese firms for managing the pelletizing project.

Manganese.—Reportedly, a deposit of manganese and other minerals was discovered in April by a resident of Luanda, at Morro Maginga, Cabinda District.[5]

Nonmetals.—*Cement.*—Companhia dos Cimentos do Angola was expanding its Lobito plant to 220,000 tons per year from its present capacity of 99,000 tons per year.

Diamond.—According to DIAMANG, the percentage of gem stones produced in 1972 increased over that of 1971. Gem stone production for the period 1966–70 was reported as follows:

Year	Gem stone production	Percent of total
1966	967,971	76.33
1967	982,868	76.28
1968	1,316,411	78.96
1969	1,546,270	76.49
1970	1,560,701	65.15

The sharp drop in the percentage of gem stones found during 1970 and 1971 was due to the opening of new producing areas containing a lower quantity of gem-quality diamonds in surface layers. Reportedly, the percentage of gem stones found since 1971 has been increasing and is expected to reach 70% in 1973. Consorcio de Diamantes de Angola (CONDIAMA), the consortium that obtained all but 19,300 square miles of DIAMANG's former concession area, has been very active in exploring its concession during 1972. Several promising kimberlite occurrences have been located, but there are no plans to exploit these bodies immediately.

Phosphate Rock.—Companhia dos Fosfatos de Angola S.A.R.L. (COFAN), which has been exploring deposits in Cabinda, reportedly ceased its operations. Recent assays have indicated that the deposits in the company's concession area are not of commercial value. COFAN planned to conduct additional exploration to determine the true value of its concession.

Mineral Fuels.—*Petroleum.*—Cabinda Gulf Oil Co. discovered two new areas reportedly testing at 5,000 barrels per day and 4,000 barrels per day. Further tests in the area were not successful, and it was uncertain whether the wells would be considered commercial.

Shipments from the Cabeca de Cobra Field, 25 miles south of Santo Antionio do Zaire, to the refinery at Luanda began in July. The field was operated by Petrofina for the Companhia de Petróleos de Angola (PETRANGOL) — Sociedade Portuguesa de Exploração de Petróleos (ANGOL)—Texaco Oil Co. consortium at a rate of 1,800 barrels per day of low-sulfur, 41° gravity crude. Until late 1971, PETRANGOL's output from its North Quenguela Field was enough to supply its Luanda refinery, but production from this source decreased, and PETRANGOL was required to purchase some crude oil from Cabinda Gulf Oil Co. Refinery throughput dropped to 656,000 tons in 1971 and to 524,000 tons in the first 10 months of 1972. However, PETRANGOL made a promising producing strike in the Belas area, 8 miles south of Luanda in late 1972.[6] Industry sources believe the oil find may be sufficient to supply the requirements of the Luanda refinery for the foreseeable future, including the planned expansion of the refinery to a capacity of 3 million tons per year by 1978.

Argo Petroleum Corp. of Los Angeles, was examining its five concession areas comprising 3.1 million acres below the 11th parallel and in the Zaire District. Aerial surveys were being carried out mainly in the Congo and Cuanza Basins near the northern coast. The company may begin drilling in early 1974. Reportedly, Argo must expend almost $5 million in the first 3 years of its permit and give the Government a 30% interest when a commercial strike is made.[7]

[4] Work cited in footnote 3.
[5] Marches Tropicaux et Mediterraneens (Paris). Manganese in Cabinda. 29 Annie, No. 1438. June 1, 1973, p. 1524.
[6] Work cited in footnote 3.
[7] World Petroleum Report. Angola. V. 19, 1973, p. 60.

MOZAMBIQUE

Activity in the mineral industry of Mozambique consisted mainly of the mining of coal, stone, salt, columbite and tantalite, fluorite, asbestos, refining of crude oil, and manufacture of cement. Production of mineral commodities contributed about 1% of the gross domestic product (GDP) estimated at $1,863 million [8] in 1972. The search for mineral commodities continued to expand as the Portuguese Government authorized Companhia Mineira do Lobito, Bethlehem Steel Corp., and Companhia de Uranio de Moçambique S.A.R.L. to form a company to conduct mineral exploration in the Tete District. The company will have a share capital of about $270,000 and spend about $243,000 during a 3-year exploration program. In June the Mozambique Mining and Geological Department posted a notice that it intended to declare a mining area for copper and nickel near Namaacha, southern Mozambique. The Government of Mozambique extended to June 30, 1973, the license of Mozambique Amoco Oil Co. to develop the Pande natural gas deposit. Reportedly, four international oil companies requested permission from the Portuguese Overseas Ministry to construct a petroleum refinery at Nacala. Estimated cost of the project was about $27 million.

The Civil Engineering Laboratory in Lisbon was studying the feasibility of constructing a 373-mile-long pipeline for transporting coal and iron ore mined in the Tete area.[9] An offshore loading platform in the mouth of the Zambezi River would receive the coal and iron ore. A plan to construct a new ocean port at Ponta Dabela near Lourenço Marques has been proposed. The port will permit petroleum tankers and ore carriers with a capacity up to 250,000 tons to be berthed. The port facilities will make it possible to load iron ore at the rate of 10,000 tons per hour, coal at 5,000 tons per hour, and phosphates at 7,000 tons per hour. A warehouse area will be provided for storing 2 million tons of mineral products.

PRODUCTION AND TRADE

Mineral commodities (excluding petroleum products) produced in 1972 increased in value to an estimated $24.1 million compared with $18 million in 1971. Coal, columbium and tantalum minerals, petroleum products, and cement were the principal mineral commodities produced as shown in table 1.

Exports of mineral commodities in 1971 were valued at about $14.6 million, petroleum products valued at $11.1 million, columbium and tantalum mineral valued at $1.4 million, and bituminous coal valued at $821 thousand, cement valued at $311.5 thousand, were the principal mineral commodity exports.[10] Imports of mineral commodities were mainly crude oil, iron and steel semimanufactures, and fertilizer materials. Statistics on foreign trade are shown in tables 5 and 6.

[8] Where necessary, values have been converted from Mozambique escudo (M. Esc) to U.S. dollars at the rate of M. Escl=US$0.027.

[9] Marches Tropicaux et Mediterraneens (Paris). Pipeline, Port Construction Noted. Annie 28, No. 1606, Oct. 20, 1972, p. 2995.

[10] U.S. Embassy, Lourenço, Marques. State Department Airgram A-150, Oct. 6, 1972, 4 pp. Encl. 1.

Table 4.—Mozambique: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum, bauxite, gross weight	7,146	7,713	5,419
Beryllium, beryl concentrate, gross weight	33	13	8
Bismuth, mine output, metal content	1	1	--
Cesium mineral, pollucite, gross weight	100	--	--
Columbium and tantalum ore and concentrate, gross weight:			
Columbite-tantalite	97	59	--
Microlite	[r] 63	15	61
Tantalite	--	--	42
Copper ore and concentrate:			
Gross weight	602	1,654	706
Metal content	130	414	176
Gold, mine output, metal content, troy ounces	34	19	[e] 20
Rare-earth minerals, gross weight:			
Euxenite, kilograms	2,100	--	--
Monazite, do	2,100	--	--

See footnotes at end of table.

Table 4.—Mozambique: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
NONMETALS				
Abrasives, natural, garnet	kilograms	[r] 2,295	1,744	NA
Asbestos		228	1,430	534
Cement, hydraulic	thousand tons	[r] 394	421	468
Clays:				
Bentonite (including montmorillonite)		6,483	6,374	8,315
Kaolin (including china clay)		[r] 1,177	1,726	1,838
Fluorspar		1,136	8,218	--
Gem and ornamental stones:				
Amazonite	kilograms	1,000	3,500	NA
Beryl crystals	do.	118	143	10
Obsidian	do.	[r] 248,454	244,150	NA
Tourmaline	do.	6,209	3,000	--
Lime		9,334	9,230	6,992
Lithium minerals:				
Amblygonite		13	--	--
Lepidolite		24	700	--
Mica, mainly scrap		[r] 183	950	--
Salt:				
Marine		[r] 49,461	27,763	31,217
Rock		18	[e] 20	[e] 20
Sand, quartz		7,429	6,813	NA
Stone:				
Limestone	thousand tons	[r] 697	646	991
Granite and other quarry, n.e.s.	do.	NA	761	872
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous	do.	351	329	336
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	1,137	1,113	1,020
Distillate fuel oil	do.	1,431	1,449	1,469
Residual fuel oil	do.	2,208	2,291	2,182
Other	do.	324	344	401
Refinery fuel and losses	do.	476	848	681
Total	do.	5,576	6,045	5,753

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

[1] In addition to the commodities listed, other varieties of crude construction materials (clays, sand, gravel, and stone) may be produced for local use, but information is inadequate to make reliable estimates of output levels.

Table 5.—Mozambique: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum metal, including alloys, all forms		55	
Beryllium, beryl		25	NA
Bismuth ore and concentrate	kilograms	1,000	
Columbium and tantalum minerals:			
Columbite		[r] 122	[1] 144
Other		[r] 91	
Copper:			
Ore and concentrate		238	NA
Metal, including alloys, all forms, including matte		300	
Iron and steel:			
Iron ore		1	
Scrap		12,769	NA
Semimanufactures		598	
Lead metal, including alloys, all forms		306	NA
Tin metal, including alloys, all forms	long tons	3	NA
Zinc metal, including alloys, all forms		48	NA
Other:			
Ores and concentrates n.e.s.		890	NA
Metals and alloys, all forms		5	NA
NONMETALS			
Asbestos		316	[1] 239
Cement, hydraulic		19,820	[1] 20,509
Clays and clay products:			
Crude bentonite		5,047	[1] 4,671
Crude kaolin		20	NA
Feldspar, leucite and nepheline		304	NA
Fertilizer materials, manufactured, nitrogenous		682	NA
Gem stones, except diamond	kilograms	5,370	[1] 2,100
Lime, quick and hydraulic		6	NA
Mica, all types		759	NA
Salt		4,951	[1] 7,051
Sand		247	NA
Stone, all types		1,577	NA
Other, crude		147	NA

See footnotes at end of table.

Table 5.—Mozambique: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
MINERAL FUELS AND RELATED MATERIALS			
Coal		r 108,059	1 53,949
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	r 714	449
Jet fuel	do	r 156	
Kerosine	do	2	591
Distillate fuel oil	do	691	
Residual fuel oil	do	2,062	1,962
Lubricants	do	1	NA
Other	do	r 133	NA
Total	do	r 3,759	NA

r Revised. NA Not available.
1 Data are for 11 months (January–November) only.

Table 6.—Mozambique: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum metal, including alloys, all forms		r 722	1 590
Arsenic, oxides and acids		20	NA
Chromium, oxides and hydroxides		2	NA
Copper metal, including alloys, all forms		601	2 186
Iron and steel:			
Iron ore		4	NA
Scrap		335	NA
Pig iron and ferroalloys		396	NA
Primary forms, n.e.s		7,783	NA
Semimanufactures		83,434	3 92,010
Lead:			
Oxides		26	
Metal, including alloys, all forms		353	NA
Manganese:			
Ore and concentrate		2	
Oxides		1	NA
Mercury, elemental	76-pound flasks	3	NA
Nickel metal, including alloys, all forms		7	NA
Tin metal, including alloys, all forms	long tons	49	NA
Titanium oxide		495	NA
Tungsten metal, including alloys, all forms	kilograms	200	NA
Zinc:			
Oxides		90	
Metal, including alloys, all forms		2	NA
Other:			
Ores and metal-bearing residues		1,382	
Metals, n.e.s., all forms		2	NA
NONMETALS			
Abrasives, natural crude, except diamond		26	NA
Asbestos		753	NA
Barite		685	NA
Boron materials, oxide and acid		5	NA
Bromine, elemental	kilograms	24	NA
Cement, hydraulic		19,834	NA
Chalk		706	NA
Clays:			
Bentonite		562	
Kaolin		73	NA
Other		305	
Diatomite		347	NA
Feldspar, leucite, nepheline		947	NA
Fertilizer materials:			
Crude, phosphatic		362	NA
Manufactured:			
Nitrogenous		13,929	
Phosphatic		505	37,215
Potassic		2,662	
Other, including mixed		16,467	
Graphite, natural		5	NA
Gypsum and anhydrite		8,174	NA
Lime, quick and hydrated		996	NA

See footnotes at end of table.

Table 6.—Mozambique: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971
NONMETALS—Continued		
Magnesite, crude—kilograms	39	NA
Mica, all types	145	NA
Pigments, mineral:		
Iron oxides	115	NA
Other natural	93	
Salt	683	NA
Sand	648	NA
Sodium and potassium oxides and hydroxides	3,617	[3] 3,334
Stone, all types	4,830	NA
Sulfur	4,637	NA
Talc and related materials	189	NA
Other:		
Crude minerals	1,682	NA
Oxides of barium, strontium, magnesium	692	
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	158	NA
Coal:		
Anthracite	1,252	NA
Bituminous	337,025	368,939
Coke and semicoke	1,711	NA
Petroleum:		
Crude oil—thousand 42-gallon barrels	5,576	6,228
Refinery products:		
Gasoline—do	296	183
Jet fuel—do	64	[4]
Kerosine—do	r 189	213
Distillate fuel oil—do	717	757
Residual fuel oil—do	1	
Lubricants—do	r 116	111
Other—do	120	NA
Total—do	r 1,503	NA
Crude chemicals from coal, gas and oil distillation	2,680	NA

r Revised. NA Not available.
[1] Excludes pipes, tubes, and fittings.
[2] Data for 11 months (January–November) only.
[3] Partial figure, but believed to represent by far the largest part of the total.
[4] Included with distillate and residual fuel oil.

COMMODITY REVIEW

Metals.—*Chrome and Nickel.*—Occurrences of chrome and nickel minerals have been identified in ultrabasic rocks near Mount Achiza (15° 28′S., 30° 53′E.). The firm Companhia Moçambicana de Minas, S.A. (COMOCMIN) has been conducting mineral exploration in its concession area at Mount Achiza.

Copper.—The firm COMOCMIN has studied the copper deposit at Chidue, circumscription of Macanga.[11] Other known occurrences of copper are located near Sanangoe (15° 44′S., 33° 06′E.) and Messeca (15° 27′S., 31° 21′E.).

Gold.—A deposit of gold was discovered in Manica County, Vila Pery District, near the border with Rhodesia. Other occurrences of gold are known in the Luenha River (16° 24′S., 33° 48′E.), at Vila Gamito (14° 10′S., 32° 59′E.) and Cazula (15° 24′S., 33° 38′E.).

Iron Ore.—Mineral exploration by the Companhia Uranio de Moçambique S.A.R.L. near Tete located a deposit estimated to contain 12 million tons of titanomagnetite.[12] The company planned to build a steel mill in Moatize with an annual capacity of 250,000 tons per year. Known iron ore deposits occur at Muende (14° 41′S., 34° 00′E.), Txizita (15° 56′S., 33° 59′E.), Inhantipissa (15° 57′S., 33° 46′E.) and Massamba (15° 39′S., 33° 39′E.).

Manganese.—Deposits at Mazói (16° 38′S., 33° 07′E.) have been studied and estimated superficially at about 150,000 tons. Evaluation of reserves will be undertaken soon.

Uranium.—Reportedly, 26 deposits of uranium have been discovered in Moatize zone, Tete District, by the Companhia Uranio de Moçambique, S.A.R.L.[13] Radio-

[11] Economia de Moçambique (Beira). Minerals of Tete. V. 10, No. 2, February 1973, p. 28.
[12] Marches Tropicaux et Mediterraneens (Paris). New Iron Deposit. 28 Annie, No. 1393, July 21, 1972, p. 2204.
[13] Actualidade Economica (Luanda). Mozambique Ore Deposits Include Uranium. Jan. 25, 1973, pp. 15–16.

active ores were first discovered in 1934 near Ribaue, northern Mozambique, and later in the Mavuzi area, Tete, near the uranium deposits discovered recently. Companhia Uranio de Moçambique, S.A.R.L. has three exclusive prospecting concessions in the Tete District.

Other Metals.—Deposits of unknown quantity and quality occur in the following areas: Galena—region of Mazói; rutile-Moatize and Tete; magnesite-Mount Achiza; beryl-Changara (16° 50'S., 33° 16'E.); and Zambué (18° 22'S., 34° 03'E.).

Nonmetals.—*Cement.*—Companhia de Cimentos de Moçambique installed a third kiln at its Nova Maciera plant at Dondo near Beira. This increased capacity by 333,,000 tons, bringing the plant capacity to a total 506,000 tons. A fourth kiln was being constructed at the company's Matola plant near Lourenço Marques and was expected to be completed by late 1977.

Corundum.—Deposits of unknown size occur in Tete, Moatize, and Mazói areas.

Fluorite.—An estimated 2 million tons of fluorite occurs in the districts of Beira and Tete at the following locations: Beira—Macossa (17° 54'S., 33° 56'E.), Maringoé (17° 58'S., 34° 23'E.), and Canxixe (17° 35'S., 34° 18'E.); Tete—Djanguire (16° 23'S., 32° 35'E.) and Mount Domba (16° 46'S., 33° 05'E.). The deposits at Canxixe are being exploited by Interminas-Fluorites de Moçambique.

Mineral Fuels.—*Coal.*—Several coalbeds crop out along the Zambezi River. The Moatize-Minjova bed, currently being exploited by Companhia Carbonifera de Moçambique, occurs in the following locations: 16° 10'S., 33° 46'E.; 16°41'S., 34° 17'E. The Chicoa-Rio Mecúcoé bed, which contains strata of coking coal, outcrops for more than 9.3 miles along the Zambezi River. It has been located in the following areas: 15° 36'S., 32° 21'E.; 15° 38'S., 30° 49'E. The Sanângoé-M'Fidzi bed, located at 15° 44'S., 33° 06'E.; 15° 53'S., 33° 18'E., was being evaluated by COMOCMIN for tonnage of reserves and quality of its coals. Companhia Carbonifera de Moçambique planned to start large-scale mining of coal in the Chupanga area. The company, which has been exploiting the Moatize coalbed, expected to increase annual production to 1 million tons. A number of firms have applied for mining rights in the 93-mile-long tract of land between Chicoa and Rio Mecúcoé in the Zambezi Basin.

Petroleum and Natural Gas.—Société Nationale des Pétroles d'Aquitaine operator for a consortium consisting of Anglo American Corp. and Gelsenberg of West Germany discovered oil 15 miles west of Sengo Beach, north of Beira.[14] Reportedly the find was very large; however, little information is available on the commercial viability of the discovery.

Société Nacional de Refinacao de Petroles (SONAREP) planned to expand its petroleum refinery at Matola from the present 17,000-barrel-per-day capacity to 47,000 barrels per day.

Reserves of natural gas in the Pande field of Mozambique Amoco Oil Co. were estimated at 600 billion cubic feet of gas recoverable valued at an estimated $6,000 million.[15]

PORTUGUESE GUINEA

Activity in the minerals industry in 1972 consisted mainly of the import of cement, iron and steel semimanufactures and petroleum products.

OTHER PORTUGUESE POSSESSIONS

Hidrocarbonetos de São Tomé e Principe S.A.R.L., a subsidiary of Ball and Collins Oil and Gas Ltd. of the United Kingdom and Texas Pacific Oil Co. of Portugal, started drilling its first well in late May in the waters offshore from the islands of São Tomé and Principe, Gulf of Guinea.[16] Early in 1972 the company drilled two stratigraphic holes.

[14] World Petroleum Report. Mozambique. V. 19, 1973, p. 66.
[15] Economia de Moçambique (Beira). Pande and a World Review of Natural Gas. V. 10, No. 5, May 1973, pp. 4, 5.
[16] Work cited in footnote 13.

The Mineral Industry of Argentina

By Larry S. Dewey [1]

The mineral industry in Argentina accounted for less than 3% of the country's gross domestic product (GDP) in 1972. However, during recent years the country has imported mining machinery at a rapid pace to implement the exploitation of the Sierra Grande iron ore deposits and the copper deposits discovered in the San Juan-Neuquén area.

Additionally, an agreement was signed in 1972 between the Ministry of Industry and Mining and the Argentine Air Force to carry out an aerophotographic study of 110,000 square kilometers in the Cordillera area of the Provinces of Río Negro, Chubut, and Santa Cruz. The study will allow an evaluation of all the metallic and nonmetallic mineral resources for future development.

The Argentine Government continued studies to revise the 1887 Mining Code, which fails to furnish the necessary incentives to attract risk capital for large-scale mineral exploration and development. Although no specific revisions were announced in 1972, the proposed goal is to develop a domestic mineral industry that can supply the majority of Argentina's industrial raw materials requirements.

PRODUCTION

Output performance of the more important minerals, metals, and fuels produced in 1972 was mixed compared with 1971 performance levels. In the mineral fuels sector, the most significant attainment was a 2.6% increase in crude oil production.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Argentina: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Antimony, mine output, metal content—kilograms	[r] 322	14,000	[e] 14,000
Beryllium, beryl concentrate, gross weight	302	250	[e] 270
Bismuth, mine output, metal content—kilograms	42	210	[e] 500
Chromium, chromite, gross weight	30	300	[e] 300
Columbium-tantalum, columbite-tantalite concentrates, gross weight—kilograms	[r] 4,591	[e] 4,500	[e] 4,500
Copper:			
Mine output, metal content	[r] 89	654	[e] 650
Smelter output [e]	300	300	300
Iron and steel:			
Iron ore and concentrate—thousand tons	239	282	231
Pig iron—do	[r] 810	859	855
Ferroalloys, electric furnace—do	31	28	[e] 30
Crude steel—do	1,823	1,913	2,106
Semimanufactures (rolled only)—do	2,233	2,475	2,045
Lead:			
Mine output, metal content	35,588	39,888	39,461
Smelter	38,100	43,544	39,463
Manganese ore and concentrate, gross weight	31,613	13,772	[e] 14,000
Silver, mine output, metal content—thousand troy ounces	2,816	3,179	2,122
Tin, mine output, metal content—long tons	1,153	700	[e] 1,000
Tungsten, mine output, metal content	[r] 144	135	[e] 140
Uranium, mine output, U_3O_8 content—kilograms	[r] 49,465	49,000	[e] 100,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS—Continued			
Zinc:			
Mine output, metal content	38,985	42,000	36,200
Smelter	32,000	33,500	40,800
NONMETALS			
Abrasives, natural, n.e.s., garnet	60	--	NA
Asbestos	35	393	e 400
Barite	26,589	20,540	e 20,500
Boron minerals, crude	43,346	59,984	e 60,000
Cement, hydraulic [2] thousand tons	4,743	5,533	5,445
Chalk	61,126	78,281	NA
Clays:			
Bentonite	73,660	85,969	e 90,000
Foundry earth	2,024	2,562	NA
Fuller's earth (decolorizing clay)	3,816	937	e 900
Kaolin	74,555	68,375	e 70,000
Refractory	115,941	136,175	NA
Other thousand tons	r 2,381	1,788	NA
Diatomite	8,228	9,587	e 9,600
Feldspar	29,536	36,284	e 36,000
Fertilizer materials, crude natural phosphates (guano)	317	594	e 600
Fluorspar	29,655	72,234	e 70,000
Graphite	76	147	e 150
Gypsum, crude	421,563	590,260	e 600,000
Lithium minerals	245	81	e 80
Mica:			
Sheet	90	154	e 150
Waste and scrap	1,314	2,903	e 3,000
Pigments, natural mineral, ocher	60	256	NA
Pumice and related volcanic materials	32,617	18,724	e 19,000
Rhodochrosite	164	81	NA
Salt:			
Rock	1,160	2,813	e 3,000
Solar	957,566	821,648	e 847,000
Total	958,726	824,461	e 850,000
Sand and gravel:			
Sand:			
Construction thousand tons	r 9,218	10,635	NA
Silica sand (glass sand) do	182	153	NA
Gravel do	8,956	e 9,000	NA
Stone:			
Dimension:			
Flagstone	64,974	68,200	NA
Granite	r 13,760	19,554	NA
Marble and other calcareous, n.e.s	26,414	25,261	NA
Sandstone	r 18,512	72,722	NA
Crushed, broken and unspecified:			
Basalt thousand tons	2,084	2,772	NA
Calcite, nonoptical	10,448	15,643	NA
Dolomite thousand tons	214	200	NA
Granite, crushed do	r 6,127	6,222	NA
Limestone do	11,983	11,659	NA
Marble rubble do	75	81	NA
Quartz do	76	62	NA
Quartzite do	1,427	1,497	NA
Serpentine	30,156	34,677	NA
Shell marl	103,687	92,990	NA
Slate	21	--	NA
Strontium minerals, celestite	426	2,137	e 2,200
Sulfur, elemental, refined	39,564	38,182	43,000
Sulfates, natural:			
Aluminum (alum)	14,080	10,501	NA
Iron (melanterite)	r 374	903	NA
Magnesium (epsomite)	1,172	1,458	NA
Sodium (mirabilite)	34,993	19,707	NA
Talc and related materials:			
Pyrophyllite	6,860	7,263	NA
Steatite	5,376	5,661	NA
Talc	18,668	35,113	e 35,000
Vermiculite	3,238	4,288	e 4,300
Water, mineral	r 30,422	NA	NA
Zeolite	75	60	NA
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	5,575	2,679	NA
Carbon black e	30,000	30,000	30,000
Coal, bituminous thousand tons	616	632	676
Coke, all types including breeze do	r e 450	474	470
Gas, natural:			
Gross production million cubic feet	270,683	286,654	277,642
Marketed do	r 212,454	229,323	218,244

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Natural gas liquids, natural gasoline	thousand 42-gallon barrels	[3] 645	3,088	NA
Peat, agricultural		3,407	3,985	[e] 4,000
Petroleum:				
Crude oil	thousand 42-gallon barrels	143,428	154,514	158,464
Refinery products:				
Aviation gasoline	do	377	381	284
Other gasoline	do	33,559	36,751	37,736
Jet fuel	do	2,341	2,753	[4]
Kerosine	do	6,880	5,847	5,835
Distillate fuel oil	do	34,915	41,651	41,608
Residual fuel oil	do	59,609	[5] 58,364	59,147
Lubricants	do	1,084	1,062	1,543
Other:				
Naphtha	do	[e] 700	[5] 4,806	[4]
Liquefied petroleum gas	do	[e] 4,200	[5] 6,823	10,201
Petroleum coke	do	3,645	2,393	[4]
Asphalt	do	4,205	4,431	3,879
Solvents	do	410	488	[4]
Other	do	350	418	8,950
Refinery fuel and losses	do	[e] 1,830	[5] 449	
Total	do	154,105	166,617	169,183

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

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

[2] Excludes white cement, for which data are not available; white cement output totaled 41,831 metric tons in 1969.

[3] Includes material reported in official sources as "naphtha for reforming" as well as that material reported as natural gasoline.

[4] Included with "Other" and "Refinery fuel and losses."

[5] Data for refinery fuel and losses (derived by subtracting reported individually listed products from reported total refinery input) appears inadequate to maintain refinery operations at the indicated level; a portion of the recorded production of residual fuel oil, naphtha, and/or liquefied petroleum gas presumably may have been used for refinery fuel.

TRADE

Mineral commodities constituted a relatively small part of Argentina's total exports; however, imports of mineral commodities, principally iron and steel products and mineral fuels, represented about 28% of the value of all imports.

Table 2.—Argentina: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum:			
Oxide (alumina) and hydroxide		5	9
Metal, including alloys, all forms		306	272
Antimony metal, including alloys, all forms		87	--
Beryllium, beryl ore and concentrate		50	100
Cadmium metal, including alloys, all forms		11	--
Chromium:			
Chromite		--	100
Oxide and hydroxide	kilograms	950	200
Copper:			
Ore and concentrate		564	468
Metal, including alloys, all forms		105	79
Iron and steel:			
Ferroalloys		1,205	2,570
Ingots and other primary forms		336	3
Semimanufactures:			
Bars and rods:			
Wire rods		29,061	22,795
Other bars and rods		[r] 63,995	37,702
Angles, shapes, sections		38,483	34,446
Universals, plates and sheets		53,907	139,002
Hoop and strip		722	1,479
Rails and accessories		17	2

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Iron and steel—Continued		
Semimanufactures—Continued		
Wire	5,303	6,655
Tubes, pipes and fittings	20,614	21,115
Castings and forgings	72	32
Lead ore and concentrate	1,184	615
Mercury, 76-pound flasks	5	--
Silver metal, thousand troy ounces	132	749
Tantalite ore and concentrate, kilograms	1,050	1,201
Tin:		
Ore and concentrate, long tons	5,058	4,410
Oxides, do	5	6
Tungsten:		
Ore and concentrate	198	185
Metal, including alloys, all forms, kilograms	2	5
Zinc:		
Ore and concentrate	--	7,634
Oxide	2	5
Metal, including alloys, all forms	2,841	485
Other:		
Ore and concentrate	268	125
Ash and residue containing nonferrous metals	2,811	2,459
Waste and sweepings of precious metals, kilograms	612	--
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc, do	1,200	1,100
Grinding and polishing wheels and stones, do	3,792	6,006
Asbestos	4	4
Barite	165	15
Boron materials:		
Crude natural borates	535	1,126
Oxides and acid	43	--
Cement	3,740	1,793
Chalk	--	20
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Bentonite	6,132	7,533
Kaolin	77	77
Other	391	275
Products:		
Refractory (including nonclay bricks and cement)	77	63
Nonrefractory	355	455
Diatomite and other infusorial earth	39	6
Fertilizer materials:		
Crude:		
Nitrogenous	4	1
Manufactured:		
Nitrogenous	2,292	1,984
Phosphatic:		
Thomas slag	235	330
Other	(1)	296
Potassic	20	205
Mixed	1,990	1,950
Ammonia	482	429
Fluorspar	679	28,215
Graphite, natural	2	4
Gypsum and plasters	12,240	11,893
Lime	41	293
Lithium and lithium compounds	20	15
Mica, crude, including splittings and waste	903	1,919
Pigments, mineral:		
Natural, crude	3	2
Iron oxides, processed	5	7
Salt	84,161	67,500
Sodium compounds, n.e.s., caustic soda	141	7
Stone, sand and gravel:		
Dimension stone:		
Crude	2,011	12,058
Worked	5,228	70
Dolomite	1,490	1,835
Gravel and crushed rock	25	1,224
Quartz	3	3
Sand	46	11
Ornamental:		
Onyx	--	20
Rhodochrosite	18	97
Sulfuric acid	449	292
Talc, steatite, soapstone and pyrophyllite	80	510
Other nonmetals, n.e.s.:		
Crude	8	26
Slag, dross and similar waste, not metal bearing	926	1,122

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Other nonmetal n.e.s.—Continued			
Bromine, iodine and fluorine		8	3
Oxides, hydroxides and peroxides of strontium, barium or magnesium		172	158
Building materials of asphalt, asbestos and fiber cement and unfired nonmetals, n.e.s		614	2,125
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		1,260	4,564
Carbon black		3,665	3,547
Coal, all grades		1,879	347
Coke and semicoke		12,670	25,444
Rare gases, argon and other	kilograms	463	67
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	128	628
Kerosine	do	--	8
Distillate fuel oil	do	21	11
Residual fuel oil	do	611	254
Lubricants	do	55	46
Liquefied petroleum gas	do	(1)	46
Other	do	986	1,083
Mineral tar and other coal-petroleum, or gas-derived crude chemicals		208	22

r Revised.
1 Less than ½ unit.

Table 3.—Argentina: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum:			
Bauxite and concentrate		41,652	11,820
Oxide (alumina) and hydroxide		7,814	6,530
Metal, including alloys, all forms		51,495	60,062
Antimony:			
Ore and concentrate		67	388
Metal, including alloys, all forms	kilograms	838	410
Arsenic:			
Trioxide and acids		569	211
Metal, including alloys, all forms		65	22
Bismuth metal, including alloys, all forms		14	14
Cadmium metal, including alloys, all forms	kilograms	385	779
Chromium:			
Chromite		8,113	1,256
Oxide and hydroxide		17	9
Metal, including alloys, all forms		3	4
Cobalt:			
Oxide and hydroxide		10	5
Metal, including alloys, all forms		59	84
Columbium and tantalum, tantalum metal, including alloys, all forms	kilograms	18	13
Copper:			
Ore and concentrate		1,111	385
Metal, including alloys, all forms		23,549	35,212
Gold metal, unworked or partly worked	troy ounces	183,130	529,168
Iron and steel:			
Ore and concentrate	thousand tons	1,448	1,592
Metal:			
Scrap	do	5	57
Pig iron, including spiegeleisen	do	123	87
Sponge iron, powder and shot		1,206	1,290
Ferroalloys		3,159	3,482
Ingots and other primary forms	thousand tons	1,064	1,097
Semimanufactures:			
Common steel:			
Bars and rods	do	r 5	6
Angles, shapes and sections	do	35	33
Universals, plates and sheets (including tinplate and other coated)	do	r 346	361
Hoop and strip	do	r 13	8
Rails and accessories	do	10	16
Wire	do	r 1	(2)
Tubes, pipes and fittings	do	18	10
Castings and forgings		153	51
High carbon and alloy steel, all shapes[3]	thousand tons	49	41

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Lead:		
Oxides	30	54
Metal, including alloys, all forms	1,705	663
Magnesium metal, including alloys, all forms	377	688
Manganese:		
Ore and concentrate	34,175	36,008
Oxides	3,416	2,480
Metal	52	30
Mercury, 76-pound flasks	627	927
Molybdenum:		
Ore and concentrate	--	9
Metal, including alloys, all forms	12	13
Nickel metal including alloys, all forms	680	751
Platinum-group metals and silver:		
Platinum group, troy ounces	2,476	5,851
Silver, do	139,663	95,809
Rare-earth metals and compounds	42	40
Selenium, elemental	7	9
Tellurium, kilograms	200	152
Tin:		
Ore and concentrate, long tons	--	(2)
Oxides, do	(2)	1
Metal, including alloys, all forms, do	1,110	1,287
Titanium:		
Ore and concentrate	1,348	1,736
Oxides	1,494	1,334
Metal, including alloys, all forms	6	5
Tungsten metal, including alloys, all forms	4	10
Uranium metal, including alloys, all forms, kilograms	--	55
Zinc:		
Oxide	85	102
Metal, including alloys, all forms	5,970	2,987
Zirconium ore and concentrate	937	962
Other:		
Ore and concentrate, n.e.s	--	15
Ash and residue containing nonferrous metals	--	50
Oxides, hydroxides and peroxides of metals, n.e.s	323	391
Metals including alloys, all forms:		
Metalloids	3,194	3,842
Pyrophoric alloys	3	1
Base metals, n.e.s	1	1
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	289	420
Grinding and polishing wheels and stones	148	139
Asbestos	21,106	22,026
Barite and witherite	40	91
Bromine	118	97
Cement	300,216	25,395
Chalk	345	360
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Bentonite	2	3
Fire clay	177	467
Kaolin	14,962	13,741
Andalusite, kyanite and sillimanite	1,066	443
Other	239	514
Products:		
Refractory (including nonclay bricks and cement)	20,313	29,889
Nonrefractory	5,820	3,675
Cryolite and chiolite	58	17
Diamond:		
Gem, thousand carats	6	21
Industrial, do	215	95
Powder, do	89	139
Diatomite and other infusorial earth	2,578	2,413
Feldspar and fluorspar	165	43
Fertilizer materials:		
Crude:		
Nitrogenous	13,470	9,060
Manufactured:		
Nitrogenous	4,562	4,847
Phosphatic:		
Thomas slag	170	50
Other	16,267	19,287
Potassic	14,922	18,108
Mixed	39,520	46,749
Ammonia	4	5
Graphite, natural	433	264
Gypsum and plaster	28	4

See footnotes at end of table.

Table 3.—Argentina: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Iodine		62	69
Lime		1	369
Magnesite		21,423	12,778
Mica:			
Crude, including splittings and waste		44	41
Worked, including agglomerated splittings		10	8
Pigments, mineral:			
Natural, crude		140	120
Iron oxides, processed		435	374
Precious and semiprecious stones, except diamond	thousand carats	11,900	11,925
Pyrite (gross weight)		13	8
Salt and brine		16	4
Sodium and potassium compounds, n.e.s.:			
Caustic soda		13,465	25,453
Caustic potash, sodic and potassic peroxides		1,087	1,027
Sodium carbonate, natural and manufactured (soda ash)		161,639	149,540
Stone, sand and gravel:			
Dimension stone:			
Crude		16,818	11,554
Worked		201	33
Dolomite		43,920	13,332
Gravel and crushed rock		327,257	215,652
Quartz and quartzite		672	373
Sand, excluding metal bearing	thousand tons	1,165	1,124
Sulfur:			
Elemental:			
Other than colloidal		56,805	29,994
Colloidal		114	101
Sulfuric acid		17	18
Talc, steatite, soapstone, and pyrophyllite		584	458
Other nonmetals, n.e.s.:			
Crude		727	1,600
Slag, dross and similar waste, not metal bearing, from iron and steel manufacture		260	80
Oxides, hydroxides and peroxides of strontium, barium or magnesium		162	206
Building materials of asphalt, asbestos and fiber cement and unfired nonmetals, n.e.s.		93	203
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		168	180
Carbon black		1,424	2,163
Coal, all grades, including briquets	thousand tons	839	717
Coke and semicoke	do.	14	10
Peat		376	609
Rare gases, helium and hydrogen		3	3
Petroleum:			
Crude	thousand 42-gallon barrels	10,590	16,666
Refinery products:			
Gasoline	do.	9	(2)
Kerosine	do.	(2)	372
Distillate fuel oil	do.	3,932	1,730
Residual fuel oil	do.	1,089	921
Lubricants	do.	963	1,194
Other:			
Nonlubricating oils, n.e.s.	do.	7	15
Liquefied petroleum gas	do.	582	5,664
Other	do.	38	106
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		58,809	74,527

[1] Revised to exclude high carbon and alloy steel, which is included in a separate group.
[2] Less than ½ unit.
[3] In previous editions, this category was distributed among the various steel semimanufacture shapes.

COMMODITY REVIEW

METALS

Aluminum.—ALUAR, S.A. reported that the planned Futaleufu hydroelectric power project, which is to supply vital electrical power to the aluminum plant under construction at Puerto Madryn, has experienced an estimated 28-month delay. However, construction of the aluminum plant itself is proceeding on schedule with completion expected at yearend 1974. The major contractor for the 440-megawatt Futaleufu hydroelectric project, Vialco, S.A., reported that the delay resulted from three major problems: (1) the inconsistency of the rock formations, underlying the base of the dam because deep sampling of the formation at the proposed site were not

made; (2) unusually bad weather at the construction site which slowed operations; and, (3) delays in payments to contractors brought on by an upsurge in inflation which pushed wages and material costs far above expectation.

Because of the delays in the hydroelectric project, gas turbines will be temporarily installed at Puerto Madryn to provide electricity for the local power system and the aluminum smelter. It is unlikely that the smelter can begin significant operations based on gas turbine power; therefore, even if the aluminum plant is completed on schedule, it will lack enough power to begin full operations until at least mid-1975.

Copper.—Compañía Minera Aguilar, S.A., a subsidiary of St. Joe Minerals Corp. of the United States, has released revised results of diamond drilling activities at its Pachon copper prospect in the high Andes area of western San Juan Province. St. Joe Minerals Corp. had previously estimated San Juan copper reserves at 140 million tons. Results of exploratory activity in 1972 were favorable enough to place copper reserves at 270 million tons, almost double previous estimates. The Government of Argentina has indicated that it will give Compañía Minera Aguilar, S.A., the discoverer of the deposit, the right to develop the site for the Argentine market.

Iron and Steel.—In recent years the Argentine Government has expanded its domestic iron and steel production capabilities. However, the increased expansion is estimated to equal only half of the 9% annual increase in domestic demand for steel products in Argentina.

Fabricaciones Militares, the Argentina agency most closely associated with the steel industry, has authorized Industria Argentina de Aceros, S.A. (Acindar) the largest privately-owned steel company in the country, to proceed with a plan for further integration of its facilities. This authorization will permit Acindar to close its obsolete steel plant in Rosario, which utilizes scrap as the raw material. Acindar's new basic steelmaking facility will produce steel by the Hojalata y Lámina sponge iron process used in Mexico. The initial stage of the project will involve a 400,000-ton-per-year facility which is expected to begin production in 1976, with 500,000-ton capacity being achieved by 1980.

In the face of growing demand the principal point of concern is how the iron and steel industry is going to accelerate output to provide an increasingly larger share of domestic demand. Currently, the industry must run at peak capacity to merely keep pace with 50% of the demand increase, while imports maintain an approximate 50% share of the Argentine market.

Uranium.—Nuclear development in Argentina is under the direction of the Comisión Nacional de Energía Atómica (CNEA) which was created by the Government in 1950. CNEA announced in 1971 that out of a total land area of 487,000 square miles believed to have uranium potential, only 56,000 square miles had been explored. The results of 1972 exploratory activity have revealed proved reserves of 16,000 tons of U_3O_8 which represents enough fuel to operate a nuclear plant producing 10,000 megawatts for 25 years.

The country has already taken its first step toward nuclear power generation. A 314-megawatt plant, the first in Latin America, is nearing completion at Atucha about 60 miles northwest of Buenos Aires and is expected to be commissioned in 1973. A 600-megawatt plant is planned for construction in the near future in the Province of Córdoba.

NONMETALS

Cement.—In 1972 six companies were operating 39 kilns at 16 plants with a combined annual capacity of approximately 7,353,600 tons. Approximately 5,445,000 tons of cement was produced in 1972. This was 2% less than in 1971. Cia. Sudamérica de Cemento Juan Minetti announced in early 1972 that it would build a new cement plant with a capacity of 440,000 tons per year. The new plant is expected to be fully operational in 1974.

Sulfur.—Since domestic production of sulfur satisfied only 60% of the country's sulfur requirements in 1972, the Government removed the duty on imports of sulfur of 99% or more purity. However, the removal of this duty imposed the requirement that importers, whether end users or resellers, must secure an import license from the Ministry of Industry and Mining. Prior to this decree, there was a duty of 150% on most sulfur imports.

MINERAL FUELS

Coal and Coke.—During 1972, production of washed coal, which was only about 55% of total gross mine output, increased almost 7%. The country's only active coal mine is located at Río Turbio in extreme southwestern Argentina. In 1972 Yacimientos Carboníferos Fiscales (YCF), the Government coal-mining entity, announced a plan to increase production from the Río Turbio site to 3 million tons by 1975 and 8 million tons by 1980. However, mining experts in Argentina have acknowledged that since only one of the three shafts at Río Turbio is mechanized, considerable investment in new mechanized mining equipment will be required in order to reach YCF's goal.

Reports indicated that over 450 million tons of high-quality coal have been proven in the Río Turbio basin, and with proper mechanization and transportation facilities this coal will have a ready market through either domestic consumption or exporting.

Petroleum and Natural Gas.—Argentina's crude petroleum production in 1972 increased almost 3% to 433,000 barrels per day. Yacimientos Petrolíferos Fiscales (YPF), the Government oil entity, was again responsible for the majority of crude output with 70% of the total production, while companies holding contracts with YPF accounted for 29%. The remaining 1% of crude production was from private firms operating under earlier agreements.

Natural gas production decreased 3% to 760 million cubic feet per day in 1972. YPF accounted for 93% of Argentina's natural gas production in 1972.

According to industry estimates the country's total proved reserves of crude oil were approximately 2.5 billion barrels at the beginning of 1972. Natural gas reserves, as of the same date, were reported to be slightly more than 6 trillion cubic feet. Geologic and geophysical surveying and exploratory and development drilling activities were as follows:

		1970	1971	1972
Geologic and geophysical surveying:				
Geologic	party months	112.0	90.0	84.0
Gravimetric	do.	14.0	15.5	14.0
Magnetic	do.	--	--	--
Seismic	do.	341.9	276.0	284.5
Total	do.	467.9	381.5	382.5
Drilling, wells drilled:				
Exploratory:				
Oil	number	14	32	21
Gas	do.	10		
Dry	do.	89	113	89
Subtotal	do.	113	145	110
Development:				
Oil	do.	334	NA	NA
Gas	do.	38	NA	NA
Dry	do.	94	NA	NA
Subtotal	do.	466	459	513
Total	do.	579	604	623

NA Not available.

With regard to future petroleum supply, YPF planned to put 40 exploration teams into the field in 1972 and 1973. They are expected to drill a total of about 160 wildcat wells. Observers feel Argentina will have to drill an average of 800 development and exploration wells per year through the remainder of this decade in order to attain and maintain national self-sufficiency. Argentina's oil and gas production comes from fields located in Chubut, Jujuy, Las Pompas, Mendoza, Neuquén, Río Negro, Salta, and Santa Cruz Provinces and Tierra del Fuego Island.

In late 1971 a Government decision that YPF run its refineries at full capacity, leaving the residual balance of demand to be served by the privately-owned refineries, left little incentive for these refineries to improve and/or expand their facilities.

Soon after YPF became the country's sole allocator and importer of crude, the

privately-owned refineries began experiencing serious feedstock shortages beginning in mid-1972 which greatly reduced the supply of petroleum products for domestic consumption. Additionally, a refinery breakdown and a product pipeline failure along with the feedstock problem created severe shortages of gasoline in late 1972.

The immediate effect of the feedstock shortage was soon realized when the supply of kerosine, which in Argentina is a substitute for bottled gas, was greatly restricted. Shortages of fuel oil were apparent in deliveries to private homes, apartment buildings, and even Government buildings. Natural gas had to be diverted from household use as a substitute fuel at the main Buenos Aires powerplant. Realizing the magnitude of the supply-demand gap, YPF began buying crude on a spot basis in an attempt to alleviate the supply problem on a short-term basis. However, YPF pointed out that buying crude on a spot basis is very costly, and with the worldwide shortage of crude, it would be almost impossible on short notice to buy enough spot shiploads to keep gaps from developing in the local fuel supply. In late 1972 the products supply problem was compounded by a refinery breakdown at the Esso Sociedad Anónima Petrolera's plant which restricted the production of gasoline to the point where an emergency purchase of 63,000 barrels of gasoline from Uruguay was necessary. Another problem was a products pipeline breakdown at YPF's link between La Plata and Buenos Aires, which caused minor disruptions to the domestic supply situation.

At yearend 1972, Argentina's refining capacity was estimated at 667,300 barrels per day. YPF's seven refineries' total capacity was 393,600 barrels per day, while the eight privately owned plants had a capacity of 273,700 barrels per day. Domestic refinery units processed a total of 462,000 barrels per day, which represented an increase of almost 2% over 1971. Of the total crude oil processed 94% was Argentine and 6% was imports. Domestic production of oil in 1972 was estimated to be approximately 45,000 barrels per day short of the required domestic demand.

Sales of principal petroleum products increased less than 1% over 1971 levels. Natural gas sales decreased by 5% while liquefied petroleum gas sales decreased by 3% compared with 1971. Petroleum products imported recorded a significant decrease of 50% for the yearend 1972.

On April 28, 1972, Bolivia began shipping natural gas to Argentina through the newly completed 24-inch pipeline from the hydrocarbon fields north and south of the city of Santa Cruz to the Argentine border town of Pocitos. Bolivian deliveries to Argentina in 1972 totaled 35,496,554,000 cubic feet with a wellhead value of US$9,863,785, an average of U.S. 27.8 cents per thousand cubic feet.

In other developments, YPF released a statement of intent by Bolivia and Argentina regarding projects that relate to the petroleum industry of these two countries. The first proposal was that Argentina buy up to 17,700 barrels per day of butane and propane from a proposed gas processing plant in the Río Grande field. An extension to this proposal would involve the Argentine national company, Gas del Estada, assisting Bolivia with technical and financial help in erecting a liquid petroleum gas plant on the Bolivian-Argentine border.

Another announced area of agreement was a joint participation of YPF and Gas del Estada in an exploration and exploitation company with Yacimientos Petrolíferos Fiscales of Bolivia. The final agreement to be reached was an increase in the price of petroleum sold by Bolivia to Argentina using a reference value of US$5.15 per barrel as an approximate price. This price would be revised semiannually in accordance with the factors which may influence price variations.

The Inter-American Bank announced the approval of a loan equivalent to US$20 million to help Argentina finance a 448-mile gas pipeline interconnecting fields in lower Patagonia with the main pipeline serving consuming districts in the vicinity of Buenos Aires. This loan will finance another project in Gas del Estada's general program of pipeline expansion which is to run through 1978. It will help increase the supply of gas to greater Buenos Aires by tapping the Cerro Redondo and El Cóndor gasfields in lower Patagonia, linking them through a 30-inch pipeline to the Pico Truncado-Buenos Aires line. Once completed, the line capacity will be 274,000 cubic feet per day.

Argentina is the only Latin American

country with an integrated and highly developed system for natural gas transmission from producing areas to the ultimate consumer.

On June 30, 1972, an unexplained explosion occurred in a pipeline at the General Cerri gas plant in the city of Bahía Blanca. The ignited gas from the broken pipe set fire to and totally destroyed one compressing station and severely damaged another. It was not made clear whether the failure was in a valve or a pipe seam. The pipeline itself was repaired within 24 hours, but the loss of the compressors caused sharp temporary reductions in the supply of gas reaching Buenos Aires. One of the compressor stations housed five U.S.-manufactured compressors which were installed just 2 weeks prior to the accident. Each of the five compressors had a capacity of 49,000 cubic feet per day. Two compressors were completely destroyed while three were slightly damaged. Replacements were being built in San Diego, Calif. Before the accident, the daily supply of gas was 289,000 cubic feet per day. By mid-July, the supply was back up to 254,000 cubic feet per day and local industry was not seriously affected. The primary reason for this was that major industrial customers were capable of using fuel oil in place of natural gas.

The Mineral Industry of Australia

By Charlie Wyche [1]

The pattern of continuing growth in the Australian mineral industry was sustained in 1972, and outlook for the future is for further expansion. According to preliminary data, Australia's mineral production for the year was valued at $2.3 billion,[2] an increase of 10% over the $2.1 billion reported for 1971. In comparison with the national economy, the value of minerals produced and initially processed in Australia during 1972 represented 3.2% of the $72 billion adjusted gross national product (GNP). The mineral output index (based on 1959=100) approximated 465 in 1972, compared with 351 and 414 in 1970 and 1971, respectively.

Production of most of the major metals increased with the exception of aluminum, and titanium concentrates. Of the more than 60 commodities produced in Australia during 1972, 15 showed substantial increases. Notable among those were zinc, iron ore, bauxite and alumina, bituminous coal, nickel, petroleum, and copper.

In 1971, the most recent year for which complete data were available, 11 commodities supplied over 75% of the total Australian mineral output value. In descending order the list included the following, with value in million U.S. dollars: Iron ore concentrates and pellets, 471; black (bituminous and subbituminous) coal, 350; crude petroleum, 289; construction materials, 186; bauxite, 169; lead in ore and concentrates, 88; beach sands (including rutile, zircon, and ilmenite), 77; zinc in ores and concentrates, 64; tin-in-concentrates, 36; brown coal, 32; and gold, 23. The value added by domestic smelting and refining of concentrates of copper, lead, zinc, iron, tin, nickel, and alumina, increased the mine value of mineral output by about $654 million in 1971 compared with $644 million in 1970.

Western Australia maintained its position as Australia's most important mineral producing state, accounting for 31% of the Nation's mine output in 1971. The value of mineral and petroleum production in Western Australia for 1971 was $639 million compared with $510 for the preceding year. The leading mineral commodity produced in the state, in terms of value was again iron ore with a value of $425 million, followed by nickel ore and concentrates valued at $89 million, alumina at $79 million, and crude oil at $46 million. New South Wales retained second place with 23% in 1971. Queensland contributed 18%; Victoria, South Australia, Tasmania, and Australian Capital Territory contributed 17%, 6%, 5%, and 2%, respectively.

Despite revaluation of the Australian dollar on December 7, 1972, by 7.05% to the U.S. dollar, mineral exports in 1972 expanded to an estimated $1.8 billion compared with $1.6 billion in 1971. Exports of iron ore and iron ore pellets increased to 70 million tons valued at $635 million or 35% of the total value of mineral exports. Iron ore, alumina, and black coal continued as the three largest export earners and in 1972 accounted for about 61% of domestic mineral exports. Increased exports were also recorded for refined nickel, refined copper, tin, manganese, and pig iron. Australia exported minerals and metals to more than 100 countries, but during 1972 Japan, the United Kingdom, and the United States received about 90% of the exports. Japan imported large quantities of iron ore, coal, copper, aluminum, iron and steel, zinc, manganese, and mineral sands. Exports to the United States were principally lead, zinc, manganese, mineral sands, and tin. Exports to the United Kingdom

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Unless otherwise indicated, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$1=US$1.27.

consisted mainly of lead, zinc, copper, mineral sands, iron ore, tin, and coal. With the increase in exports there was growing support in Australia for greater domestic processing. Imports of minerals in 1972 were less than in the previous year as the downward trend of recent years continued. Imports continued to be dominated by crude petroleum, the estimated value of which in 1972 was $129 million or 52% of the total value of mineral imports. Other commodities imported in substantial quantities included phosphate rock, sulfur, asbestos, and industrial diamond.

There was continued interest in exploration and the high success ratio of recent years promised a strong resources position for all important nonferrous minerals. Since 1968 expenditures on mineral exploration have increased threefold to $216 million. The expanded level of exploration in 1972 resulted in the discovery of deposits of iron ore, gold, bauxite, and nickel in Western Australia, uranium in the Northern Territory, coal in Queensland, and natural gas in the Bass Strait, off the coast of Victoria.

PRODUCTION

Reflecting the improved condition of world mineral markets, impressive increases were recorded in most sectors of the Australian mineral industry in 1972. The most significant increases were in the metals and fuels groups. There were, however, appreciable increases in most nonmetallic products.

Table 1.—Australia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Bauxite, gross weight thousand tons	9,256	12,733	14,433
Alumina do	2,152	2,713	2,852
Metal, refined do	206	224	206
Antimony, mine output (content of antimony and lead concentrates)	930	1,362	1,331
Beryllium, beryl, gross weight	18	72	--
Bismuth, mine output metal content	191	256	e 377
Cadmium:			
Mine output metal content	1,639	1,487	e 1,600
Smelter output (refined)	614	560	719
Cobalt, mine output (content of zinc and nickel concentrates)	469	796	e 740
Columbium-tantalum concentrates, gross weight	101	75	e 190
Copper:			
Mine output metal content	157,790	177,261	180,453
Blister:			
Primary	111,652	142,867	144,655
Secondary	8,718	6,938	4,790
Refined:			
Primary	104,125	127,044	139,107
Secondary	20,517	15,356	34,656
Gold:			
Mine output metal content troy ounces	619,922	672,491	754,932
Refined (excluding recovery from scrap) do	604,795	598,201	652,580
Iron and steel:			
Iron ore, gross weight [1] thousand tons	51,188	62,063	63,870
Pig iron do	6,148	6,128	6,497
Ferroalloys: [2]			
Ferrochromium, high carbon	2,169	313	e 2,000
Ferromanganese, high carbon	42,569	38,852	e 43,000
Ferronickel	1,357	349	e 1,000
Ferrosilicon	9,406	9,960	e 10,000
Silicomanganese	23,188	21,316	e 24,000
Total	78,689	70,790	e 80,000
Crude steel thousand tons	6,822	6,737	6,744
Steel semimanufactures [2] do	6,217	5,579	NA
Lead:			
Mine output metal content	456,528	403,557	398,917

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Lead—Continued			
Metal:			
Primary:			
Bullion for export	r 170,921	161,549	138,339
Refined	r 180,076	163,236	179,741
Total	r 350,997	324,785	318,080
Secondary (excluding remelt)	r 32,845	30,190	29,997
Manganese ore, gross weight	751,113	1,050,537	1,207,281
Mercury—76-pound flasks	37	9	e 6
Molybdenum, mine output metal content	r 69	14	15
Nickel:			
Mine output metal content	r 30,243	35,562	35,781
Metal, refined e	9,000	15,000	16,500
Platinum-group metals—troy ounces	3 1,643	e 3 1,400	e 3 1,400
Rare-earth minerals: Monazite concentrate, gross weight	4,437	4,381	5,023
Selenium (in refinery slimes)—kilograms	e 3,300	4 3,734	4 33,244
Silver:			
Mine output metal content—thousand troy ounces	25,992	21,811	21,422
Refined—do	9,422	8,429	8,354
Tin:			
Mine output metal content—long tons	8,689	9,876	11,765
Smelter output (primary only)—do	5,129	6,233	6,916
Titanium concentrates, gross weight:			
Ilmenite	886,452	800,945	708,808
Leucoxene	10,593	14,560	
Rutile	370,867	347,705	317,424
Tungsten, mine output metal content	1,265	1,440	1,074
Uranium oxide (U_3O_8) e	300	(5)	--
Zinc:			
Mine output metal content	487,207	452,647	502,187
Smelter:			
Primary	260,591	6 258,699	296,704
Secondary	7,863	7,043	NA
Zirconium concentrates, gross weight	395,352	412,947	360,192
NONMETALS			
Abrasives, natural:			
Beach pebble	1,688	1,617	NA
Garnet (sales)	202	516	300
Asbestos	828	846	e 15,000
Barite	r 44,774	53,811	e 24,800
Cement, hydraulic—thousand tons	4,599	4,721	4,936
Clays:			
Bentonite and bentonitic clay	358	288	e 350
Brick clay and shale—thousand tons	e 6,927	7,648	e 8,100
Cement clay and shale—do	300	292	e 300
Damourite clay (sales)	417	474	e 500
Fire clay—thousand tons	319	241	e 280
Fuller's earth	--	91	e 90
Kaolin and ball clay	89,577	76,497	e 90,000
Other—thousand tons	774	1,689	e 1,700
Diatomite	2,656	1,927	e 1,200
Feldspar	3,535	3,253	e 3,600
Fertilizer materials, crude, phosphate rock	14,489	6,786	e 10,000
Fluorspar	e 1,281	464	e 900
Gem stones e—value, thousands	$17,325	$21,000	NA
Gypsum	845,444	889,222	e 1,040,000
Kyanite and sillimanite (sillimanite only produced)	1,183	857	e 500
Lime e	210,000	230,000	250,000
Lithium minerals: Petalite, gross weight	783	1,674	e 1,800
Magnesite	r 22,663	18,087	e 19,000
Perlite, crude	838	2,122	NA
Pigments, natural mineral, ocher	660	71	NA
Pyrite, including cupreous:			
Gross weight	r 213,700	230,778	e 260,000
Sulfur content	103,039	105,391	e 125,000
Salt—thousand tons	r 3,071	7 3,788	e 4,000
Sand and gravel:			
Construction sand—do	16,973	18,394	NA
Gravel—do	12,093	12,849	NA
Stone:			
Dolomite—do	328	366	392
Limestone for cement—do	r 6,852	7,128	e 9,800
Limestone for other uses—do	3,143	3,208	
Silica in the form of quartz, quartzite and glass sand—do	879	1,112	NA

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
NONMETALS—Continued				
Stone—Continued				
Other:				
Crushed and broken	thousand tons	r 8 50,793	8 50,275	NA
Dimension	do	r 8 90	7 81	NA
Unspecified	do	r 8 28,594	9 28,465	NA
Sulfur, byproduct [10]	do	146	135	NA
Talc, soapstone and pyrophyllite		r 55,224	47,876	e 56,000
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous [11]	thousand tons	49,211	49,002	59,625
Lignite	do	24,175	23,382	23,697
Total	do	73,386	72,384	83,322
Coke:				
Metallurgical	do	4,293	4,405	4,591
Gas house (including breeze)	do	236	197	e 200
Total	do	4,529	4,602	e 4,791
Fuel briquets	do	1,449	1,391	1,215
Gas, natural, marketable production	million cubic feet	53,061	79,049	112,581
Natural gas liquids	thousand 42-gallon barrels	478	1,692	NA
Petroleum:				
Crude	do	65,149	112,914	119,516
Refinery products:				
Aviation gasoline	do	246	407	269
Other gasoline	do	62,255	65,626	67,375
Jet fuel	do	8,753	10,254	9,937
Kerosine	do	1,676	1,784	1,308
Distillate fuel oil	do	34,043	37,598	26,155
Residual fuel oil	do	r 41,735	36,567	32,287
Lubricants	do	2,576	2,929	2,761
Other	do	12,876	15,105	14,151
Refinery fuel and losses	do	r 15,333	15,826	26,930
Total	do	r 179,493	186,096	181,173

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Excluding iron oxide for use in cement production, coal washing and gas purification; output of such material totaled 60,783 tons in 1970 and 65,881 tons in 1971 (1972 data not available).

[2] Data are for year ended November 30 of that stated.

[3] Partial data; figures represent actual smelter/refinery recovery from nickel concentrates exported to Japan from Kambalda. Additional quantities of palladium and platinum are present in Kambalda concentrates produced for domestic smelting and for export to Canada for smelting, but platinum-group metals reportedly are not recovered from domestically smelted materials, and the quantity recovered in Canada (if any) is not reported.

[4] Partial figure; output by Peko Wallsend Ltd. only for years ended June 30 of that stated; the Electrolytic Refining and Smelting Co. of Australia Pty. Ltd. also produces selenium from tank house slimes containing 1% to 3% selenium, but output data are not available for publication.

[5] Revised to zero.

[6] Excludes zinc dust.

[7] Excludes production from Victoria, for which no figures are published in Australian sources, although production did occur.

[8] Excludes production from Northern Territory and Australian Capital Territory.

[9] Excludes production from Northern Territory, Australian Capital Territory and Western Australia.

[10] Sulfur content of sulfuric acid produced as a byproduct of oil refining and nonferrous metal operations (excludes sulfur content of sulfuric acid derived from pyrite).

[11] Includes semianthacite and subbituminous.

TRADE

The trade data shown in tables 2 and 3, were provided by the Commonwealth Bureau of Census and Statistics and cover the official July 1 to June 30 annual reporting period; therefore, the data are not comparable with calendar year data presented elsewhere in this review.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal destinations, 1970–71
METALS			
Aluminum:			
Bauxite, gross weight [2] thousand tons	3,750	5,056	Japan 2,632; West Germany 1,459; France 325.
Alumina, gross weight [2] do	r 1,419	1,685	United States 1,125; Japan 498; New Zealand 62.
Metal:			
Scrap	2,718	2,335	Japan 1,936; France 156; West Germany 129.
Unwrought	50,521	79,846	Japan 50,696; East Germany 5,675; Hong Kong 5,469.
Semimanufactures [3]	2,955	4,735	Malaysia 1,434; New Zealand 1,323; Indonesia 565.
Beryllium ore and concentrate	25	59	All to United States.
Cadmium metal, refined	r 529	506	United States 239; United Kingdom 148; India 34.
Columbium and tantalum: Tantalite-columbite concentrates, gross weight	108	123	United Kingdom 97.
Copper:			
Ore and concentrate, gross weight	65,111	140,217	Japan 134,051; United Kingdom 5,904.
Metal:			
Copper-lead dross and speiss	7,112	1,420	Japan 779; United States 641.
Copper slags and residue	136	81	Spain 71; Belgium-Luxembourg 10.
Unwrought:			
Blister and cement	8,140	7,105	All to Japan.
Other, unalloyed	38,624	36,014	West Germany 12,231; United Kingdom 7,747; France 6,549.
Alloyed	57	37	Thailand 26; New Zealand 6.
Semimanufactures:			
Unalloyed	10,984	14,005	New Zealand 8,943; Malaysia 1,312; Singapore 917.
Alloyed	4,876	3,752	Hong Kong 2,131; New Zealand 572; Singapore 517.
Gold:			
Ore and concentrate, metal content [2] troy ounces	r 188,464	151,354	NA.
Mint bullion do	146,795	96,635	All to Hong Kong.
Refined bullion do	828,783	88,922	Hong Kong 88,130; New Zealand 784.
Iron and steel:			
Iron ore and concentrate thousand tons	33,778	48,348	Japan 36,296; West Germany 1,348; France 1,005.
Scrap do	529	468	Japan 401; New Zealand 24; Thailand 14.
Pig iron do	290	389	Japan 310; Romania 41.
Steel ingots and other primary forms [2] do	r 484	119	Philippines 71; Hong Kong 27; Japan 13.
Steel semimanufactures do	r 673	423	New Zealand 177; United States 53; Papua New Guinea 35.
Lead:			
Ore and concentrate, gross weight	121,385	83,097	United States 26,381; Japan 20,010; Belgium-Luxembourg 19,641.
Metal:			
Bullion, lead-silver, lead content	169,755	179,814	United Kingdom 145,177; Netherlands 27,649; West Germany 6,988.
Refined	162,919	123,374	United Kingdom 48,228; United States 39,422; India 16,604.
Lead-antimony alloys	5,945	3,189	New Zealand 1,239; Philippines 711; Thailand 536.
Semimanufactures	r 2,627	3,671	United Kingdom 3,010; Indonesia 234; Singapore 109; Philippines 109.
Manganese ore, gross weight	648,936	703,828	Japan 550,985; United States 95,696; Spain 27,548.
Platinum-group metals [3] troy ounces	6,245	8,365	Hong Kong 6,163; New Zealand 1,736; Singapore 210.
Rare-earth metals, monazite concentrate [2]	r 4,764	4,661	Netherlands 1,473; France 1,380; United States 713.
Silver:			
Concentrates and lead-silver bullion, silver content [2] thousand troy ounces	15,410	11,279	NA.
Mint bullion do	7,503	7,896	United Kingdom 5,118; Japan 2,508; Thailand 257.
Other do	611	63	New Zealand 58; Singapore 4.
Tin:			
Ore and concentrate, gross weight long tons	7,002	35,441	United Kingdom 32,160; Spain 1,567; Mexico 862.
Metal, unwrought do	r 640	1,456	United States 1,118; New Zealand 213; West Germany 54.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal destinations, 1970–71
METALS—Continued			
Titanium concentrates, gross weight:			
Ilmenite	596,216	641,062	United Kingdom 247,496; Japan 243,519; France 80,051.
Leucoxene	2,861	8,562	United States 7,538; France 656; Japan 368.
Rutile	346,436	377,224	United States 211,031; Netherlands 31,552; Japan 34,967.
Tungsten concentrates, gross weight:			
Scheelite	1,431	1,214	United Kingdom 573; West Germany 510; Japan 131.
Wolframite	995	1,002	West Germany 648; Netherlands 244; United Kingdom 68.
Zinc:			
Ore and concentrate, gross weight	437,121	383,482	United Kingdom 178,191; Japan 118,806; Belgium-Luxembourg 34,271.
Metal:			
Slags and residues	5,965	5,782	Belgium-Luxembourg 2,245; Republic of South Africa 1,084; Netherlands 629.
Unwrought	154,716	136,831	United States 26,915; India 23,454; New Zealand 15,741.
Semimanufactures [3]	1,085	2,174	New Zealand 584; India 428; Japan 421.
Zircon concentrates, gross weight, minimum 30% $ZrSiO_4$ [3]	351,101	360,171	Japan 93,152; United States 71,089; Netherlands 37,536.
NONMETALS			
Abrasives, crude natural value, thousands	r $62	$69	Japan $46; United Kingdom $7.
Asbestos, crude and fiber [4]	551	228	Indonesia 136; New Zealand 92.
Cement, hydraulic [3]	10,273	13,810	Papua New Guinea 12,365; Nauru 561; Indonesia 480.
Clays, fireclay and others, including sillimanite [3]	6,279	7,461	Japan 3,486; United Kingdom 2,625; New Zealand 767.
Diamond:			
Gem [3]—carats	2,094	3,313	Belgium-Luxembourg 1,014; Israel 682; United Kingdom 634.
Industrial [3]—do	83,411	142,362	United States 79,056; United Kingdom 48,303; New Caledonia 9,979.
Gem stones, except diamond:			
Opals [3]—value, thousands	r $13,758	$12,741	Hong Kong $5,020; Japan $2,951; United States $2,140.
Sapphires [3]—do	$3,838	$3,620	Thailand $1,830; United Kingdom $477; Hong Kong $346.
Other [3]—do	r $312	$586	Hong Kong $138; United Kingdom $95; West Germany $93.
Gypsum	205,718	259,465	New Zealand 101,056; Taiwan 38,064; Singapore 18,362.
Magnesite	951	2,317	Netherlands 2,054; United States 181; New Zealand 82.
Salt	1,304,078	3,039,789	Japan 2,988,447; Republic of Korea 41,597; United States 9,252.
Talc and steatite [3]	39,221	36,138	Japan 24,593; Netherlands 9,946; New Zealand 1,477.
MINERAL FUELS AND RELATED MATERIALS			
Coal, including briquets—thousand tons	17,623	19,139	Japan 16,215; Netherlands 727; United Kingdom 622.
Coke and semicoke—do	455	593	Japan 339; New Caledonia 235; Portugal 19.
Petroleum:			
Crude—thousand 42-gallon barrels	--	1,020	United States 729; Japan 264; Singapore 27.
Partly refined—do	(4)	496	Japan 380; Singapore 116.
Refinery products:			
Gasoline—do	1,304	1,703	Singapore 1,004; New Zealand 581; Papua New Guinea 33.
Jet fuel and kerosine—do	1,041	1,741	New Zealand 757; Singapore 733; Fiji 180.
Distillate fuel oil—do	1,926	3,022	Singapore 1,392; New Zealand 796; Republic of South Africa 329.
Residual fuel oil—do	2,966	1,963	Singapore 859; New Caledonia 740; Fiji 232.
Lubricants—do	672	1,014	New Zealand 335; Republic of South Africa 272; Kenya 156.
Other products—do	r 474	408	New Zealand 344.

r Revised. NA Not available.

[1] Data are for years beginning July 1, unless otherwise specified.

[2] Data given are for years beginning January 1; in the cases of bauxite and alumina, figures are receipts by trading partner countries.

[3] Includes reexports.

[4] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal sources, 1970–71
METALS			
Aluminum metal:			
Scrap	856	566	New Zealand 494; Fiji 32; Canada 31.
Unwrought	1,073	328	United Kingdom 190; United States 81; New Zealand 36.
Semimanufactures	r 3,720	3,480	United States 1,183; United Kingdom 932; West Germany 799.
Antimony metal, all forms	66	27	Japan 14; People's Republic of China 10; United Kingdom 3.
Arsenic trioxide	1,237	1,040	People's Republic of China 335; France 281; Sweden 265.
Bismuth metal, all forms	14	15	United Kingdom 9; Belgium-Luxembourg 4.
Chromium ore and concentrate	10,576	31,529	Philippines 22,845; Iran 8,535; Republic of South Africa 149.
Cobalt and cobalt base alloys	r 99	80	Zambia 31; Congo (Brazzaville) 14; Tanzania 12.
Copper:			
Ore and concentrate	5	39	New Zealand 15; Fiji 9.
Metal and alloys:			
Scrap:			
Unalloyed	1,328	749	New Zealand 509; Papau New Guinea 140; Fiji 34.
Alloyed	1,588	1,659	New Zealand 715; Papua New Guinea 502; Fiji 113.
Unwrought	r 100	145	New Zealand 55; United Kingdom 41; United States 26.
Semimanufactures	r 2,252	3,598	United Kingdom 2,214; Japan 780; United States 255.
Gold:			
Crude bullion, gold content troy ounces	134,015	123,168	Fiji 104,001; Papua New Guinea 19,146.
Refined bullion do	62,229	7,177	Fiji 5,844; Papua New Guinea 1,078; United Kingdom 173.
Iron and steel:			
Ore and concentrate, including roasted pyrite	181	2,393	Philippines 1,897; Republic of South Africa 436.
Scrap	1,556	1,012	New Zealand 889; United States 44.
Ferroalloys:			
Powder:			
Manganese	582	595	Japan 256; France 164; West Germany 163.
Other	492	233	United Kingdom 49; Republic of South Africa 41; United States 39.
Shot:			
Ferrochromium	9,607	10,595	Republic of South Africa 4,932; Finland 4,091; Japan 689.
Ferromanganese	6,116	9,241	Japan 6,017; Republic of South Africa 2,715; Italy 508.
Ferromolybdenum	247	234	United States 149; United Kingdom 38; Sweden 24.
Ferrosilicon	9,277	12,281	United States 5,379; Republic of South Africa 3,425; Canada 1,411.
Ferronickel	2,884	1,914	New Caledonia 1,384; Greece 530.
Other	2,523	4,134	United Kingdom 2,739; Republic of South Africa 683; Japan 414.
Steel, primary forms	16,699	39,367	Japan 38,081; United Kingdom 1,139.
Semimanufactures	346,474	633,312	Japan 499,642; United Kingdom 58,692; United States 18,761.
Lead, metal and alloys, all forms	321	96	New Zealand 47; United Kingdom 16; United States 13.
Magnesium, metal and alloys, all forms	1,602	1,280	United States 912; Norway 325.
Manganese ore and concentrates:			
Battery grade	3,028	996	All from Ghana.
Metallurgical grade	5,213	3,535	People's Republic of China 3,236; Indonesia 125; United States 122.
Mercury 76-pound flasks	1,012	1,283	United States 665; Spain 194; Philippines 100.
Nickel:			
Matte and similar materials	682	1,308	Canada 1,308.
Metal and alloys:			
Unwrought	r 1,512	2,102	Canada 1,895; United Kingdom 171.
Semimanufactures	r 875	1,196	United Kingdom 682; United States 255; Canada 1,458.
Platinum-group metals troy ounces	r 14,769	332,358	West Germany 180,009; United Kingdom 141,517; United States 9,082.
Silicon metal value, thousands	$696	$1,335	Canada $563; France $373; Italy $146.
Silver, crude bullion, silver content troy ounces	r 93,953	68,215	New Zealand 23,317; Fiji 22,643; Papua New Guinea 10,578.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal sources, 1970–71
METALS—Continued			
Tin, metal and alloys, all forms_long tons	r 128	137	Mainly from Malaysia.
Tungsten, metal and alloys, all forms	r 20	18	West Germany 5; United Kingdom 5; United States 4.
Zinc:			
Metal and alloys, all forms	r 154	248	United Kingdom 76; Singapore 76; Japan 34.
NONMETALS			
Abrasives, natural, pumice and tripoli [5]	1,465	1,518	United States 715; New Zealand 505; Italy 104.
Asbestos:			
Chrysotile	46,160	54,303	Canada 53,159.
Amosite	8,405	11,671	Republic of South Africa 7,630; Canada 4,032.
Other	2,669	5,783	Canada 5,615.
Barite and witherite, natural and ground	r 2,194	915	People's Republic of China 503; United States 376.
Boron minerals, crude and concentrates	1,753	1,692	United States 1,676.
Cement, hydraulic	85,220	120,504	Japan 44,370; Okinawa 29,015; Republic of Korea (South) 20,935.
Chalk	8,151	7,887	France 5,949, United Kingdom 1,935.
Clays:			
Bentonite	68,699	74,667	United States 69,474; New Zealand 2,583; Japan 2,032.
White clays, including kaolin	33,686	43,319	United Kingdom 24,745, United States 18,529.
Fire clay and ball clay	23,849	22,152	United Kingdom 11,061, Republic of South Africa 5,204; United States 5,689.
Other	18,772	15,981	United States 7,971, Republic of South Africa 7,604.
Diamond:			
Gem_carats	33,826	49,816	Belgium-Luxembourg 16,552; Israel 12,522; Republic of South Africa 6,936.
Industrial, including dust_do	964,984	743,002	Republic of South Africa 333,306; United States 196,469; Netherlands 134,481.
Diatomite	8,227	6,191	United States 5,636; Mexico 274; Japan 246.
Dolomite	1,037	443	West Germany 352; United States 59.
Feldspar, leucite and nepheline	4,466	5,123	Canada 4,258.
Fertilizer materials:			
Crude:			
Nitrogenous (sodium nitrate)	4,588	3,242	All from Chile.
Phosphatic, phosphate rock thousand tons	2,692	2,107	Nauru 1,151; Christmas Island 610; Gilbert and Ellice Islands 308.
Manufactured:			
Nitrogenous	33,491	19,191	Japan 9,776; France 3,385; West Germany 3,287.
Phosphatic	1,649	3,141	Japan 2,023; Christmas Island 1,118.
Potassic	135,274	155,737	United States 69,533; Canada 62,735; West Germany 15,012.
Mixed and other	25,489	9,000	West Germany 6,396; Italy 1,593; United States 403.
Fluorspar and cryolite:			
Fluorspar	20,183	33,490	Republic of South Africa 19,164; United Kingdom 9,542; People's Republic of China 3,446.
Cryolite, natural and synthetic	269	310	Mainly from Denmark.
Gem stones (except diamond) pearls and and other precious and semiprecious stones_value, thousands	$2,323	$3,705	Australia (reimported) $1,052; Thailand $301; West Germany $277; Hong Kong $214.
Gypsum, crude and calcined	964	1,109	United Kingdom 581; United States 360; West Germany 133.
Graphite, natural	1,504	1,800	Republic of Korea 624; Ceylon 355; People's Republic of China 312.
Kyanite and sillimanite:			
Kyanite	4,430	1,595	India 1,005; United States 548.
Sillimanite	9	10	All from United Kingdom.
Magnesite, crude, calcined and fused	12,829	215	United States 166.
Mica:			
Block and/or sheet	10	8	Mainly from India.
Splittings	70	9	All from India.
Ground and scrap	797	1,040	Republic of South Africa 596; India 273; People's Republic of China 80.
Pigments, mineral, iron oxides	10,303	10,165	West Germany 7,080; United Kingdom 647.
Salt	r 8,316	7,046	United Kingdom 6,665.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal sources, 1970–71
NONMETALS—Continued			
Sand, gravel and stone:			
Sand (except metal bearing)	690	401	United States 220; United Kingdom 98.
Stone:			
Dimension:			
Marble	1,941	7,053	Italy 5,985; Belgium-Luxembourg 1,036.
Slate	90	121	Japan 66; Italy 49.
Other	6,181	2,206	Republic of South Africa 960; Finland 608; Italy 175.
Other:			
Limestone	471,101	596,264	All from Japan.
Quartz and quartzite	785	1,126	Sweden 851; West Germany 108.
Gravel and crushed, n.e.s	10,180	4,042	Italy 3,691.
Sulfur, elemental	434,162	273,332	Canada 190,281; United States 61,022.
Talc and steatite	2,969	8,419	People's Republic of China 6,947; United States 848.
Vermiculite	3,763	3,961	Republic of South Africa 2,801; People's Republic of China 587; United States 501.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,134	1,223	United States 734; Trinidad and Tobago 457.
Carbon black and gas carbon	3,705	3,292	United States 2,754; United Kingdom 405.
Coal, all types, including briquets	10,503	11,042	Republic of South Africa 8,937; United Kingdom 1,291.
Coke and semicoke	88,370	5,773	United States 4,865.
Peat	3,705	4,097	West Germany 3,163; Ireland 613.
Petroleum:			
Crude—thousand 42-gallon barrels	139,363	65,727	Kuwait 21,802; Saudi Arabia 15,557; Iraq 9,858; Indonesia 9,010.
Partly refined—do	6,233	5,116	Singapore 2,077; Kuwait 1,733; Bahrain 658.
Refinery products:			
Gasoline—do	4,149	4,159	Bahrain 1,690; Iran 759; People's Democratic Republic of Yemen 557.
Jet fuel and kerosine—do	1,003	1,221	Singapore 495; Bahrain 373; People's Democratic Republic of Yemen 133.
Distillate fuel oil—do	2,162	3,619	Kuwait 1,013; Singapore 1,008.
Residual fuel oil—do	7,598	10,113	Singapore 4,316; Kuwait 2,139; People's Democratic Republic of Yemen 1,133.
Lubricants—do	256	366	United States 152; Netherlands 135; United Kingdom 65.
Liquefied petroleum gas—do	2	(4)	NA.
Bitumen—do	12	89	United States 70; Singapore 13; United Kingdom 1.
Other—do	2,597	1,761	Indonesia 700; United States 715.

r Revised. NA Not available.
[1] Data are for years beginning July 1.
[2] Includes refined bullion.
[3] Includes emery and natural corundum.
[4] Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—In 1972, Australia produced 14.4 million tons of bauxite, increasing its lead as the world's largest producer. Although the production of bauxite and alumina set new records, the output of refined aluminum declined slightly. The increased production of alumina reflected the commissioning of expanded capacity by Alcoa of Australia Pty. Ltd. at Pinjarra, Western Australia, in May and at Gove, Northern Territory, during July. In August, Alcoa and American Metal Climax Inc. (AMAX) announced that additional contracts had been signed for the supply of alumina to AMAX which will result in further expansion at Alcoa's Pinjarra refinery. The initial agreement was for 400,000 tons of alumina per year starting in early 1975. The further expansion will increase production capacity at Pinjarra to 800,000 tons per year, which can be increased to 900,000 tons when required. This will give Alcoa a total alumina production capacity of 2.2 million tons per year, making it one of the largest alumina producers in the world. Alcoa has supplied AMAX with 200,000 tons of alumina annually from its Kwinana refinery in Western Australia.

The Western Australia Minister for De-

velopment and Decentralization announced in October the approval of a new site for an alumina plant to be constructed by Pacminex, Pty. Ltd. The new site is at Muchea, 30 miles north of Perth, and 16 miles north of the site rejected by the Environmental Protection Authority. In order to offset additional costs in construction of the refinery, estimated at $8 million, the state granted certain concessions to Pacminex. These included waiving of a company contribution toward the cost of a harbor berth and other infrastructure.

Comalco Industries Pty. Ltd. produced 7.3 million tons of bauxite at Weipa and output is being raised to 10.6 million tons annually. Between 30% and 40% of Weipa's output was processed at the Queensland Alumina Ltd. plant at Gladstone in Queensland; most of it was exported to Japan, Europe, and North America and the remainder was shipped to Comalco's alumina plant in Tasmania, with a capacity of about 95,000 tons per year. Comalco also has a 50% interest in an aluminum refinery in New Zealand and is associated with European aluminum producers in the construction of an alumina plant in Sardinia, Italy with a 600,000-ton-per-year capacity. All bauxite for the plant will be supplied from Weipa. The tremendous size of the Weipa bauxite reserves, estimated at about 2.5 billion tons, offers scope for a series of major developments. Construction of the world's largest refinery is being considered by Comalco and a group of international companies. The new alumina plant will be built near the ore body at Weipa. Other companies interested in the project include Alcan Australia, Ltd., Péchiney Group (France), Kobe Steel Ltd. and Mitsubishi Chemical Industries Ltd. (Japan), and Reynolds Metal Co. (United States). The ultimate capacity of the plant has been quoted as high as 4.8 million tons per year.

Another integrated bauxite-alumina-aluminum plant was established by Alcoa of Australia based on bauxite deposits in the Darling Ranges, near Perth, in Western Australia. The next major project to come into operation will be at Gove, Northern Territory, where Nabalco Pty. Ltd. is building an alumina plant with an initial output of 500,000 tons per year, which will be increased to 1 million tons by mid-1973. Australia's bauxite reserves are estimated at 4.5 billion tons, and if current plans come to fruition, capital expenditure of about $3 billion will be needed to provide new mining facilities and to increase alumina and aluminum capacity over the next decade.

Copper.—Growth in the Australian copper industry continued through 1972. The 1972 mine output of approximately 180,000 tons of copper was 2% higher than in the preceding year, and production of primary refined copper was 9.5% more than in 1971. The higher Australian output mainly reflected expanded output at Mount Isa and Mount Lyell, augmented by minor increases in production of copper in lead-zinc ores at Broken Hill and in nickel concentrates from the Kalgoorlie area. Production of blister copper increased only marginally in 1972 to 144,655 tons.

Principal producers and quantities of their output in recent years are summarized in table 4.

During the company year ending June 30, 1972, Mount Isa Mines Ltd. treated 4.10 million tons of copper ores containing 3.0% copper. In view of the world market situation, however, cuts were made in production of silver-lead-zinc ores so that the total throughput of all ores fell to about 6 million tons. Copper ore reserves at Mount Isa were increased by 8 million tons during the year to 141.5 million tons with an estimated average grade of 3.0% copper.

Mount Isa Mining Holdings Ltd. successfully negotiated a $42 million loan with an international banking consortium headed by the Chase Manhattan Bank of New York. The loan will be used in expanding the annual copper production at Mount Isa and Townsville to 155,000 tons by mid-1973.

Mount Lyell Mining and Railway Co. Ltd. continued to expand production at Mount Lyell. Mining of copper ore from the West Lyell open cut ceased in September and production from underground workings of the Prince Lyell mine was increased. Proven ore reserves in mid-1972 were reported at 32.9 million tons assaying 1.5% copper, 3.7 million tons less than on June 30, 1971. Probable ore reserves of 6.0 million tons assaying 1.5% copper showed an increase of 1.4 million tons over 1971. Although the expansion program currently underway was not scheduled for completion until June 1974, approximately 22,000 tons of copper contained in concentrates was produced in 1972.

Table 4.—Australia: Major copper industry facilities

Facility	Production (metric tons of copper [1]) 1969	1970	1971
Mine:			
Mount Isa Mines Ltd	78,229	84,225	122,143
Mount Morgan Ltd	8,139	r 6,971	7,232
Broken Hill Field	3,752	3,644	3,751
Cobar Mines Pty. Ltd	11,351	8,313	6,258
Mount Lyell Mining and Railway Co. Ltd	16,615	16,720	21,227
Electrolytic Zinc Co. of Australasia Ltd	1,790	1,674	2,448
Tennant Creek Field	6,608	5,482	6,254
Rum Jungle Field	140	120	240
Smelters:			
Mount Isa Mines Ltd	80,490	81,663	121,148
Mount Morgan Ltd	8,132	8,034	7,942
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd.[2]	13,689	9,315	11,244
Mount Lyell Mining and Railway Co. Ltd	13,872	13,925	14,203
Refineries:			
Mount Isa Mines Ltd	77,380	80,521	115,987
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd	23,474	21,959	24,639

r Revised.
[1] Metal content of ore for mines; primary blister copper for smelters; and primary electrolytic for refineries.
[2] Treats concentrates from Cobar Mines Pty. Ltd.

Peko-Wallsend Ltd. announced that studies were underway to determine whether the combined output of the Peko, Gecko, and Warrego mines could be treated at the new Warrego concentrator, scheduled to begin operation early in 1973. This followed excellent results from trial batch runs conducted at the Warrego mill which indicated that the plant could operate in excess of its designed capacity of 500,000 tons per year. The year's mine development and drilling activities at the Warrego mine indicated a new gold-copper-bismuth ore shoot which can be mined independent of the main ore body. The ore shoot is reported to contain 200,000 tons of material with an estimated average grade of 20 pennyweight per ton of gold, 2.5% copper, and 0.5% bismuth. Development work at Orlando revealed 100,000 tons of additional ore, with an estimated average grade of 5% copper, 0.7 pennyweight per ton of gold, and 0.10% bismuth.

Cobar Mines Pty. Ltd. extracted and treated 426,260 tons of copper and copper-zinc ores during the year ending June 30, 1972, in comparison with 41,707 tons treated during the preceding year. The average grade of ore mined was 1.9% copper. A total of 25,326 tons of copper concentrate averaging 25.5% copper was produced. The decline in production resulted from a 10-week strike at Cobar Mines and the slow return to full production following the end of the strike. Broken Hill South Ltd. announced in October that an additional copper stope at Cobar Mines was brought into production late in 1972. Installation of a third grinding mill and ancillary equipment was scheduled for early 1973. When the new unit is brought onstream it will bring the concentrator capacity at the CSA mine to 90,000 tons of ore per month.

In South Australia, Kanmantoo Mines Ltd. established a sixth bench at their Kanmantoo open pit operation. Ore extraction proceeded on schedule and the presence of oxidized material in the upper levels which had previously reduced recoveries in the concentrating plant were not encountered in the lower benches.

Gold.—Domestic production of gold increased to about 755,000 ounces in 1972, nearly 12% above the 1971 output. Approximately 46% of the nation's gold production came from Western Australia. The Northern Territory accounted for 34%; Queensland, 10%; Tasmania, 7%; the remaining 3% came from the three remaining states. Most of the increase came during the final 6 month's period as a result of rising prices in world gold markets. Also the Federal Government increased the maximum assistance granted to gold producers under the Gold Subsidy Act to $12 per ounce on January 1, 1972. Granting of the increased subsidy enabled several gold mining companies to continue operating and to defer planned closures.

Gold markets also improved as a result of developments in the United States where the official price, $35 an ounce, was

increased to $38 in mid-December 1971. Subsequently, the free market price also commenced to rise and reached $70 per ounce on August 1, 1972. The effect of high free market prices was particularly noted in the increased production of gold by Peko-Wallsend, the country's leading producer. At Kalgoorlie, both the North Kalgurli (1912) Ltd. and Lakeview and Star Ltd. increased exploration. Proven ore reserves at Gold Mines of Kalgoorlie (Aust.) Ltd. at the end of 1972 were 2,297,000 tons assaying 0.19 ounce gold per ton. The principal gold producers and quantities recovered during 1972 were as follows:

Company	Gold produced (troy ounces)
Central Norseman Gold Corp. N.L.	68,342
Golden Plateau N.L.	16,160
Gold Mines of Kalgoorlie (Aust.) Ltd.	142,670
Hill 50 Gold Mine N.L.	20,257
Lakeview and Star Ltd.	101,244
North Kalgurli (1912) Ltd.	37,410
Peko-Wallsend Ltd.	231,629

According to trade records, Australia in 1972 exported a total of 239,753 ounces of gold in all forms. Of this total, 119,519 ounces was in the form of refined gold and 120,234 ounces was contained in ores, concentrates, blister copper, and other materials.

Iron and Steel.—*Iron Ore.*—The growth trend in the Australian iron and steel industry continued through 1972, but at a much slower rate than in the preceding year. The increase in iron ore production was 3% in 1972 compared with 21% during 1971. The lower production rate in 1972 reflected a reduction in ore output in the Pilbara region because of the reduced overseas demand. Export of iron ore and pellets in 1972 decreased 8% to 31 million tons. In addition to reduced demand, industrial disputes at domestic port sites and delays caused by the strike of Japanese seamen also had an effect on exports.

Japan imported 24 million tons of iron ore from Australia in 1972, worth $270 million which accounted for 43% of total Japanese imports of iron ore. The original contracts called for a minimum 1972 tonnage of 51 million tons. Overly optimistic Japanese production projections upon which the contracts were based, plus the unforeseen slowdown of Japan's economy in recent months, resulted in the inability of the Japanese importing mills to utilize all the ore for which they had contracted.

Perhaps the situation which caused the greatest concern in the iron ore industry during 1972 was the loss of income resulting from the 1971 appreciation of the Australian dollar in reference to the U.S. dollar. The companies' prime problems, however, were that the long-term contracts for the export of iron ore to Japan are based on U.S. dollars. In the past 15 months the U.S. dollar was devalued 23% in terms of the Australian dollar, resulting in a $383 million drop in industry profits. Discussions between Australia's iron ore companies and Japanese steel mills are being held in an effort to increase ore prices.

In 1972 the iron mining industry consisted of 10 principal producers, including the Broken Hill Pty. Co. Ltd. (BHP) group of companies that dominates the production of iron and steel in Australia. In addition, the Western Australia State Cabinet approved an agreement for the development for two new iron ore projects—the 500-million-ton McCamey's Monster deposit and the 1-billion-ton, 61% iron deposit at Rhodes Ridge. The cost of developing McCamey's Monster was estimated at about $2.4 million. This includes mine and port development, a railroad linking mine to port, and associated infrastructures. The Rhodes Ridge iron ore project will be developed by Rhodes Ridge Mining Co. Ltd. and is expected to cost around $3.6 million.

The principal iron ore producers and quantities shipped during the year, were as follows:

Company	Quantity (thousand metric tons)
Goldsworthy Mining Ltd., Western Australia (lump)	6,785
Hamersley Iron Pty. Ltd., Western Australia (lump, pellets)	17,344
Western Mining Corp. Ltd., (WMC), Western Australia (lump)	637
Broken Hill Pty. Co. Ltd., Western Australia (lump)	4,559
Broken Hill Pty. Co. Ltd., South Australia (lump, pellets)	6,379
Savage River Mines, Tasmania (pellets)	2,454
Frances Creek Iron Mining Corp. Ltd., Northern Territory (lump)	685
Mount Newman Iron Ore Co., Western Australia (lump)	22,872

The BHP produced a total of 10,938,553 metric tons of iron ore, and an additional 1,458,484 tons of pellets during 1972. During the previous year, iron ore production of the company was 12,308,430 tons. The 1972 shipments amounted to 8,830,549 tons including 1,240,192 tons of pellets. At the largest mining properties, situated in the Middleback west of Whyalla, iron ore production of BHP totaled 6,379,500 tons. This quantity consisted of 3,248,800 tons produced at the Iron Baron and Iron Prince mines and 3,130,700 tons produced at the Iron Monarch mine at Iron Knob. At Whyalla, 1,458,500 tons of pellets were produced from ore originating at the Iron Prince mine in the fourth full year of operation of the pelletizing facilities. Production totaled 2,952,100 tons at Yampi Sound, in the northern part of Western Australia. The major tonnage comprised 1,849,000 tons from the mine on Koolan Island, and the remaining 1,103,100 tons originated at the mine on Cockatoo Island. Output of iron ore at Koolyanobbing in the southern portion of Western Australia amounted to 1,606,900 tons.

The ore was delivered by BHP principally to its steelworks in Newcastle and Port Kembla, New South Wales; Whyalla, South Australia; and Kwinana, Western Australia. The remainder was exported to Japan.

Mount Newman Iron Ore Co. increased ore production marginally at its Mount Whaleback mine. Production in 1972 was 12.9 tons, compared with 12.3 tons for 1971. Mount Newman is expanding its Pilbara, Western Australia, facilities to increase capacity to a yearly rate of 35 million tons of iron ore by 1974. The company is installing a third secondary crusher and providing more drills and dump trucks at the mine site. It is also adding four new locomotives and more ore cars to the railroad rolling stock and building more homes at Mount Newman and Port Hedland to accommodate the larger work force. Mount Whaleback, the company's prime ore body, contains proven reserves of 1.2 billion tons of high-grade hematite.

Hamersley Iron Pty. Ltd. produced 20.3 million tons at its Mount Tom Price mine in 1972 compared with 19.3 million tons in 1971. The company expects to increase its Western Australian pellet production from 2.6 million to 3.2 million tons per year by May 1974. Proven ore reserves at Mount Tom Price are 166 million tons of 64% iron and 377 million tons of indicated ore containing 64% iron. Hamersley's total reserves are 5.1 billion tons, of which 1.6 billion tons are high-grade hematite, 2 billion tons low-grade hematite, and 1.5 billion tons limonite.

Goldsworthy Mining Ltd. operating the Mount Goldsworthy mine, Areas A and B, located 70 miles east of Port Hedland, is making plans for the mining of Area C, located near the Ophthalmia Range. The iron mineralization is found in the Marramamba formation and is estimated to contain 480 million tons of 62.5% iron. The company is planning to start production in 1976 and will boost production at mining Areas A and B in the same year. Under present plans, total production by Mount Goldsworthy in 1977 will be 20 million tons per year. Some 45% of the planned output will be 6- by 30-millimeter-size ore and the remaining 55% will be below 6-millimeter-size ore.

Pig Iron and Steel.—Virtually all of Australia's primary iron and steel was produced by BHP and its wholly owned subsidiaries, Australian Iron and Steel Pty. Ltd. and Commonwealth Steel Co. Ltd. The consolidated annual reports for periods ending May 31, 1971, and May 31, 1972, summarize output of various products as follows:

Commodity	Quantity (thousand metric tons) 1971	1972
Pig Iron	6,087	6,022
Steel ingots and billets	6,608	6,579
Blooms and slabs	5,668	5,543
Sheets, bars, billets, etc	2,706	2,869
Plate and strip	2,450	2,273
Merchant	1,637	1,518
Rod	482	550
Narrow cold-rolled strip	101	103
Tinplate	304	317

Total pig iron output fell about 3% below that of last year, to 6,022,000 tons, and raw steel production was down 3%, to 6,579,000 tons. A record 2,776,000 tons of pig iron was produced at Port Kembla. The No. 5 blast furnace commenced operating early in March as part of the steel plant expansion to a capacity of 5,500,000 tons of raw steel annually. Both iron and raw steel production at Newcastle, of 1,811,000 and 2,028,000 tons, respectively,

was below the tonnage attained the preceding year. The downturn in market demand late in 1971 led to the shutdown of the 50-ton blast furnace in November. Whyalla operations were seriously affected by the market conditions during the second half of 1972. Iron production dropped to 745,000 tons, 24% less than that of 1971. Continuous operation of the Kwinana blast furnace was made possible by pig iron orders for export, particularly to the People's Republic of China, Japan, and Italy.

Lead and Zinc.—In 1972 the domestic lead and zinc industry began to show signs of recovery from the decline experienced during the preceding year. Although mine production of lead was below the 1971 level, increases were recorded in production of zinc in concentrates, primary refined zinc, and primary refined lead. Exports of lead bullion and refined lead decreased about 7% and 9%, respectively, and the export of zinc concentrates was reduced by 22%.

A doubling of capacity at the Rosebery mine in Tasmania, an increase in the capacity at Risdon, and freedom from industrial disputes was responsible for the improvement in zinc production. The export of zinc concentrates in the first half of 1972 was reduced as a result of temporary closure of the Avonmouth Smelter in the United Kingdom as well as by the Japanese seamens strike. The sharp reduction in exports to the United Kingdom (27,000 tons in the 6 months to June 30, 1972, compared with a total of 153,000 tons in 1971) resulted in the diversion of some concentrate shipments to markets in Finland and the Republic of South Africa. In contrast, shipments of refined zinc to the United States and to the United Kingdom, where closure of several smelters in 1971 created a shortage of refined zinc, was increased. Total shipments of refined zinc in 1972 were more than 50% higher than in 1971. The combined output of refined zinc from Risdon, Cockle Creek, and Port Pirie during 1972 was about 15% higher than the 1971 output.

Mine production at Broken Hill increased sharply above the 1971 level. A feature of the production recorded by the three major mines—Zinc Corp. Ltd., New Broken Hill Consolidated Ltd., and North Broken Hill Ltd., was the greater percentage increase in zinc content than in the lead content of concentrates. In April, Broken Hill South Ltd. announced that its loss on operations from the last half of 1971 had persisted into 1972. A review of all aspects of operations at the South mine showed that the remaining ore does not have the potential for returning the mine to a profitable operation. Subsequently, the South mine was closed in July, after 87 years of operation. The treatment of residue dump material was continued until the end of 1972.

Electrolytic Zinc Co. of Australasia Ltd. (EZ) produced 175,240 tons of slab zinc for the year ending June 30, 1972, an increase of 8% over that of 1971. Part of the zinc output throughout the year was produced under a toll contract for zinc concentrate treatment for another producer. The rate of production rose steadily following the commissioning of the new residue treatment plant and No. 6 cell unit early in the year. Increased output of ore during the year resulted from the additional rock hoisting capacity which became available when the Rosebery No. 2 Main Shaft commenced operation in October 1971. Ore delivered to the concentrating mill was about doubled. The average grade of ore milled in 1972 was 17.4% zinc, 5.8% lead, 0.8% copper, 6.6 ounces silver per ton, and 0.14 ounce gold per ton.

Mount Isa Mines treated 2.0 million tons of silver-lead-zinc ore in the year ending June 30, 1972, yielding 9.1 million ounces of silver, 121,058 tons of lead, and 90,973 tons of zinc, compared with 13.3 million ounces of silver, 130,368 tons of lead, and 88,280 tons of zinc in 1971. Ore reserves of silver-lead-zinc in the Mount Isa and Hilton Mines remained at 56.0 and 35.6 million tons, respectively. Mount Isa Holdings Ltd. commissioned a new $1.4 million mineral dressing pilot plant, a highly flexible unit capable of handling any type of ore at a rate of 1 ton per hour.

The Zinc Corp. Ltd. and New Broken Hill Consolidated Ltd., subsidiaries of New Broken Hill Consolidated Holdings Ltd., operated adjoining lead, zinc, and silver mines at Broken Hill. The Zinc Corp. milled 826,000 tons of lead-zinc-silver ore in 1972 and recovered 87,000 tons of lead and 80,000 tons of zinc in concentrates, compared with 829,000 tons of ore, 79,000 tons of zinc, and 86,000 tons of lead in 1971. New Broken Hill Consolidated milled

1,124,000 tons of ore in 1972 and recovered in concentrates 84,000 tons of lead and 142,000 tons of zinc, compared with 1,096,000 tons of ore, 84,000 tons of lead, and 142,000 tons of zinc in 1971. The marginal increase in total ore production in 1972 was due mainly to the absence of industrial stoppages during the year. The average grades of ore mined at both mines were slightly higher than in 1971.

The principal producing companies and quantites recovered in concentrates and other mine products in recent years were as follows, in metric tons:

Mine	1969		1970		1971	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
North Broken Hill Ltd	71,529	60,568	66,234	48,524	64,837	49,451
Broken Hill South Ltd	24,141	27,501	25,733	29,012	17,791	13,408
The Zinc Corp. Ltd	101,252	81,509	95,245	78,120	86,105	79,152
New Broken Hill Consolidated Ltd	84,671	170,403	81,742	148,374	84,248	142,269
Mount Isa Mines Ltd	150,090	105,682	142,744	92,694	115,987	90,982
Electrolytic Zinc Co. of Australasia Ltd. (Read-Rosebery)	15,144	51,010	14,982	49,872	18,864	64,172

Manganese.—In 1972, mine production of manganese ore increased 15% above that of 1971. Most of the production gain was attributed to a full year of operation by Groote Eylandt Mining Co. Pty. Ltd. (subsidiary of BHP) in the Northern Territory. BHP supplied 80% of the total domestic output. Both production and shipments of manganese ore from Groote Eylandt increased to record levels. The increase in output was made possible by the commissioning of major new production facilities comprising a new ore concentrator, and associated mining, ore handling, and stockpiling facilities. Ancillary facilities including an additional power-generating plant, workshops, stores, housing, and township amenities were also completed. Shipments totaled 889,000 tons, of which 713,000 tons were exported. Japan received about 80% of the exports in 1972 and most of the remainder went to the United States and Europe. Production from the Tasmanian Electro Metallurgical Co. Pty. Ltd. plant at Bell Bay totaled 67,000 tons, made up of 43,000 tons of high carbon ferromanganese and 24,000 tons of silicomanganese.

The mining firm of Hancock and Wright was considering the possibility of setting up a manganese dioxide plant at Bunbury in Western Australia. The firm has a patented process to produce high-grade manganese dioxide and ferric hydroxide. This process would use low-grade manganese ore from the Pilbara region and the iron sulfate in the effluent from the Laporte titanium plant at Bunbury. The company expects to produce battery-grade (70%) manganese dioxide. Initial production from the Ripon Hill deposit in Western Australia is still planned for 1974.

Nickel.—Three companies produced nickel ore in Australia, with the largest mine operated by Western Mining Corp. Ltd. (WMC). In 1972, the Kambalda mines operated by WMC treated 1,074,000 tons of ore and produced 274,000 tons of concentrate containing 35,781 tons of nickel. Improvements in milling practice resulted in an increase in the grade of concentrates from 11.5% to cover 13% nickel towards the end of the year. Ore reserves, as of June 1972, were estimated at 22.3 million tons averaging 3.29% nickel. This represents a net increase of some 1.7 million tons for the year after allowing for production of approximately 1 million tons. Construction of the Kalgoorlie nickel smelter continued on schedule. The smelter is due to be commissioned early in 1973, with an initial input capacity of 200,000 tons of concentrate per year.

Great Boulder Mines Ltd. (in a joint venture with North Kalgurli) produced 136,000 tons of nickel ore from its Scotia mine in Western Australia. These concentrates containing 2,688 tons of nickel were sold to WMC. Development work at the Carr Boyd mine 50 miles north of Kalgoorlie continued. A special lot of 7,500 tons of ore was treated and the concentrates were sold, but full-scale production from the mine will depend on sale contracts being obtained.

Selcast Exploration Ltd.'s feasibility study on its nickel deposit at Agnew in Western Australia will be completed about mid-1973. Among other things, the study also includes the possibility of building a

refinery. Recent exploration results by Selcast indicate that the Agnew is the largest single deposit of medium to high-grade nickel ore known in Australia. Ore reserves have been more than doubled to 33 million tons averaging 2% nickel. Drilling continued, and samples were being sent to the United States and Europe for metallurgical testing. Reserves are sufficient to justify a mining operation but no decision will be made until the feasibility study has been completed.

During 1972, Poseidon N.L. signed an agreement for the sale of its total output of nickel concentrate from the Mount Windara mine, for a period of 5 years commencing in 1974. The agreement is the first made by a Western Australia nickel producer in 2 years. Under terms of the agreement signed with WMC and Sherritt Gordon Mines Ltd., each company will purchase half of the projected output of 11,000 tons of contained nickel per year from the mine. Ore production will be at the rate of 700,000 tons per year, which will be treated at a mill to be erected at Mount Windara. Concentrates will be transported to the WMC smelter near Kalgoorlie. Reserves at Mount Windara and the adjoining South Windara deposits are estimated at 8.9 million tons averaging 1.81% nickel. At the proposed rate of mining, these reserves are sufficient to ensure a life of 13 years for the mine.

Development work on the Greenvale open pit lateritic deposit by Metals Exploration N.L. and Freeport Sulphur Co. continued on schedule. Greenvale's main ore body of high-grade nickel laterite is situated 140 miles west of Townsville on the coast in Northern Queensland. Ore reserves of 40 million tons average 1.5% nickel and 0.12% cobalt. The major output will be exported to countries throughout Western Europe when it reaches production late in 1974. All contracts have been written for the life of the mine, which is expected to last more than 20 years.

Silver.—In 1972, mine production of silver recovered as a coproduct or byproduct of lead-copper, and zinc ores decreased slightly from 21.8 to 21.4 million ounces. The decline was mainly due to a slowdown in production at Mount Isa, where silver-lead-zinc ore treated decreased about 106,000 tons. Higher production rates by the three major silver producers failed to offset the decline at Mount Isa. According to data compiled for 1971. Queensland and New South Wales each accounted for 45% of the total Australian output of silver, Tasmania contributed 9%, and two other states accounted for the remaining 1%. About 86% of the silver output was recovered in lead-silver bullion from smelting lead concentrates. Zinc and copper concentrates contained 8% and 5%, respectively, and other mine products (including gold bullion) 1% of the total. Principal producers of silver and their output during 1970 and 1971 were as follows:

Company	Quantity (thousand troy ounces) 1970	1971
North Broken Hill Ltd	2,334	3,394
Broken Hill South Ltd	1,269	1,122
Zinc Corp. Ltd	1,935	2,122
New Broken Hill Consolidated Ltd.	1,276	1,993
Mount Isa Mines Ltd	13,880	8,224
Electrolytic Zinc Co. of Australasia Ltd	906	1,560

Australian refineries reported production of 8,354,000 ounces of silver in 1972, compared with 8,429,000 ounces the preceding year. In 1972, Broken Hill Associated Smelters Pty. Ltd. at Port Pirie recovered 7.2 million ounces of silver from lead concentrates produced by Broken Hill mines. The copper refinery of the Electrolytic Refining and Smelting Co. of Australia at Port Kembla produced about 0.7 million ounces of silver in 1972. The silver was contained in copper concentrates from Cobar and Mount Lyell and in slimes from the electrolytic copper refinery at Townsville. The Royal Mint in Perth produced 0.3 million ounces of refined silver in 1972, about one-third of which was derived from bullion of domestic origin. The remainder was derived from jewelry and bullion of overseas origin.

Exports of silver in lead bullion and concentrates, and all other products in 1971 were about 8.6 million ounces.

Tin.—Australian tin production, continuing the rising trend since 1963, increased sharply to 11,800 long tons in 1972, the greatest annual output since 1907. The spectacular increase in Australian tin production is a direct result of long-term expansion programs undertaken by the three major hard-rock producers, Renison Ltd. and Cleveland Tin N.L. in Tasmania and Ardlethan Tin N.L. in New South

Wales. Output from these mines increased progressively throughout 1972, and by the latter part of the year, combined production had been increased to an annual rate of 8,800 tons. Australia's other significant tin producers include Aberfoyle Tin Co. N.L. (Tasmania), Gibsonvale Alluvials N.L. (New South Wales), Greenbushes Tin N.L. (Western Australia), and Ravenshoe Tin Dredging Ltd. and Tableland Tin Dredging N.L. located in Queensland.

Renison, the largest producer, increased its ore reserves to 7.1 million long tons with an estimated tin content of 1.5%. Aberfoyle, Ardlethan, and Cleveland collectively reported a mid-year total of 7.8 million tons of ore reserves. The input capacity of Associated Tin Smelting Pty. Ltd. smelter at Alexandria, New South Wales, was increased by 50% to 15,000 long tons of concentrates. The expansion was part of a 5-year plan to keep pace with increasing mine production and to produce more metal within the country. In addition, about 900 tons of secondary tin was recovered from the treatment of tinplate scrap by M & T Chemicals (Australia) Pty. Ltd., Unanderra, New South Wales, and Albert G. Sims, Melbourne, Victoria. Principal producers of tin concentrates and quantities of contained tin produced in 1970 and 1971 were as follows:

Company	Quantity (long tons) 1970	1971
Aberfoyle Tin Co. N.L.	433	480
Ardlethan Tin N.L.	1,022	1,318
Cleveland Tin N.L.	1,580	1,814
Cooglegong Tin Pty. Ltd	72	98
Gibsonvale Alluvials N.L.	212	394
Greenbushes Tin N.L.	240	317
J. A. Johnson & Sons Pty. Ltd.	76	80
Pilbara Tin Pty. Ltd.	226	256
Ravenshoe Tin Dredging Ltd.	438	465
Rension Ltd.	4,723	5,231
Storeys Creek Tin Mining Co. N.L.	104	120
Tableland Tin Dredging N.L.	387	452
Tullabong Tin Ltd.	222	238

Domestic consumption of primary tin, mainly for the manufacture of tinplate, amounted to about 32,500 long tons. Exports of tin in 1972 included 2,122 tons of refined metal and 4,531 tons in concentrates.

Titanium Concentrates.—The market for titanium minerals, particularly rutile, was rather weak throughout the year, with a firming trend noticeable near yearend. Production of rutile declined to 317,424 tons in 1972, from 374,705 tons in 1971. Ilmenite concentrate production decreased to 708,808 tons, compared with 800,945 tons in 1971. Byproduct zircon production decreased to 360,192 tons compared with 412,947 tons in 1971. Moderate demand for the concentrates and revaluation of both the Australian and U.S. currencies combined to make 1972 a year of lower profits and two actual failures.

Litigation concerning the Eneabba claims continued during the year. It seemed clear, however, that in any case Allied Minerals N.L. would control enough of the deposit to proceed with development. About midyear, the 55% interest which had been held by A. V. Jennings Industries (Australia) Ltd. was relinquished; Allied Minerals, backed by Westralian Oil N.L., sought a new partner, which shortly was announced as Du Pont (Australia) Ltd. Du Pont's initial investment was $2.22 million, plus the cost of a pilot plant operation, in return for a 25% interest in the joint venture.

The plant of Coastal Rutile Ltd. of Queensland was purchased from the receiver for $144,000, was moved to Eneabba, and was reerected. Its capacity there will be 7,000 tons of rutile and 28,000 tons of ilmenite annually. If the operation is successful, six additional units of similar capacity will be erected. No metallurgical difficulties are foreseen, except that the heavy minerals are coated with a siliceous clay.

At yearend the new venture was christened Allied Eneabba Pty. Ltd. E. I. du Pont de Nemours & Co. Inc., contracted for delivery of 200,000 tons of ilmenite per year to its chloride-process pigment plants.

In addition to Coastal Rutile, Naracoopa Rutile Ltd. was also placed in receivership, and its rutile-zircon operations on King Island, Tasmania, sold to Buka Minerals Ltd. The new management expects to begin operations early in 1973 at a rate of 10,000 tons of rutile and 5,000 tons of zircon per year. Operations were also suspended at the Matthew Flinders rutile-zircon operation near Yamba, New South Wales, by the Dillingham Mining Co.

A joint venture of Mining Corp. of Australia and Kamilaroi Mines Ltd. is drilling sands at Jurien Bay, near Eneabba, to delineate a rutile-zircon-ilmenite body. Late in the year it was announced that enough reserves had been measured to support an-

nual production of up to 25,000 tons of rutile, 30,000 tons of zircon, and 130,000 tons of ilmenite.

Cudgen R.Z. and its subsidiary, Consolidated Rutile, are considering integration of operations and of financial arrangements. Such a merger would make the resulting company Australia's third largest producer of rutile and zircon.

Interest in processes to convert ilmenite to rutile remained high. Western Titanium N.L. was reportedly proceeding with construction of a $7.30-million plant at Bunbury, Western Australia, which will have initial capacity of 30,000 tons per year. Target date for full operation is late in 1974 or early in 1975. Expansion to a 100,000 ton-per-year capacity is contemplated. Western Titanium continued shipping products from its pilot plant during the year.

NONMETALS

Phosphate Rock.—Australia's production of phosphate rock remained negligible compared with domestic requirements. In 1972 domestic production of 10,000 tons was again confined to South Australia. Broken Hill South was making plans to start production from a deposit in Northwest Queensland in the late 1970's. If this operation goes ahead as planned, Australia could become self-sufficient in phosphate.

A number of companies were active in the search for phosphate in Queensland, including the International Minerals and Chemical Development Corp. of the U.S., Continental Oil Co. of Australia Ltd., and Mobil Oil. International Minerals and Chemical tested a deposit at Yelvertoft, Queensland, containing 500 million tons of medium grade ore. The most accessible deposits were discovered at Cooktown on the eastern coast of Cape York Peninsula.

Imports of phosphate rock were 2.6 million tons, most of which came from Nauru and Ocean Islands in the Pacific, Christmas Island in the Indian Ocean, and to a lesser extent, from the United States and Africa.

Salt.—An increase in salt production took place in 1972, as production was recorded from a number of recently established solar evaporation plants in Western Australia. Australia's salt industry produced around 4 million tons in 1972. All domestic salt production came from solar evaporating pans and dry-salt lakes.

Western Australia with an estimated production of about 2.2 million tons remained the chief source of supply in 1972. The combined production of Dampier Salt Ltd. and Leslie Salt Co. accounted for about two-thirds of the total Western Australian output. Capacity of Dampier company's 28,000-acre solar saltfield at Dampier is now estimated at 3.5 million tons per year. The original capacity of the Dampier operation was 850,000 tons per year when the project came onstream in 1971. The increased capacity was mainly due to four factors: (1) The salt content of sea water entering the field was 12% higher than expected; (2) a higher rate of water evaporation; (3) improved operating techniques in the salt-washing plant; and (4) the loss of saturated brine through the floor of the field was less than expected. Leslie Salt achieved full production capacity and shipped in excess of 1.0 million tons in 1972. Within the next 2 to 3 years, shipments will exceed 2.0 million tons per year. Small production rates were reported by Lefroy Salt Pty. Ltd., Ferada Mines Pty. Ltd., and Shark Bay Gypsum Pty. Ltd.

South Australia remained the second largest salt-producing state. The principal producer, Imperial Chemical Industries of Australia and New Zealand Ltd. (I.C.I.A.N.Z.) reported that salt production at the company's saltfields at Dry Creek amounted to 450,000 tons in 1972. At Whyalla, South Australia, BHP reported that production of salt by solar evaporation amounted to 70,000 tons. Other principal producing centers were Price, Stenhouse Bay, Lake Fowler, and Lake MacDonnell. The bulk of Queensland's 1972 production was from Central Queensland Salt Industries Ltd. and I.C.I.A.N.Z. (250,000 tons), both at Bajoal near Rockhampton. The principal salt producer in Victoria was Cheetham Salt Ltd. which operates solar evaporating pans near Laverton on Port Phillip Bay and at Lara and Geelong on Corio Bay.

Apparent domestic consumption of Salt by manufacturers of industrial chemicals and by refineries was estimated at 1.2 million tons in 1970 and 2 million tons in 1971.

Sulfur.—Imports of elemental sulfur, principally from Canada and the United

States, declined for the fourth consecutive year, from the record high level of 557,340 tons in 1968 to about 250,000 tons in 1972. Imports totaled 320,151 tons in 1970 and 264,286 tons in 1971. Although there are no known commercial deposits of native sulfur, three oil companies operate sulfur recovery units with a combined capacity of 70 tons of elemental sulfur per day. A small quantity is also recovered from indigenous pyrite and base metal sulfide ores.

In 1972 there were four companies in Australia that produced pyrites for use in the manufacture of sulfuric acid: Mount Lyell, in Tasmania (obtained as a byproduct of base metal operations); Nairne Pyrites in South Australia (obtained by direct pyrites mining); Gold Mines of Kalgoorlie in Western Australia (byproduct of gold mining); and Electrolytic Zinc Co. of Australasia, Ltd. (EZ) in Tasmania. EZ produced 51,558 tons of sulfur in 1972 compared with 18,193 tons in 1971. The quantity of sulfuric acid produced by EZ in 1972 was 223,219 tons. Total production of pyrites in 1972 was about 260,000 tons.

A large quantity of sulfur was contained in base-metal concentrates, particularly zinc concentrates exported from Australia. In 1971 the sulfur content of zinc concentrates exported was about 170,000 tons, of which 140,000 tons was recoverable.

Australian plants produced 1,673,000 tons of sulfuric acid in 1972, compared with 1,575,000 tons in the preceding year. Of the 1972 total, about 63% was made from elemental sulfur, 10% from pyrites, 25% from zinc and lead concentrates, and the remaining 2% from other materials.

Domestic consumption of sulfuric acid in 1971 totaled 1,600,000 tons, of which 73% was used in the manufacture of superphosphate fertilizers, 3% in ammonium sulfate, 21% in general chemicals, and the remaining 3% in mining and metallurgy.

MINERAL FUELS

Coal.—*Black Coal.*—The spectacular growth of Australia's coal industry continued through 1972 as output reached a record high of about 83.3 million tons, 16 more than in 1971. Production of black coal in New South Wales and Queensland during 1972 increased by 18% to 52 million tons compared with output of 44 million tons for 1971. Output from New South Wales increased by 14% to 39 million tons, the result of a 5% increase in production from underground mines and a 149% increase in open cut output. Production in Queensland increased by 18%, to 13 million tons, from 11 million tons in 1971. The major part of the increase in Queensland output resulted from the Goonyella open cut mine which commenced production in mid-1971. The two states accounted for 90% of the total black coal production. Mines in South Australia, Western Australia, and Tasmania produced a total of 6.7 million tons, most of which was consumed locally. There were 84 mines in New South Wales on December 30, 1972, as compared with 88 mines on December 30, 1971, with a total employment of 14,733. Over 99.9% of all coal recovered from New South Wales Underground mines was mechanically loaded.

Utah Development Co. announced in June on behalf of Central Queensland Coal Associates (85% Utah Development Co. and 15% Mitsubishi Development Pty. Ltd.) that new long-term contracts had been concluded with Japanese, French, the Netherlands, British, and Italian buyers for the sale of major quantities of coking coal over a 10-year period. Large-scale deliveries are to begin in 1974. Total deliveries under these contracts range from a minimum of approximately 34 million tons to a maximum of 52 million tons. The annual delivery levels will depend on future price agreement for optional tonnages. Part of the coal required will be produced from the new Peak Downs mine and the remainder will be supplied from a new mine to be brought into operation in 1974 at Saraji, located near the existing Peak Downs mine. The total cost of the Saraji mine is estimated at $140 million, thus making the total investment by Utah Development and Mitsubishi Development in the Bowen Basin in excess of $350 million. The development of the Saraji mine will result in an extension of port facilities at Hay Point, an additional railway line connecting to the existing Peak Downs line, and a new town. Shipments of Saraji coal are reportedly planned at 3.5 million tons in the first year of operation and between 4 and 5 million tons per year thereafter.

It was announced in August by Thiess-Peabody-Mitsui Coal Pty. Ltd. that exploration in the Nebo area, Queensland, has shown that measured reserves of both steam and coking coal to a depth of 1,000

feet was greater than 1,000 million tons. Studies have been carried out on the feasibility of developing three mines at an estimated cost of $250 million in the area.

Black coal reserves are estimated at around 25.1 billion metric tons, consisting of approximately 12.2 billion tons in Queensland; 12.1 billion tons in New South Wales; and the remaining 0.8 billion tons in Victoria, Tasmania, South Australia, and Western Australia. About 15.7 billion tons of the reserves consist of coking coal. The Joint Coal Board reported output in leading producing states as follows:

Table 5.—Production of black coal

(Thousand metric tons)

State	1969	1970	1971
Queensland	8,635	9,964	16,086
New South Wales	33,973	35,433	36,380
Tasmania	117	112	140
South Australia	2,245	1,827	3,025
Western Australia	1,107	1,198	3,052
Total	46,077	48,534	58,683

Domestic consumption of black coal in recent years was as follows:

Industry	Quantity (thousand metric tons)		
	1969	1970 r	1971
Iron and steel	7,782	7,956	7,533
Electricity	12,578	12,512	13,677
Railways	370	130	74
Town gas	702	384	246
Cement	899	790	779
Metallurgical coke	493	541	433
Other (including bunkers)	2,469	2,261	2,356
Total	25,293	24,574	25,098

r Revised.

Brown Coal (Lignite).—Production of brown coal in 1972 increased by 1% over that of 1971, to 23.7 million tons. Victoria was the only state in Australia where brown coal was produced. Substantial deposits are known in South Australia but are regarded as uneconomical under current conditions. The major deposits in Victoria are in the Latrobe Valley, 40 to 80 miles southeast of Melbourne, where operations of the State Electricity Commission (SEC) at Yallourn and Morwell were responsible for about 98% of the state's total production. Smaller quantities were produced from privately owned mines at Anglesea and Bacchus Marsh.

Alcoa operated the open cut mine at Anglesea, 60 miles southwest of Melbourne to provide fuel for its powerstation. Most of the electricity required by the Point Henry aluminum smelter is supplied from the powerstation. Maddingley Brown Coal Co. conducted the coal mining operations at Bacchus Marsh.

Because brown coal deteriorates rapidly and is subject to spontaneous combustion under stockpile conditions, virtually the entire mine production was consumed locally. The use pattern showed that 75% of the total was used to generate electric power, 20% to manufacture briquets (one-fourth of which was used in power generation), and about 5% as factory fuel.

The Yallourn Briquette Works produced about 260,000 tons of briquets from 1,085,000 tons of raw coal from the Yallourn open cut mine. Output from the Morwell briquet works was 1,283,300 tons from 3,390,000 tons of coal supplied from the Yallourn mine.

Petroleum and Natural Gas.—Domestic production of crude oil and natural gas continued to rise in 1972 along with an increase in demand. Crude oil production totaled 120 million barrels in 1972 (327,000 barrels per day), which was 6% above the 1971 output. The quantity of natural gas sold to consumers in 1972 was 113 billion cubic feet, an increase of 30% compared with that of 1971. The increased production of oil and gas was due mainly to the expanded output from the Gippsland Basin fields by BHP and Esso Exploration and Production. A full year of operation at the Kingfish field in the Bass Strait was also a contributing factor to the increased natural gas production. The total crude oil production by Esso-BHP from the Gippsland Basin fields amounted to 107 million barrels, an average production rate of 292,000 barrels per day. Of this production, 2 million barrels were produced from the Barracouta field, 57 million barrels from Halibut, and 47 million barrels from Kingfish.

Oil was also produced at the Barrow Island field in Western Australia by Western Australian Petroleum Pty. Ltd. (WAPET). The average rate of crude oil produced throughout the year was approximately 44,000 barrels per day, down slightly from 1971. A steady decline in production rate is expected to occur over the remaining life of the field. In Queensland, two oil-

fields, Moonie and Alton, produced a combined total of 2,300 barrels daily.

In addition to oil output, gas was produced at the Barracouta and Marlin fields in Victoria, the Barrow and Dangara fields in Western Australia, the Roma district, Queensland, and the Gidgealpa and Moomba fields in South Australia.

The current national reserves of crude oil as of December 31, 1972, were estimated at 1,550 million barrels compared with 1,850 million barrels at yearend 1971. National gas reserves stood at 37,700 billion cubic feet on December 31, 1972, more than twice the 13,800 billion cubic feet reported at yearend 1971.

Expenditures on petroleum exploration, development, and production in 1971 totaled $163 million. Private enterprise contributed $155 million, and Commonwealth and State Governments $8 million. Western Australia and Victoria used 21% and 18%, respectively, of the total private expenditure on offshore exploratory development. The footage drilled for petroleum exploration in 1972 was 971,387 feet, approximately 28% above the 1971 figure. The most significant features of the increase were as follows: A 45% increase in drilling in Western Australia; a 40% increase in South Australia; and a 741% increase in Tasmania. The distribution between onshore and offshore categories varied slightly with offshore drilling accounting for 466,025 feet (48%) in 1972 compared with 348,796 (46%) in 1971.

Despite a 2.9% decline in sales of fuel oil in 1971–72, the first decrease recorded since 1957–58, total consumption of petroleum products rose 4.9% compared with 3.5% in the previous year. The percentage increases in sales of motor spirit, heating oil, automotive distillate, industrial diesel fuel and liquefied petroleum gas were all higher in 1971–72 than in the preceding year. In contrast to a rise of 3.4% in 1970–71, refinery production of petroleum products increased only 2.3% in 1971–72. The percentage increase was significantly higher in motor spirit, aviation turbine fuel, heating oil, and solvents. Offsetting this, however, was a sharp drop in fuel oil production.

Exports of petroleum in 1972 were valued around $59.2 million, according to figures compiled from preliminary statistics made available by the Commonwealth Bureau of Census and Statistics. In 1971, the value of cargo exports was $55.3 million. The most valuable product exported was mineral lubricating oil, 1.1 million barrels valued at $11.9 million in 1971 compared with 956,000 barrels valued at $10.1 in the previous year. Other main products exported in 1971 were crude oil (4.3 million barrels valued at $8.6 million); motor spirit (1.5 million barrels valued at $6.5 million); automotive distillate (2.8 million barrels valued at $9.1 million); aviation turbine fuel (1.9 million barrels valued at $7.3 million); and fuel oil (1.2 million barrels valued at $2.5 million). The main destinations of exports in 1972 were Singapore, New Zealand, Japan, and the Pacific Islands.

The Mineral Industry of Austria

By Grace N. Broderick [1]

During 1972 Austria produced aluminum, antimony, copper, iron and steel, lead and zinc, cement, graphite, illite, kaolin, magnesite, salt, coal, crude oil, natural gas, and a number of other mineral commodities. Production of these items, except for magnesite and graphite, was not significant by world standards, and imports of crude minerals and fuels were essential to sustain the industrial economy.

The Austrian economy in 1972 continued to grow vigorously. Gross national product (GNP), according to estimates of the Austrian Institute of Economic Research, was 5.6% higher, at constant prices, than that of the previous year. Only a small part of the GNP was contributed by the mineral economy. Large contributors to the economic growth were industrial production, the building industry, and tourism.

In the latter part of December, the Austrian Parliament passed the "Federal Law for the Safeguarding of the Continuation of Coal Mines, as well as of Copper Mines, Lead Mines, Tin Mines and Antimony Mines, and for the Coverage of Expenses for the Shutting-Down of such Mining Operations (1973 Law for the Promotion of Mining Operations)." The law, effective January 1, 1973, for a period of 5 years, concerns conditions under which financial assistance may be granted from budgetary funds earmarked for the promotion or shutdown of mining operations. In general, the new legislation differs but slightly from the 1968 Law for the Promotion of Mining Operations, which expired at the end of 1972. One change worthy of note, however, is that whereas the 1968 law provided for credits only, the new legislation stipulates that assistance may be granted also in the form of financial grants.

[1] Physical scientist, Division of Ferrous Metals.

Table 1.—Austria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Alumina (abrasive grade), gross weight	27,537	27,226	26,257
Metal:			
Primary	90,004	90,698	83,989
Secondary	32,202	59,353	119,382
Antimony:			
Mine output, metal content	610	461	535
Antimony sulfide	749	661	NA
Cadmium metal	22	25	26
Copper:			
Mine output, metal content of ore	2,262	2,649	2,303
Metal, refined including secondary	22,504	21,295	22,693
Germanium, metal content of concentrate kilograms	6,800	5,000	e 5,000
Iron and steel:			
Iron ore and concentrate, gross weight-thousand tons	3,997	4,171	4,132
Pig iron do	2,964	2,849	2,846
Ferroalloys (electric furnace) do	6	5	5
Crude steel	4,079	3,960	4,070
Semimanufactures do	3,025	3,054	r 3,055
Lead:			
Mine output, metal content of ore	6,003	7,715	6,668
Metal:			
Primary	8,743	9,314	9,777
Secondary	6,858	5,881	6,505
Manganese, Mn content of domestic iron ore	81,074	83,415	80,198
Silver metal, including secondary troy ounces	175,864	219,911	192,904

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Tungsten, metal content of:			
Crude ore	125	57	--
Concentrate	85	45	--
Zinc:			
Mine output, metal content of ore	15,707	21,073	20,480
Metal, refined	16,018	15,969	16,877
NONMETALS			
Barite	315	789	202
Cement, hydraulic thousand tons	4,806	5,491	6,345
Clays:			
Illite	263,058	248,785	291,538
Kaolin:			
Crude	339,844	302,334	329,336
Marketable	98,332	92,165	e 98,000
Other	74,888	80,592	153,500
Diatomite	3,772	3,084	2,453
Feldspar	1,206	2,656	3,076
Graphite, crude	27,733	21,392	18,772
Gypsum and anhydrite, crude thousand tons	628	594	760
Lime do	741	672	798
Magnesite:			
Crude do	1,609	1,556	1,429
Sintered or dead-burned do	546	508	451
Caustic calcined do	180	191	180
Pigments, mineral (iron mica)	7,734	7,969	8,194
Pumice (trass)	19,866	32,237	28,518
Salt:			
Rock	940	1,036	694
In brine:			
Evaporated thousand tons	265	252	256
Other do	225	223	e 244
Total do	490	475	e 500
Sand and gravel:			
Industrial sand do	217	328	NA
Other sand and gravel do	4,367	5,926	NA
Stone: [2]			
Dimension stone do	84	110	NA
Quartz and quartzite do	86	98	102
Other quarry stone and broken stone do	2,061	1,944	NA
Sulfur:			
Byproduct, recovered, elemental do	3	3	e 3
Content of gypsum and anhydrite used for sulfur raw materials do	44	19	e 20
Other, including recoverable content of nonferrous sulfide ores and of spent do	10	13	e 15
Total do	57	35	e 38
Talc and soapstone	100,159	91,621	83,212
MINERAL FUELS AND RELATED MATERIALS			
Coal, brown coal and lignite thousand tons	3,670	3,770	3,756
Coke:			
Breeze do	1,768	1,638	411
Metallurgical do			1,255
Gas:			
Manufactured, all types [3] million cubic feet	76,067	81,082	NA
Natural:			
Gross do	67,007	66,790	69,327
Marketed do	66,992	64,293	65,459
Petroleum:			
Oil shale	520	490	380
Crude oil thousand 42-gallon barrels	19,515	17,546	17,281
Refinery products:			
Gasoline, aviation and motor do	8,487	11,697	12,255
Jet fuel do	646	777	905
Kerosine do	194	62	60
Distillate fuel oil do	11,437	12,534	15,044
Residual fuel oil do	17,316	22,768	22,911
Lubricants do	2,128	1,935	1,818
Liquefied petroleum gas do	1,227	1,026	1,200
Bitumen do	1,619	1,674	1,959
Other do	1,819	2,490	3,438
Refinery fuel and losses do	638	1,240	1,419
Total do	45,511	56,203	61,009

e Estimate. p Preliminary. NA Not available.

[1] Excludes finished steel castings.

[2] Excluding stone used by the cement and iron and steel industries.

[3] Includes blast furnace and coke oven gas. Manufactured gas is reported in source as gas having a calorific value of 4,200 calories per cubic meter. (One cubic meter equals 35.3145 cubic feet).

Table 2.—Austria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide and hydroxide (including manufactured corundum)	21,961	22,141	Poland 6,302; West Germany 4,197; United Kingdom 2,064.
Metal, including alloys:			
Scrap	7,154	11,083	West Germany 5,048; Italy 3,868; Czechoslovakia 2,135.
Unwrought	18,843	27,141	West Germany 19,171; Turkey 2,074; Yugoslavia 1,794.
Semimanufactures	33,405	28,083	United Kingdom 5,343; Portugal 2,119; Yugoslavia 1,246; West Germany 1,090.
Antimony ore and concentrate	140	234	West Germany 212; Argentina 5; Syrian Arab Republic 5.
Cadmium metal, including alloys, all forms kilograms	200	500	All to Romania.
Chromium:			
Chromite	94	39	NA.
Oxide kilograms	800	500	NA.
Columbium and tantalum:			
Tantalum metal, including alloys, all forms kilograms	6,100	31,300	West Germany 26,500; United Kingdom 1,600.
Copper:			
Ore and concentrate	1,977	3,476	All to East Germany.
Copper sulfate	1,080	1,120	All to Italy.
Metal, including alloys, all forms:			
Scrap	1,074	299	West Germany 169; Italy 58.
Unwrought	6,525	6,710	West Germany 5,509; Switzerland 1,074.
Semimanufactures	11,148	10,550	Sweden 1,486; Switzerland 1,295; Bulgaria 1,205; United Kingdom 1,036.
Gold metal, unworked or partly worked troy ounces	17,876	20,384	Italy 11,285; West Germany 7,845.
Iron and steel:			
Ore and concentrate, except roasted pyrite	641	600	All to Belgium-Luxembourg.
Metal:			
Scrap	6,309	4,498	Switzerland 3,352; West Germany 608; Italy 225.
Pig iron, ferroalloys, and similar materials thousand tons	31	16	Italy 12; West Germany 1.
Steel:			
Primary forms do	371	393	West Germany 367; United Kingdom 10; East Germany 8.
Semimanufactures:			
Bars, rods, angles, shapes and sections do	226	201	Switzerland 39; West Germany 32; Italy 32.
Universals, plates and sheets do	508	563	West Germany 196; U.S.S.R. 103; Italy 46.
Hoop and strip do	81	79	Switzerland 28; West Germany 14; Italy 6.
Rails and accessories do	40	34	Switzerland 24; Greece 3; Bulgaria 2.
Wire do	58	54	West Germany 13; Switzerland 12; Hungary 9.
Tubes, pipes and fittings do	85	91	Sweden 19; United Kingdom 16; Switzerland 15.
Castings and forgings, rough do	7	7	Switzerland 4; West Germany 1.
Lead:			
Oxide	1,427	1,259	Czechoslovakia 1,020; Yugoslavia 238.
Metal, including alloys, all forms	2,435	3,836	Yugoslavia 2,152; Italy 1,469.
Magnesium metal, including alloys, all forms	2,879	440	West Germany 285; Italy 133.
Manganese oxide	361	359	Brazil 277; Denmark 50; West Germany 30.
Mercury 76-pound flasks	273	265	West Germany 177; France 29.
Molybdenum metal, including alloys, all forms	491	441	West Germany 221; United Kingdom 93; France 37.
Nickel metal, including alloys, all forms	487	399	West Germany 262; Yugoslavia 25.
Platinum-group metals and silver metal, including alloys, all forms:			
Platinum group troy ounces	16,365	10,127	West Germany 6,269; Bulgaria 1,157; Romania 836.
Silver:			
Bullion thousand troy ounces	161	145	All to West Germany.
Other (powder) do	51	42	Do.
Semimanufactures do	296	145	Yugoslavia 129; Bulgaria 6.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Tin:			
Oxide—long tons	69	55	Poland 39; Czechoslovakia 10; Portugal 3.
Metal, including alloys, all forms—do	77	12	Denmark 5; Switzerland 2; Venezuela 2.
Titanium oxide	(1)	(1)	NA.
Tungsten:			
Ore and concentrate	172	100	All to West Germany.
Metal, including alloys, all forms	93	126	West Germany 89; Italy 5; Poland 4.
Zinc:			
Ore and concentrate	r 1,198	280	All to Italy.
Oxide	76	1	NA.
Metal, including alloys, all forms	1,035	803	West Germany 697. Switzerland 48.
Other:			
Ore and concentrate	81	71	All to West Germany.
Ash and residue containing nonferrous metals	23,577	35,161	Italy 19,847; West Germany 10,864; Yugoslavia 2,408.
Waste and sweepings of precious metals—kilograms	25,826	25,138	West Germany 24,856; France 268.
Oxides, hydroxides and peroxides of metals, n.e.s	74	186	Czechoslovakia 111; Sweden 26; West Germany 21.
Base metals, including alloys, all forms n.e.s	52	39	West Germany 20; Sweden 10; Switzerland 8.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum and other natural abrasives	8	3	NA.
Dust and powder of precious and semiprecious stones (including diamond)—kilograms	480	2	NA.
Grinding and polishing wheels and stones	8,887	8,810	West Germany 1,060; Yugoslavia 976; Poland 975; Italy 904.
Asbestos	29	20	NA.
Barite	--	(1)	NA.
Cement	247,831	224,119	Yugoslavia 163,572; Hungary 36,822.
Chalk	3,708	3,892	Hungary 2,047; Italy 782; Switzerland 447.
Clays and clay products (including all refractory brick):			
Crude clays:			
Kaolin (china clay)	25,211	22,090	Italy 12,719; Switzerland 5,160; Poland 2,886.
Other	576	906	Romania 478; Argentina 105; United Kingdom 60.
Products:			
Refractory (including nonclay bricks)	284,265	297,998	France 60,122; West Germany 44,436; Sweden 24,257.
Nonrefractory	22,659	27,793	Yugoslavia 20,139; Switzerland 6,473.
Cryolite and chiolite, natural	21	20	NA.
Diamond, industrial—thousand carats	50	10	All to Yugoslavia.
Diatomite and other infusorial earths	53	166	Yugoslavia 115; West Germany 39.
Feldspar	712	1,363	Switzerland 1,168; Italy 99.
Fluorspar	41	20	NA.
Graphite, natural	25,820	21,745	Poland 6,945; Italy 5,998; West Germany 4,967.
Gypsum and plasters	142,903	163,341	West Germany 127,243; Switzerland 36,044.
Lime	18,341	9,258	Yugoslavia 8,071; Switzerland 1,160.
Magnesite	213,448	191,711	West Germany 109,567; France 17,930; United States 12,265.
Mica, all forms	28	32	Poland 8; Yugoslavia 6; Hungary 3.
Pigments, mineral including processed iron oxides	5,220	5,750	West Germany 1,609; United Kingdom 1,607; France 503.
Precious and semiprecious stones, including diamond:			
Natural—kilograms	1,260	483	United States 63; Sweden 39; Australia 38.
Manufactured—do	736	986	United States 201; Spain 138; Sweden 102.
Salt	10	5	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous including marble and limestone	102,424	115,699	West Germany 101,624; Switzerland 13,862.
Slate	12	14	NA.
Other	68,235	73,356	West Germany 69,292; Yugoslavia 3,662.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Dimension stone—Continued			
Worked:			
Paving and flagstone	18,005	17,921	Switzerland 10,255; West Germany 5,666.
Slate	32	(1)	NA.
Other	4,066	3,033	West Germany 2,123; Switzerland 371; United States 323.
Dolomite	11,076	9,483	United Kingdom 3,885; West Germany 3,389; Philippines 802.
Gravel and crushed rock	445,770	672,357	West Germany 398,246; Switzerland 264,099; Yugoslavia 7,556.
Limestone	1,811	50	NA.
Quartz and quartzite	189	335	West Germany 122; Hungary 91; U.S.S.R. 64.
Sand excluding metal bearing	63,270	186,180	Switzerland 93,977; West Germany 84,138; Italy 6,815.
Sulfuric acid and oleum	501	254	Italy 206; Czechoslovakia 11.
Talc, steatite, soapstone and pyrophyllite	83,929	74,225	West Germany 38,005; Italy 10,547; Switzerland 7,511.
Other nonmetals, n.e.s.:			
Crude	4,529	4,653	West Germany 4,124; Yugoslavia 162; France 140.
Slag, dross and similar waste, not metal bearing	26,824	23,190	West Germany 22,164; Czechoslovakia 486; Italy 449.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	9	2	NA.
Carbon black and gas carbon	4	4	NA.
Anthracite and bituminous coal and briquets	12	34	NA.
Lignite and lignite briquets	7,803	6,108	West Germany 5,908; Yugoslavia 200.
Coke and semicoke	5,757	19,792	Romania 16,766; Yugoslavia 2,776.
Hydrogen, helium and rare gases thousand cubic feet	12,154	4,811	West Germany 3,242; Yugoslavia 154.
Peat, including peat briquets and litter	25	2	NA.
Petroleum refinery products:			
Gasoline, aviation and motor thousand 42-gallon barrels	1	2	Mostly to West Germany.
Kerosine and jet fuel ---do	18	(1)	NA.
Distillate fuel oil ---do	2	16	Switzerland 9; West Germany 5.
Residual fuel oil ---42-gallon barrels	278	193	NA.
Lubricants thousand 42-gallon barrels	904	895	Poland 488; Czechoslovakia 252; Hungary 72.
Other ---do	50	32	Yugoslavia 16; Switzerland 4.
Total ---do	975	945	
Mineral tar and other coal-, petroleum- or gas-derived chemicals	8,370	8,348	West Germany 4,965; Yugoslavia 1,901; Switzerland 713.

r Revised. NA Not available.
1 Less than ½ unit.

Table 3.—Austria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite	29,565	24,464	NA.
Oxide and hydroxide	198,959	198,644	West Germany 9.562; France 1,946.
Metal:			
Unwrought including scrap	16,484	19,928	U.S.S.R. 6,586; Hungary 5,361 Czechoslovakia 2,131; Poland 1,875.
Semimanufactures	11,443	11,219	West Germany 4,027; Switzerland 3,859; France 718.
Antimony:			
Ore and concentrate	28	--	
Metal, including alloys, all forms	45	104	Belgium-Luxembourg 62; Japan 28; Netherlands 12; France 34.
Arsenic trioxide, pentoxide and acids	68	41	
Cadmium metal, including alloys, all forms	15	6	West Germany 4.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Chromium:			
Chromite	81,793	94,290	Republic of South Africa 29,396; Iran 18,506; Turkey 16,215.
Oxide and hydroxide	259	318	West Germany 146; U.S.S.R. 101; Hungary 36.
Cobalt oxide and hydroxide—kilograms	1,900	2,500	West Germany 1,500.
Columbium and tantalum:			
Tantalum metal, including alloys, all forms—do	16,200	10,400	West Germany 8,900; United States 1,400.
Copper:			
Copper sulfate	111	59	Switzerland 50; West Germany 9.
Metal, including alloys:			
Scrap	13,544	9,483	West Germany 6,399; Switzerland 1,430; Italy 544.
Unwrought	33,041	35,564	West Germany 21,013; Zambia 6,934; Republic of South Africa 2,327.
Semimanufactures	5,716	6,230	West Germany 2,604; Sweden 1,356; United Kingdom 1,013.
Gold, metal, unworked and partly worked thousand troy ounces	1,102	1,547	Switzerland 1,128; West Germany 192; Republic of South Africa 156.
Iron and steel:			
Ore and concentrate, except roasted pyrite—thousand tons	2,112	1,842	Brazil 1,389; U.S.S.R. 340; Sweden 71.
Roasted pyrite—do	238	276	Italy 254; West Germany 11; Czechoslovakia 7.
Metal:			
Scrap—do	79	83	West Germany 36; Poland 21; U.S.S.R. 11.
Pig iron including cast iron [1] —do	87	78	U.S.S.R. 39; Hungary 13; West Germany 13.
Ferroalloys:			
Ferromanganese—do	18	17	Norway 10; Republic of South Africa 2; West Germany 2.
Other—do	45	35	Norway 8; U.S.S.R. 5; Czechoslovakia 4; Mozambique 4.
Steel:			
Primary forms—do	107	145	Hungary 50; West Germany 15; Poland 12.
Semimanufactures:			
Bars, rods, angles, shapes, and sections—do	108	89	West Germany 55; Hungary 10; Belgium-Luxembourg 6.
Universals, plates and sheets—do	90	77	West Germany 33; Belgium-Luxembourg 11; France 10.
Hoop and strip—do	r 13	16	West Germany 7; Switzerland 4; United Kingdom 2.
Rails and accessories do	2	2	West Germany 2.
Wire—do	12	9	West Germany 4; Belgium-Luxembourg 2; Sweden 2.
Tubes, pipes and fittings do	121	106	West Germany 67; Sweden 8; Switzerland 7.
Castings and forgings, rough—do	7	9	West Germany 6.
Lead:			
Ore and concentrate	6,090	4,941	All from Italy.
Oxides	72	26	United Kingdom 11; West Germany 7.
Metals, including alloys:			
Unwrought, including scrap	20,573	15,448	Yugoslavia 11,053; Bulgaria 2,272; West, Germany 1,156.
Semimanufactures	553	475	West Germany 189; Switzerland 130; Yugoslavia 122.
Magnesium metal, including alloys, all forms	3,944	844	Norway 494; Czechoslovakia 110; Italy 70.
Manganese:			
Ore and concentrate	937	739	Netherlands 456; West Germany 202.
Oxides	403	349	West Germany 101; Japan 78; Belgium-Luxembourg 75.
Mercury—76-pound flasks	386	641	Yugoslavia 249; West Germany 131; Mexico 90.
Molybdenum:			
Oxides	702	637	West Germany 504; United States 98.
Metal, including alloys, all forms	6	8	West Germany 6.
Nickel:			
Matte, speiss and similar materials	799	533	Netherlands 240; United Kingdom 222.

See footnotes at end of table.

(Metric tons unless otherwise specified)

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

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Nickel—Continued			
Metal, including alloys:			
Unwrought, including scrap	2,512	1,609	United Kingdom 483; Netherlands 334; West Germany 194.
Semimanufactures	798	902	West Germany 481; United Kingdom 292.
Platinum-group metals and silver metal, including alloys, all forms:			
Platinum group—troy ounces	26,267	18,487	West Germany 11,317; U.S.S.R. 3,601.
Silver:			
Bullion—thousand troy ounces	2,739	4,112	Mexico 2,000; West Germany 1,077; Peru 694.
Other (powder)—do	10	NA	
Semimanufactures—do	727	781	West Germany 633; Switzerland 132.
Tin metal, including alloys, all forms long tons	665	735	Netherlands 417; West Germany 114; United Kingdom 58.
Titanium oxide	7,264	7,081	West Germany 3,626; United Kingdom 1,250; Belgium-Luxembourg 806.
Tungsten:			
Ore and concentrate	3,703	3,076	NA.
Oxide and hydroxide	302	212	West Germany 103; United States 55; France 34.
Metal, including alloys, all forms	229	113	United States 61; West Germany 13.
Zinc:			
Ore and concentrate	5,750	292	All from Italy.
Oxides	688	579	West Germany 484; Netherlands 41; Belgium-Luxembourg 36.
Metal including alloys:			
Scrap and blue powder	562	744	Yugoslavia 256; West Germany 182; Belgium-Luxembourg 120.
Unwrought	6,643	4,413	Poland 1,516; Zambia 1,068; Bulgaria 795.
Semimanufactures	531	971	West Germany 854; Yugoslavia 56.
Other:			
Ore and concentrate	24,671	27,126	Czechoslovakia 20,533; Australia 1,975; United States 1,821.
Ash and residue containing nonferrous metals	34,608	41,980	U.S.S.R. 17,852; East Germany 10,343; Poland 3,965.
Waste and sweeping of precious metals kilograms	805	12	West Germany 1.
Oxides, hydroxides and peroxides of metals, n.e.s	1,832	1,427	Republic of South Africa 649; Netherlands 227; United States 208.
Base metals, including alloys, all forms, n.e.s	1,002	789	Belgium-Luxembourg 148; Republic of South Africa 120; West Germany 97.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum and other natural abrasives	792	712	West Germany 481; Italy 123; Netherlands 73.
Dust and power of precious and semi-precious stones (including diamond) kilograms	14	20	West Germany 15; Switzerland 3.
Grinding and polishing wheels and stones	709	712	West Germany 364; Italy 66.
Asbestos	34,155	39,943	Canada 20,297; Republic of South Africa 7,745; U.S.S.R. 7,700.
Barite and witherite	8,214	6,628	Yugoslavia 2,633; West Germany 2,162; Italy 998.
Boron materials:			
Crude natural borates	9,849	10,025	United States 8,092; Turkey 1,788; West Germany 130.
Oxide and acid	742	627	Turkey 310; United States 210; Czechoslovakia 60.
Cement	22,687	37,222	Italy 18,523; France 5,715; West Germany 5,404.
Chalk	2,823	4,072	France 3,248; West Germany 450; East Germany 240.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	532	658	West Germany 602.
Kaolin (china clay)	48,029	55,264	West Germany 22,383; United Kingdom 19,645; Czechoslovakia 7,879.
Other	94,414	98,420	West Germany 57,503; Czechoslovakia 31,423; Poland 5,092.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Clays and clay products (including refractory brick)—Continued			
Products:			
Refractory (including nonclay brick)	13,673	15,423	West Germany 10,546; Yugoslavia 1,139; France 757.
Nonrefractory	119,441	147,789	Italy 72,748; West Germany 51,489; Switzerland 11,719.
Cryolite and chiolite, natural	358	209	All from Denmark.
Diamond, industrial—thousand carats	100	70	India 35.
Diatomite and other infusorial earths	2,635	3,300	Hungary 1,769; United States 602; France 251.
Feldspar	7,902	3,087	West Germany 3,069.
Fertilizers:			
Crude:			
Phosphatic	333,673	330,799	United States 114,919; Israel 97,245; U.S.S.R. 77,832.
Potassic	57,925	45,937	East Germany 33,624; West Germany 12,313.
Other	2,547	2,116	West Germany 1,579; Switzerland 515.
Manufactured:			
Nitrogenous	6,419	4,783	West Germany 4,584; Yugoslavia 164.
Phosphatic	295,400	200,452	France 104,592; Belgium-Luxembourg 75,494.
Potassic	258,552	286,978	East Germany 111,265; West Germany 88,994; U.S.S.R. 45,703.
Other, including mixed	1,890	2,388	West Germany 1,740; Yugoslavia 547.
Fluorspar	13,666	13,701	East Germany 6,668; West Germany 2,937; Italy 2,170.
Graphite, natural	1,775	2,747	North Korea 2,376.
Gypsum and plasters	13,256	20,827	West Germany 12,876; Switzerland 3,825; Poland 3,496.
Lime	1,449	707	West Germany 675.
Magnesite	106,703	104,593	Turkey 65,907; Greece 22,241; Italy 1,602.
Mica:			
Crude including splittings and waste	299	317	Norway 118; West Germany 86; United Kingdom 67.
Worked, including agglomerated splittings	47	43	United Kingdom 15; West Germany 12; Belgium-Luxembourg 9.
Pigments, mineral:			
Natural, crude	r 187	207	France 115; West Germany 70.
Iron oxide, processed	1,940	2,170	West Germany 2,119; Spain 51.
Precious and semiprecious stones, including diamond:			
Natural crude—thousand carats	81,105	91,230	Brazil 34,735; West Germany 34,175; Republic of South Africa 7,730.
Manufactured—do	40,110	55,055	Switzerland 28,115; France 25,880.
Pyrite (gross weight)	19,119	15,128	U.S.S.R. 14,746; Italy 379.
Salt, including brine salt	1,959	458	All from West Germany.
Sand and gravel:			
Gravel (including crushed rock)	51,270	82,541	West Germany 64,294; Italy 11,315; Czechoslovakia 4,156.
Sand excluding metal bearing	142,748	204,647	West Germany 142,669; Czechoslovakia 26,974; East Germany 23,019.
Stone, n.e.s.:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble and limestone	10,454	10,236	Italy 7,060; West Germany 1,662.
Slate	891	1,275	West Germany 576; France 415; Italy 97.
Other	24,933	27,424	Italy 13,805; Republic of South Africa 6,761; Yugoslavia 3,569.
Worked:			
Paving and flagstone	8,870	9,304	Yugoslavia 5,383; Italy 1,694; Romania 1,120.
Slate	268	415	Italy 302; West Germany 68.
Other	4,378	5,303	Italy 4,577; West Germany 392; Switzerland 207.
Dolomite chiefly refractory grade	3,631	3,131	Italy 2,610; Norway 150.
Limestone except dimension	25	4,586	West Germany 4,585.
Quartz and quartzite	19,283	20,929	West Germany 15,731; Yugoslavia 3,361; Hungary 778.
Volcanic material (trass)	782	674	West Germany 616; East Germany 51.
Sulfur:			
Elemental, all forms	116,850	131,583	Poland 79,107; U.S.S.R. 35,828; France 7,748.
Sulfur dioxide	1,453	1,163	West Germany 1,021; Switzerland 142.
Sulfuric acid and oleum	11,294	31,346	Czechoslovakia 13,214; West Germany 11,104.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Talc, steatite, soapstone, and pyrophllite	1,049	1,288	Norway 576; Belgium-Luxembourg 155; West Germany 155.
Other, nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, and jet	17	76	France 41; Tanzania 10.
Other	32,327	36,907	West Germany 29,395; Hungary 2,920; Bulgaria 2,393.
Slag, dross and similar waste, not metal bearing	26,329	21,579	Italy 8,413; Republic of South Africa 7,490.
Oxides and hydroxides of magnesium, strontium and barium	559	696	West Germany 599; France 33; United States 31.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	710	683	Trinidad and Tobago 492; United States 82; Romania 70.
Carbon black and gas carbon	20,326	20,917	West Germany 10,096; Switzerland 866; Israel 667.
Anthracite and bituminous coal and briquets—thousand tons	3,725	2,821	Poland 1,070; U.S.S.R. 761; Czechoslovakia 606.
Lignite and lignite briquets—do	692	598	East Germany 238; West Germany 195; Yugoslavia 81.
Coke and semicoke—do	1,082	883	Czechoslovakia 551; West Germany 139; U.S.S.R. 80.
Gas, hydrocarbon	727,501	1,055,000	U.S.S.R. 1,044,000; West Germany 6,686.
Hydrogen, helium and rare gases—thousand cubic feet	50,710	26,356	West Germany 24,802.
Peat, including peat briquets and litter	16,800	22,253	West Germany 10,491; Poland 6,055; U.S.S.R. 2,842.
Petroleum:			
Crude and partly refined oils:			
Crude—thousand 42-gallon barrels	16,640	33,401	Iraq 15,943; U.S.S.R. 7,161; Libya 3,520; Algeria 1,868.
Partly refined—do	7,833	3,336	Czechoslovakia 1,608; Romania 656; Hungary 603.
Refinery products:			
Gasoline, aviation and motor—do	8,474	6,045	Italy 2,392; West Germany 1,896; Hungary 562.
Kerosine—do	2	2	Italy 1; Netherlands 1.
Distillate fuel oil—do	925	231	Italy 204; West Germany 18.
Residual fuel oil—do	r 12,932	11,433	West Germany 4,589; Italy 2,500; Czechoslovakia 1,304.
Lubricants—do	555	598	West Germany 169; Italy 139; Hungary 81.
Mineral jelly and wax—do	80	90	West Germany 49; East Germany 13; Hungary 13.
Other—do	2,129	2,117	West Germany 1,131; Italy 614; Czechoslovakia 177.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9,512	62,866	West Germany 26,883; Czechoslovakia 15,693; Romania 13,228.

r Revised. NA Not Available. 1 Includes speigeleisen, shot, powder and sponge.

COMMODITY REVIEW

METALS

Aluminum.—Production of primary aluminum in 1972 was 83,989 tons, a decrease of 7.4% from the 90,698 tons produced in 1971. Secondary production, however, increased from 59,353 tons in 1971 to 119,382 tons.

Construction was started on the new cold-rolling mill of Vereinigte Metallwerke Ranshofen-Berndorf A.G. (VMRB) with partial operation planned for 1974. No decision has been reached as yet over starting work on the planned new electrolysis plant. The new aluminum powder plant, with an initial capacity of 4,000 tons, was put into operation and helped to contribute to the increased consumption of primary metal, which rose about 6% over that of the previous year.

The extrusion plant at Nenzing in Vorarlberg, erected by the Norwegian aluminum industry, started production at the beginning of April.

Copper.—Austria continued to be a

modest producer of copper ore, concentrate, and electrolytic copper in 1972. Output of copper (metal content of ore) was 2,303 tons or 13% less than that of 1971.

Iron and Steel.—Iron ore output declined slightly from the record high level of 4.17 million tons in 1971 to 4.13 million tons in 1972. A slight decline also was shown in pig iron production, which decreased from 2,849,124 tons in 1971 to 2,846,111 tons in 1972. Crude steel production rose from 3,960,483 tons to 4,070,046 tons, an increase of 2.8%.

On November 20, 1972, the Austrian Cabinet approved the bill to merge the country's two largest nationalized steel companies, Vereinigte Österrerchische Eisen-und Stahlwerke A.G. (VÖEST) and Österreichisch-Alpine Montangesellschaft A.G. The consolidated combine, to be established January 1, 1973, will be registered as VÖEST-Alpine Montan A.G. The new combine will include the specialty steel producers, Gebrüder Böhler & Co. A.G. and Schoeller-Bleckmann Stahlwerke A.G., as subsidiaries.

Lead and Zinc.—Bleiberger Bergwerks-Union A.G. decreased production at its Bleiberg-Kreuth workings in Carinthia from the alltime high of 381,732 tons reached in 1971 to 359,635 tons (a decrease of 5.8%). Production in terms of the lead content of ore decreased from 7,715 tons in 1971 to 6,668 tons in 1972; production of metal content of zinc ore decreased from 21,073 tons to 20,480 tons.

Tungsten.—With the closing of the Hintertux mine in Tyrol, Austria's only producing tungsten mine, no tungsten ore or concentrate was produced in 1972. Ore production from the mine had decreased from 12,564 tons in 1970 to 5,944 tons in 1971; production of concentrate had dropped from 160 tons to 86 tons. Decreased production was attributed to the mining of low-grade ore. Some exploration for scheelite has been conducted at Felbertauern in Salzburg.

Other Metals.—During 1972 Austria also produced antimony, cadmium, germanium, and silver.

NONMETALS

Cement.—Austria in recent years has increased considerably its cement production reaching a high in 1972 of 6,345,000 tons, an increase of 15.5% over the 5,491,000 tons produced in 1971. There is no clearly defined cement-producing area in Austria; plants are distributed throughout the country. A number of plants have modernized their facilities, and new kilns have been added. Adequate supplies of raw materials are obtained from a number of limestone quarries.

To meet the increased raw materials supply needs for its two rotary kilns, Messrs. Hofmann & Co. of Kirchdorf a.d. Krems installed a mobile crusher, which has substantially reduced operating costs. The Hofmann quarry, at Obermicheldorf, supplies two different types of rock for the cement production. The Opponitizer limestone, the major component of the deposit, is won by blasting at a rate of 20,000 to 25,000 tons per shot. The secondary component, which has a very low lime content but is high in clay, iron, and silica, occurs at intercalations of varying thickness within the limestone, or as a landslide at one end of the quarry face. The need to load the blasted material at two locations and the need to homogenize the two components either before or after the crushing process were major considerations in choosing a mobile crusher.[2]

Clays.—*Kaolin.*—Kaolin production increased 8.9% from 302,334 tons in 1971 to 329,336 tons in 1972. Production came from two mines in Upper Austria (Kriechbaum and Weinzierl) and three mines in Lower Austria (Aspang-Zöbern, Mallersbach, and Nieder-Fladnitz).

Graphite.—Crude graphite production in 1972 was 18,772 tons, a decrease of 12.2% from the 21,392 tons produced in 1971.

Gypsum and Anhydrite.—Austria produced 760,007 tons of crude gypsum and anhydrite in 1972, an increase of 28% over the 593,719 tons produced in 1971.

Österreichische Stickstoffwerke A.G. (ÖSW), of Linz, and Krupp Chemieanlagenbau, of Essen, are cooperating on improving the ÖSW gypsum-sulfuric acid process. The improvement concerns the heat economy of the process. The Austrian process is usable with natural anhydrite or phosphoric acid byproduct gypsum.[3]

Magnesite.—Output of crude magnesite in 1972 decreased 8.2% from 1,556,459 tons

[2] Welrich, D. Mobile Crusher Slashes Austrian Quarry Cost. Rock Products, v. 76, No. 6, June 1973, pp. 72–73, 96.
[3] Chemical Age. V. 103, No. 2719, Aug. 27, 1971, p. 6.

in 1971 to 1,429,414 tons; sintered or dead-burned magnesite decreased from 507,771 tons to 451,226 tons; caustic-calcined magnesite decreased from 190,868 tons to 179,553 tons.

Austria's two large basic refractories producers are Veitscher Magnesitwerke A.G., which has been operating for over 90 years, and Österreichisch-Amerikanische Magnesit A.G. (OEAMAG), which has been operating for more than 60 years. Veitscher operates two mines, at Trieben in the Palten valley, near Selzthal, and at Breitenau near Mixnitz in the Mur valley; each has its own dead-burning facility. Bricks are made at Trieben and Veitsch. The Veitsch plant, which formerly was served by an adjacent mine, uses material from other operations. OEAMAG, a subsidiary of General Refractories Co. of the United States, has its main plant at Radenthein. There are other plants at Tux, Ferndorf, and Hochfilzen. The mine at Hochfilzen, which went into operation in 1959, produces over 400,000 tons of raw magnesite per year and is the company's largest mine.

Despite its large production of magnesite, Austria imports substantial amounts of dead-burned magnesite (nearly 80,000 tons in 1971). Imports are necessary because Austrian magnesite is a high-iron variety and for some brick qualities a low-iron magnesite is needed. Both Veitscher and OEAMAG own subsidiaries abroad that mine and process low-iron cryptocrystalline magnesite. Veitscher's subsidiary is Magnesit Anonim Sirketi of Turkey. Magnomin S.A., operating in Greece, is a subsidiary of OEAMAG. In 1971 Austria imported from Turkey 52,651 tons of dead-burned and 13,255 tons of crude magnesite; from Greece, it imported 21,640 tons of dead-burned material.

Austria produces about 80,000 tons per year of nonbasic shaped refractories, most all of which is fire-clay brick. L. Kraft, Dinas- und Schamottewerke G.m.b.H. of Vienna, a subsidiary of Didier-Werke, is the major producer. Others include Chamottewaren und Tonoefenfabrik Aug. Rath and Freudenauer Schamottefabrik Thelmann & Co., both with headquarters in Vienna.

Other Nonmetals.—In 1972, Austria also produced a variety of other nonmetals including barite, illite, diatomite, feldspar, lime, quartz and quartzite, quartz sand, salt, sand and gravel, stone, sulfur, talc, and pumice (trass).

MINERAL FUELS

Austria in 1972 continued to be a modest producer of low-rank coals, crude oil, and natural gas. Domestic supplies were not adequate to meet the country's requirements, and imports were necessary to satisfy the demand for energy.

Total electricity generation in Austria, according to preliminary figures published by the Federal Grid Authority, came to 29,366 million kilowatt-hours in 1972, compared with 28,755 million kilowatt-hours in 1971 (an increase of 2.1%). Because of the low waterflow of rivers, attributable to low precipitation, the annual production of hydroelectric power in Austria during the past 2 years has been considerably below the long-term average. In 1972, water power accounted for 17,221 million kilowatt-hours, 2.7% more than the 16,770 million kilowatt-hours generated in 1971; thermal plants generated 12,145 million kilowatt-hours, an increase of 1.3% over the 11,985 million kilowatt-hours generated in 1971. Exports of electricity fell from 4,771 million to 4,338 million kilowatt-hours (a decrease of 9.1%), and power imports increased considerably from 2,170 million to 2,849 million kilowatt-hours (an increase of 31.3%).

Construction of Austria's first nuclear powerplant at Zwentendorf in the vicinity of Tulin, Lower Austria, was started by Gemeinschaftskernkraftwerk Tullnerfeld G.m.b.H. (GKT) of Vienna, a joint venture of the Federal Grid Authority and the provincial power companies. The 700-megawatt plant is to be operational by 1976. Siemens A. G. Österreich, of Vienna, is in charge of planning and constructing the plant and also will put the installation into service. Construction of a second nuclear powerplant is envisaged to start by 1975 at the latest.

Coal.—Production of coal in Austria, which since 1968 has consisted exclusively of brown coal and lignite, amounted to 3,755,510 tons in 1972, a slight decrease from the previous year's 3,769,728 tons. This amount, expressed in bituminous coal equivalent, totaled 1,877,760 tons, compared with 1,884,864 tons in 1971.

Austria continued to be dependent on imported solid fuels for most of its total requirements. In 1972, imports amounted to 4,231,809 tons in standard coal equivalent. All of the higher rank coal was imported, and 20.6% of the lignitic coals and 36.3% of the coke was imported. Countries that supplied the imports of solid mineral fuels were Poland (27%), Czechoslovakia (25%), U.S.S.R. (18%), West Germany (12%), Yugoslavia (11%), East Germany (5%), and other countries (2%). Austria did not import coal from the United States in 1972.

Deliveries of solid mineral fuels (including coke produced from imported coal) to the domestic market in 1972 was 7.6 million tons of standard bituminous coal equivalent. The total share of solid mineral fuels in the overall energy supply declined slightly from 19.9% in 1971 to 19.6% in 1972, despite the fact that Austria's total energy demand increased to 30.6 million tons in standard bituminous coal equivalent or 6.5% above the level of 1971. A larger decline was prevented by the operation of Austria's thermal powerplants at full capacity in the last months of 1972 to offset the reduced output of hydroelectric power caused by the low waterflow of rivers. Consumer groups showing an increase in deliveries of solid fuel were as follows: Electric powerplants, up 34.6%; district heating plants, up 16.0%; and coking plants (VÖEST), up 5.5%. Consumer groups receiving less solid fuel were the railroads, down 12.6%; the industry group, down 1%; and households, down 8.5%.

Petroleum and Natural Gas.—Crude oil production in Austria in 1972 was 2,477,862 tons, a decrease of 1.5% from that of the preceding year. Production of natural gas rose from 1,891 million cubic meters in 1971 to 1,963 million cubic meters in 1972, an increase of 3.8%. Österreichische Mineralölverwaltung A. G. (ÖMVAG), the Austrian state corporation, contributed 2.1 million tons or 84.4% of the oil production and 1,606 million cubic meters or 81.8% of the gas production.

Domestic consumption of petroleum products rose from 9.7 million tons in 1971 to 10.2 million tons in 1972, an increase of 5.2%. Imports of crude oil and products increased from 7.8 million tons to 8.6 million tons, an increase of 10.3%.

ÖMVAG inaugurated the first stage of the fourth crude oil distilling plant to be erected at their Schwechat refinery. Crude oil throughput of the refinery has been increased from 7.5 to 10.5 million tons per year, which affords the company greater flexibility in both processing and deliveries. In the long run, the refinery will be expanded to a capacity of 14 million tons per year.

The Transaustria gas pipeline (TAG), which when completed will have a capacity of 12,500 million cubic meters per year, is expected to be operational around May 1974. The pipeline will transport Soviet natural gas from the Austro-Czechoslovakian border near Baumgarten via Schäfern, Styria, and St. Nikolai as well as Weissenberg, Carinthia, to the Austro-Italian border.

The Mineral Industry of Belgium and Luxembourg

By Norman A. Matthews [1]

Industrial production rates improved rapidly in Belgium and Luxembourg during the first months of 1972 and reached high levels that were sustained during the balance of the year. The improvement was spurred by a high level of government spending, increased foreign demand, and steady consumer durable goods demand. As a result, the gross national product (GNP) increased 10.3% compared with that of 1971 and export value increased by 13.5%, resulting in a trade surplus of about $490 million.[2]

In contrast, the industrial construction sector was sluggish and showed a slight decline in 1972 compared with that of 1971, influenced by inflation and relatively poor profit margins.

The mineral industry of Belgium-Luxembourg continued to focus on processing imported raw materials in the ferrous, nonferrous, and petroleum areas. Record volumes were achieved in all these industries and in derivatives such as the metal fabrication and petrochemical industries that constitute an increasing share of the industrial economy and value of exports.

Belgium has proceeded vigorously to adapt nuclear reactors to its rapidly increasing power requirements with the first reactor complex nearing completion and two more to start operation in 1975. It is also participating with West Germany in a prototype breeder reactor on which construction began in 1972.

A major 10-year construction program begin in 1972 on the Scheldt River estuary to enlarge the capacity of the Port of Antwerp, improve connections with inland waterways, and develop industrial building sites on the left bank of the river. This project is essential to continue to improve the status of Belgium-Luxembourg in international trading circles.

BELGIUM

PRODUCTION

During the first months of 1972 a surge in industrial production occurred that persisted throughout the year. Accordingly, significant increases in production were realized in metallic mineral and metal products categories. Nonmetallic minerals overall, keyed to the sluggish investment and construction climates, declined 5% to 6%. Typical indices showed the following increases compared with that of 1971: chemicals, 5%; phosphates, 13%; extractive industries, 4; and iron and steel, 15%.

Production and exports of steel, aluminum products, and primary zinc were at record high levels. Refined copper and smelter lead production increased modestly whereas tin smelter production declined, influenced by the depressed price structure that existed during most of the year and reduced availability of raw materials from the traditional sources.

Production of complex fertilizers as well as oil refinery products reached new highs in 1972. The production of heavy inorganic chemicals such as sulfuric and nitric acids also set new records during 1972.

[1] Physical scientist, Division of Ferrous Metals.

[2] Where necessary, values have been converted from Belgium francs (BF) to U.S. dollars at the rate of BF44.81 = US$1.00, approximate average at which traded during 1972.

Table 1.—Belgium: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Aluminum metal, secondary only		[r] 2,000	2,200	[e] 2,200
Cadmium		1,093	947	1,136
Copper:				
Blister [e]		10,000	10,000	7,000
Refined, including alloys		351,710	325,866	327,278
Iron and steel:				
Iron ore and concentrate	thousand tons	[r] 93	93	113
Pig iron	do	[r] 10,823	10,394	11,769
Ferroalloys	do	132	131	126
Steel:				
Crude	do	12,607	12,444	14,532
Semimanufactures	do	10,337	10,167	[2] 11,669
Lead metal:				
Primary		89,400	79,300	92,900
Secondary		16,624	16,124	12,062
Total		106,024	95,424	104,962
Tin metal:				
Primary	long tons	4,190	3,878	3,861
Secondary	do	1,450	2,422	1,699
Total	do	5,640	6,300	5,560
Zinc metal:				
Primary		231,937	208,012	NA
Secondary (remelted zinc)		9,300	4,700	NA
Total		241,237	212,712	257,369
Other nonferrous metals:				
Precious metals unworked, not further specified [3]	thousand troy ounces	31,259	28,102	25,467
Unspecified base metals [4]		[r] 3,852	2,719	[e] 3,808
NONMETALS				
Abrasives, natural, whetstones (crude)		25	12	--
Cement, hydraulic	thousand tons	6,729	6,931	7,090
Clays, n.e.s.	do	198	205	296
Fertilizer materials, manufactured:				
Nitrogenous, nitrogen content	do	397	472	397
Phosphatic, gross weight:				
Thomas slag	do	1,300	1,288	1,398
Superphosphate, ordinary	do	157	142	188
Other	do	487	546	534
Gypsum and anhydrite, calcined		87,963	96,430	105,979
Lime and dead-burned dolomite:				
Quicklime	thousand tons	2,519	2,653	2,873
Dead-burned dolomite	do	372	351	349
Stone, sand and gravel:				
Calcareous:				
Dolomite	do	1,503	1,583	1,788
Limestone	do	21,428	25,001	24,376
Marble:				
In blocks	cubic meters	3,323	2,560	4,310
Crushed and other		[r] 20,467	14,751	14,644
Petit granit (Belgium bluestone):				
Quarried	cubic meters	337,934	331,012	298,253
Sawed	do	71,234	66,242	72,986
Worked	do	11,744	17,638	11,402
Crude and other	do	278,907	300,019	238,476
Porphyre, all kinds	thousand tons	7,486	8,396	8,048
Quartzite		332,676	427,260	506,035
Sand and gravel:				
Construction sand	thousand tons	6,705	8,708	10,325
Foundry sand	do	1,537	1,399	1,321
Dredged sand	do	921	703	873
Glass sand	do	1,840	1,549	1,607
Other sand	do	1,775	1,959	2,236
Gravel (dredged)	do	4,269	4,329	6,391
Sandstone:				
Rough stone, including crushed	do	1,763	2,065	2,216
Paving and mosaic stone		2,779	1,981	1,231
Other		50,274	44,181	48,676
Slate, roofing and other		7,194	4,723	5,611
Sulfur, byproduct, recovered		[r] 10,000	23,000	25,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite	thousand tons	3,686	3,371	2,955
Bituminous	do	7,676	7,589	7,545
Total	do	11,362	10,960	10,500
Coke, all types	do	[r] 7,119	6,783	7,239
Fuel briquets, all kinds	do	[r] 745	574	496
Gas, manufactured	million cubic feet	73,189	62,969	67,729
Petroleum, refinery products:				
Gasoline, aviation	thousand 42-gallon barrels	9	--	NA
Gasoline, motor	do	30,405	31,977	38,554
Jet fuel	do	8,512	9,048	4,200
Kerosine	do	1,023	450	NA
Distillate fuel oil	do	70,303	73,675	86,730
Residual fuel oil	do	74,998	70,083	80,286
Lubricants	do	378	658	NA
Other	do	21,097	23,148	NA
Refinery fuel and losses	do	14,656	12,310	NA
Total	do	221,381	221,349	NA

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

[1] In addition to the commodities listed individually, Belgium produces a number of other metals for which only aggregate output figures are available. These aggregates are listed under other nonferrous metals.

[2] Excludes finished steel castings and steel forgings.

[3] Known to include gold and silver and may include platinum-group metals.

[4] Derived by subtracting aluminum data from a reported total for unspecified base metals.

TRADE

Belgium and Luxembourg trade and economic statistics are consolidated generally and reported as statistics for the Belgium-Luxembourg Economic Union (BLEU). As the GNP of BLEU increased 10.3% in 1972 compared with that of 1971, so also did the exports (13.5%) and imports (8.4%) of these trading countries. A substantial trade surplus was achieved during 1972, representing a distinct improvement over that of 1971. The improvement was spread over the broad spectrum of industrial and manufactured products but was most pronounced in record exports of steel, petroleum, and chemical products. Of the total export and import values, over 60% went to the European Economic Community (EEC) countries, with West Germany, France, and the Netherlands predominating. Exports to the United States increased moderately (2.5%), whereas imports from the United States declined about 6%.

Luxembourg City has rapidly become a principal financial center in Europe, attributed to an absence of capital restrictions, its political and economic stability and central location. The number of international banks doubled in the last 4 years with the total made up of 13 West German, 11 Luxembourg, 10 American, six Swiss, five French, three Belgian, and three other institutions.

Long term commercial agreements were renewed for 1973 between Benelux (Belgium-Netherlands-Luxembourg) and the East European countries, Poland and Hungary. These agreements provide quotas for duty-free trade between the signatory countries embracing a wide range of agricultural, manufactured, and industrial products.

Ferchimex, a Soviet-Belgian trading firm, was established in 1972 with facilities in the Port of Antwerp to receive and distribute Soviet products including iron ore, phosphates, and complex fertilizers, primarily for EEC and Scandinavian markets.

To augment the capacity of the Port of Antwerp, a 10-year project was initiated to deepen the Scheldt River estuary and open the left bank for industrial plant sites. Construction started on a new lock and supporting facilities at Kallo.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	73	27	NA.
Oxide and hydroxide	18	195	NA.
Ash and residue containing aluminum	1,390	1,167	France 1,020.
Metal including alloys:			
Scrap	13,799	13,295	France 6,926; West Germany 4,109; Netherlands 2,208.
Unwrought	10,147	5,216	Netherlands 3,206; West Germany 1,637.
Semimanufactures	132,618	150,981	West Germany 33,791; France 28,791; United States 27,038.
Antimony metal, including alloys, all forms	1	15	NA.
Arsenic, natural sulfides	--	43	NA.
Beryllium metal, including alloys, all forms kilograms	--	9,000	NA.
Bismuth metal, including alloys, all forms	341	371	France 252.
Cadmium metal, including alloys, all forms	1,020	1,099	West Germany 598; United States 180; France 172.
Chromium:			
Chromite	--	363	NA.
Oxides and hydroxides	r 22	75	NA.
Metal including alloys, all forms	42	2	NA.
Copper:			
Ore and concentrate	922	29	NA.
Copper sulfate	6,426	9,025	Denmark 2,146; Netherlands 1,908; West Germany 788.
Ash and residue containing copper	1,221	1,937	West Germany 1,048; France 605.
Metal including alloys:			
Scrap	16,848	12,697	West Germany 4,378; Netherlands 2,998; Italy 2,583.
Unwrought	r 304,958	282,805	France 107,533; West Germany 70,186; Italy 24,554.
Semimanufactures	112,906	115,040	Netherlands 39,070; West Germany 38,510; France 13,489.
Germanium metal, including alloys, all forms kilograms	12,000	6,400	Italy 2,000; France 1,700.
Gold metal, unworked and partly worked thousand troy ounces	223	372	United Kingdom 221; Switzerland 81; West Germany 30.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	r 36	75	France 63; West Germany 12.
Roasted pyrite do	287	229	West Germany 227.
Metal:			
Scrap do	741	458	West Germany 201; France 136; Netherlands 112.
Pig iron, including cast iron do	r 19	16	France 13.
Sponge iron, powder and shot	680	214	France 16; West Germany 15; Algeria 13.
Spiegeleisen	4,324	960	United States 401.
Ferroalloys:			
Ferromanganese thousand tons	69	55	West Germany 23; France 15; Italy 11.
Other do	5	6	West Germany 3; France 1; Italy 1.
Steel, primary forms do	1,933	1,694	France 683; West Germany 402; Italy 223.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	5,291	5,155	West Germany 1,606; United States 1,105; France 713.
Universals, plates and sheets do	3,968	4,017	West Germany 1,239; France 1,142; Netherlands 411.
Hoop and strip do	891	805	West Germany 301; France 199; Netherlands 65.
Rails and accessories do	83	111	France 19; Portugal 18; Switzerland 14.
Wire do	398	373	United States 80; West Germany 72; Netherlands 50.
Tubes, pipes, and fittings do	255	273	West Germany 79; Netherlands 67; France 54.
Castings and forgings, rough do	34	40	West Germany 10; Netherlands 6; France 6.
Lead:			
Ore and concentrate	34,383	1,758	All to France.
Oxides	7,570	5,136	Netherlands 2,518; West Germany 1,460.
Ash and residue containing lead	13,419	6,869	Netherlands 5,883; West Germany 985.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Lead—Continued			
Metal including alloys:			
Scrap	7,763	5,513	France 2,866; West Germany 1,824; Netherlands 813.
Unwrought	63,722	49,255	Netherlands 18,810; France 12,435; Italy 6,800.
Semimanufactures	5,596	5,957	Algeria 485; Norway 297; Sweden 242.
Magnesium metal, including alloys:			
Scrap	282	234	United States 175.
Unwrought and semimanufactures	22	104	Netherlands 51; West Germany 40.
Manganese:			
Ore and concentrate	r 13,126	6,225	United Kingdom 2,993; West Germany 699.
Metal	21	5	NA.
Mercury—76-pound flasks	r 580	580	France 348; Netherlands 87.
Molybdenum:			
Ore and concentrate	542	1,767	West Germany 806; East Germany 279; Italy 148.
Metal including alloys, all forms	16	22	NA.
Nickel:			
Matte, speiss and similar materials	178	--	
Metal including alloys:			
Scrap	802	813	United Kingdom 299; Netherlands 169; West Germany 136.
Unwrought	205	576	United Kingdom 177; West Germany 105; Netherlands 95.
Semimanufactures	r 472	674	Netherlands 226; France 108.
Platinum-group metals, including alloys, all forms—thousand troy ounces	67	954	West Germany 917; France 14; Netherlands 2.
Rare-earth metals, including alloys	20	149	NA.
Selenium, elemental—kilograms	30,700	54,700	Netherlands 48,100.
Silver metal, including alloys thousand troy ounces	r 37,975	27,415	Switzerland 8,415; West Germany 7,050; Netherlands 5,643.
Tin:			
Ore and concentrate—long tons	581	725	United Kingdom 583; Spain 107.
Oxides—do	266	186	West Germany 97; Netherlands 42.
Metal:			
Scrap—do	109	157	United Kingdom 96; Netherlands 32.
Unwrought—do	3,052	2,681	West Germany 797; France 559; Netherlands 409.
Semimanufactures—do	52	81	Switzerland 14; Netherlands 5.
Titanium:			
Ore and concentrate	3,529	73	NA.
Oxides	23,501	26,628	West Germany 7,073; France 2,834; Brazil 2,609.
Metal including alloys all forms	16	16	United Kingdom 13.
Tungsten:			
Ore and concentrate	64	148	Netherlands 53; Switzerland 35; United Kingdom 33.
Metal including alloys, all forms	9	82	Denmark 30; France 16.
Zinc:			
Ore and concentrate	194,549	22,645	Poland 7,510; Netherlands 5,361; West Germany 4,635.
Ash and residue containing zinc	45,012	40,341	Netherlands 32,941; France 3,495; West Germany 2,834.
Metal including alloys:			
Scrap	8,786	9,748	France 8,199.
Blue powder (dust)	31,972	32,553	West Germany 12,161; France 4,128; Italy 3,535.
Unwrought	137,291	126,752	West Germany 78,106; United States 9,064; France 7,673.
Semimanufactures	13,186	10,114	West Germany 2,918; Netherlands 2,639; France 1,206.
Other:			
Ore and concentrate:			
Of niobium, tantalum, vanadium and zirconium	352	48	West Germany 30; United States 17.
Of base metals, not elsewhere specified	11,574	4,491	West Germany 2,042; France 1,611.
Ash and residue containing nonferrous metals, n.e.s	r 12,044	13,804	West Germany 7,518; Netherlands 4,257.
Waste and sweepings of precious metals—value, thousands	$897	$1,096	West Germany $484; United States $406.
Oxides, hydroxides and peroxides of metals, n.e.s	r 3,473	3,946	West Germany 1,263; France 533; United States 532.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Other—Continued			
Metal including alloys all forms:			
Metalloids:			
Tellurium and arsenic	15	73	France 57.
Other	128	236	NA.
Base metals including alloys, all forms, n.e.s.	r 13,451	8,776	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	1,762	1,040	NA.
Dust and powder of precious and semiprecious stones, natural and manufactured, including diamond kilograms	462	321	Israel 97; West Germany 62; United States 31.
Grinding and polishing wheels and stones	2,838	2,484	France 1,544; West Germany 311.
Asbestos	952	202	France 154.
Barite and witherite	170	251	NA.
Boron materials:			
Crude natural borates	2,155	3,317	West Germany 2,940.
Oxide and acid	78	27	NA.
Bromine kilograms	125,000	300	NA.
Cement thousand tons	1,626	1,694	Netherlands 1,282; West Germany 182; Saudi Arabia 31.
Chalk	103,364	96,786	Netherlands 72,057; West Germany 4,922; Pakistan 2,344.
Clays and clay products:			
Crude clays, n.e.s.:			
Bentonite	378	47	NA.
Kaolin	10,641	8,478	Netherlands 7,259.
Other	10,740	8,046	Netherlands 3,740; France 776.
Products:			
Refractory (including nonclay bricks)	89,988	91,645	France 53,477; Netherlands 19,503; West Germany 5,087.
Nonrefractory	145,384	160,375	Netherlands 83,116; West Germany 42,465; France 29,663.
Cryolite and chiolite	294	74	NA.
Diamond (except powder):			
Gem:			
Unworked thousand carats	3,901	4,496	India 2,334; Israel 998; United States 340.
Worked do	1,895	2,462	United States 962; West Germany 301; Hong Kong 242.
Industrial:			
Unworked do	8,127	8,806	United States 1,997; United Kingdom 1,896; Switzerland 1,075.
Worked do	13	11	France 4; West Germany 3.
Diatomite and other infusorial earths	839	1,432	NA.
Feldspar, leucite, nepheline and nepheline syenite	15,422	4,597	Netherlands 4,525.
Fertilizer materials:			
Crude:			
Nitrogenous	699	177	NA.
Phosphatic	r 7,883	11,525	West Germany 4,508; Netherlands 1,793; Switzerland 1,420.
Potassic	r 1,463	1,044	NA.
Manufactured:			
Nitrogenous thousand tons	976	1,189	France 306; West Germany 299; United Kingdom 128.
Phosphatic do	1,844	1,922	France 852; West Germany 414; Ireland 153.
Potassic do	668	354	Norway 77; France 69; Netherlands 53.
Other including mixed do	1,188	1,232	France 770; West Germany 158; Denmark 39.
Ammonia do	132	131	France 126.
Fluorspar	539	207	NA.
Graphite, natural	31	111	NA.
Gypsum and plaster	9,467	10,728	Netherlands 9,113.
Lime thousand tons	577	616	Netherlands 506; France 104.
Magnesite	1,024	1,190	Netherlands 1,035.
Mica:			
Crude including splittings and waste	101	88	NA.
Worked including agglomerated splittings	519	582	United Kingdom 185; West Germany 114.
Pigments, mineral including processed iron oxides	r 3,195	24,067	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Precious and semiprecious stones:			
Natural (except diamond):			
Unworked—kilograms	18,477	9,722	Netherlands 1,918; Italy 1,396; West Germany 1,112.
Worked:			
Gem—do	167	93	West Germany 25; Netherlands 5; France 3.
Industrial—do	17	44	NA.
Manufactured (including diamond):			
Unworked—do	64	29	United Kingdom 12; Japan 4; Netherlands 3.
Worked—do	19	75	NA.
Pyrite (gross weight)	1,456	169	NA.
Salt and brine	7,083	9,406	France 8,779.
Sodium and potassium compounds, n.e.s.—thousand tons	193	297	West Germany 121; France 60.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous—do	1,148	1,049	Netherlands 1,015.
Slate—do	1	3	Netherlands 2.
Other—do	390	210	Netherlands 201.
Worked:			
Slate—do	1	1	NA.
Paving and flagstone—do	3	4	Netherlands 3.
Other—do	8	8	West Germany 2; Netherlands 2; France 1.
Dolomite, chiefly refractory grade—do	931	970	Netherlands 671; France 107.
Gravel and crushed rock—do	6,904	7,284	France 3,941; Netherlands 2,682; West Germany 281.
Limestone (except dimension)—do	677	588	Netherlands 443.
Quartz and quartzite—do	22	9	West Germany 7.
Sand excluding metal bearing—do	2,887	2,852	France 850; Italy 454; Netherlands 360.
Sulfur:			
Elemental, all forms	6,492	6,983	Netherlands 2,077; Philippines 456; Venezuela 449.
Sulfur dioxide	82	533	NA.
Sulfuric acid	156,586	142,343	France 110,081.
Talc, steatite, soapstone, and pyrophyllite	15,913	15,320	Sweden 2,841; West Germany 2,805; United Kingdom 2,700.
Other nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, jet	r 377	1,987	NA.
Lithium minerals	117	57	NA.
Vermiculite, perlite, chlorite	203	138	NA.
Other—thousand tons	1,624	239	Netherlands 229; France 7.
Slag, dross and similar waste, not metal bearing—do	2,909	2,721	Netherlands 1,323; France 830; West Germany 525.
Oxides and hydroxides of magnesium, strontium and barium	247	797	NA.
Halogens (other than chlorine and bromine)	44	49	Israel 9; Brazil 6; France 5.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	247,199	263,011	Netherlands 94,076; France 53,108; West Germany 47,328.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,332	4,953	Netherlands 3,725; United Kingdom 812.
Carbon black and gas carbon:			
Carbon black	5,490	9,802	NA.
Gas carbon	27	36	NA.
Coal and briquets:			
Anthracite and bituminous coal—thousand tons	590	543	West Germany 273; France 200; Netherlands 57.
Briquets of anthracite and bituminous coal—do	93	65	France 44; United Kingdom 7.
Coke and semicoke—do	507	516	France 134; Sweden 123; Portugal 53.
Hydrogen, argon and other rare gases	4,935	9,485	France 5,411; West Germany 1,220; United Kingdom 927.
Peat, including peat briquets and litter	r 610	817	NA.
Petroleum:			
Crude and partly refined—thousand 42-gallon barrels	178	190	West Germany 188.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum—Continued			
Refinery products:			
Gasoline, motor thousand 42-gallon barrels	r 17,604	15,623	West Germany 7,424; United Kingdom 2,777; Sweden 1,511.
Kerosine do	6,166	5,086	West Germany 1,655; United Kingdom 950; Netherlands 517.
Distillate fuel oil do	19,463	19,202	West Germany 8,982; Sweden 2,551; Norway 1,302.
Residual fuel oil do	27,066	25,295	Ship stores 14,172; West Germany 2,479; Sweden 2,306.
Lubricating oils and grease do	r 1,854	1,959	Netherlands 638; West Germany 188; Switzerland 153.
Mineral jelly and wax do	4	11	NA.
Other:			
Liquefied petroleum gas do	1,523	1,521	United States 308; United Kingdom 158; Portugal 130.
Nonlubricating oils, n.e.s. do	r 11	22	Netherlands 3; Zaire 3; Lebanon 3.
Pitch, pitch coke, petroleum coke do	422	278	Netherlands 94; France 78; Norway 47.
Bitumen and other residues do	1,934	2,353	Netherlands 1,193; West Germany 489.
Bituminous mixtures, n.e.s. do	44	73	Netherlands 35; United Kingdom 13; West Germany 5.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	152	162	West Germany 77; Netherlands 40; United States 16.

r Revised. NA Not available.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	12,865	14,659	French Guina 3,657; Guyana 3,421; People's Republic of China 2,018.
Oxide and hydroxide	12,902	16,338	West Germany 14,229.
Ash and residue containing aluminum	407	931	West Germany 515; Italy 316.
Metal including alloys:			
Scrap	6,461	6,920	Netherlands 4,818; France 868.
Unwrought	185,009	194,422	France 40,709; Norway 37,281; Netherlands 36,851.
Semimanufactures	30,225	37,108	West Germany 16,967; Netherlands 8,427; France 6,747.
Antimony:			
Ore and concentrate	6,520	8,245	Bolivia 5,191; Morocco 1,221.
Metal including alloys, all forms	4	36	NA.
Beryllium, metal including alloys, all forms kilograms	500	1,600	NA.
Bismuth, metal including alloys, all forms	r 285	235	France 126; West Germany 71.
Cadmium, metal including alloys, all forms	719	903	Japan 216; Zaire 116; U.S.S.R. 99.
Chromium:			
Chromite	18,546	21,989	Turkey 10,645; Republic of South Africa 7,491.
Oxide and hydroxide	r 424	489	West Germany 329; France 140.
Metal including alloys, all forms	73	50	United Kingdom 29; West Germany 13.
Cobalt, oxides and hydroxides kilograms	1,700	7,100	NA.
Copper:			
Ore and concentrate	21,222	37,594	Chile 16,380; Zaire 11,082; Poland 3,567.
Copper sulfate	296	1,177	U.S.S.R. 1,043.
Ash and residue containing copper	15,980	8,910	United States 1,261; France 1,250; West Germany 737.
Metal including alloys:			
Unwrought	384,748	396,958	Zaire 267,060; Peru 22,857; Chile 17,205.
Semimanufactures	r 12,934	14,424	West Germany 7,864; Netherlands 3,373; France 1,806.
Germanium, metal including alloys, all forms	14	6	Netherlands 4.
Gold, metal, unworked and partly worked thousand troy ounces	623	1,166	United States 792; Zaire 244; Switzerland 88.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Iron and steel:			
Ore and concentrate, except roasted pyrite—thousand tons	29,169	28,152	France 13,873; Sweden 8,017; Brazil 1,455.
Roasted pyrites—do	156	132	France 77; West Germany 37.
Metal:			
Scrap—do	836	632	France 282; West Germany 216; Netherlands 115.
Pig iron including cast iron—do	234	160	West Germany 90; France 37; East Germany 11.
Sponge iron, powder and shot—do	6	5	France 1; Sweden 1; West Germany 1.
Spiegeleisen—do	18	2	West Germany 1.
Ferroalloys—do	153	142	Norway 59; France 58; West Germany 14.
Steel, primary forms—do	1,068	851	Netherlands 329; France 205, West Germany 112.
Semimanufactures:			
Bars, rods, angles, shapes, and sections—do	567	586	France 268; West Germany 144; Netherlands 75.
Universals, plates and sheets—do	500	562	West Germany 220; France 112; Netherlands 91.
Hoop and strip—do	46	74	West Germany 31; France 30; Netherlands 7.
Rails and accessories—do	6	8	France 5; West Germany 2.
Wire—do	17	17	West Germany 9; Netherlands 4; France 3.
Tubes, pipes, and fittings—do	141	202	Netherlands 82; West Germany 64; France 41.
Castings and forgings, rough—do	9	10	West Germany 5; France 2; Netherlands 2.
Lead:			
Ore and concentrate	194,364	96,665	Canada 34,538; Ireland 16,904; Peru 14,690.
Oxides	3,816	2,193	Netherlands 802; West Germany 605; Mexico 286.
Ash and residue containing lead	67,544	64,991	France 22,378; West Germany 8,258; United States 7,020.
Metal including alloys:			
Scrap	13,713	10,202	West Germany 4,750; Netherlands 4,405.
Unwrought	17,000	22,243	France 8,452; West Germany 6,106.
Semimanufactures	852	1,504	West Germany 774; Netherlands 314; France 301.
Magnesium, metal including alloys:			
Scrap	r 125	173	NA.
Unwrought	1,612	1,209	Italy 552; United States 312; West Germany 150.
Semimanufactures	81	86	United States 32; West Germany 19; France 12.
Manganese:			
Ore and concentrate	349,780	463,347	Zaire 56,055; U.S.S.R. 47,660; Brazil 34,580.
Oxides	573	771	Japan 673.
Metal	175	337	Republic of South Africa 160; West Germany 59; France 58.
Mercury—76-pound flasks	3,536	4,711	Spain 1,201; United Kingdom 946.
Molybdenum:			
Ore and concentrate	5,112	4,561	Canada 2,290; United States 1,662.
Metal including alloys, all forms	13	170	Netherlands 161.
Nickel:			
Matte, speiss, and similar materials	33	88	Republic of South Africa 40; Canada 25.
Metal including alloys:			
Scrap	2,459	1,361	United States 561; United Kingdom 294; Netherlands 217.
Unwrought	2,650	2,446	United Kingdom 1,578; Norway 219; France 214.
Semimanufactures	1,278	1,727	United Kingdom 904; West Germany 275.
Platinum-group metals including alloys, all forms—troy ounces	39,461	50,200	United Kingdom 17,402; France 12,700; West Germany 11,927.
Rare-earth metals including alloys	94	176	France 72; Canada 10.
Selenium, elemental—kilograms	52,700	14,100	West Germany 11,400.
Silver, metal including alloys—thousand troy ounces	14,461	20,583	Netherlands 12,887; United Kingdom 1,688; West Germany 558.
Tin:			
Ore and concentrate—long tons	r 5,905	6,487	Zaire 4,502; Rwanda 1,580.
Oxides—do	7	32	West Germany 29.
Metal including alloys:			
Scrap—do	23	12	France 4.
Unwrought—do	2,741	1,601	Zaire 1,186; Malaysia 165.
Semimanufactures—do	r 231	200	Netherlands 129.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Titanium:			
Ore and concentrate	61,954	68,348	Canada 67,042.
Oxides	10,158	11,600	West Germany 7,357; Netherlands 1,917.
Metal including alloys, all forms	540	312	U.S.S.R. 175; United Kingdom 111.
Tungsten:			
Ore and concentrate	125	142	Zaire 121.
Metal including alloys, all forms	62	95	Portugal 25; Nauru 21; Switzerland 10.
Zinc:			
Ore and concentrate	617,863	529,122	Canada 330,806; Zaire 47,396; West Germany 36,365.
Oxide and peroxide	5,876	7,681	France 2,476; Netherlands 1,951; United Kingdom 1,376.
Ash and residue containing zinc	63,194	74,158	West Germany 31,782; France 12,426; United States 6,084.
Metal including alloys:			
Scrap	2,165	7,167	Canada 5,539; Netherlands 766.
Blue powder	1,255	370	West Germany 282; Netherlands 49.
Unwrought	29,226	35,045	Zaire 8,506; North Korea 6,566; Australia 3,809.
Semimanufactures	392	4,486	West Germany 3,169; United Kingdom 894.
Other:			
Ore and concentrate:			
Of niobium, tantalum, vanadium, and zirconium	2,456	2,592	West Germany 265; Brazil 200; U.S.S.R. 200.
Of precious metals—kilograms	46,500	--	
Of base metals, not elsewhere specified	12,317	4,070	Zaire 1,883; Bolivia 749.
Ash and residue containing nonferrous metals, n.e.s	r 123,696	126,679	West Germany 118,610; Hungary 3,397.
Waste and sweepings of precious metals value, thousands	$16,669	$1,035	United States $647; Netherlands $281.
Oxides, hydroxides and peroxides of metals, n.e.s	r 2,244	2,667	West Germany 1,403; Mozambique 322; Netherlands 245.
Metal including alloys, all forms:			
Metalloids:			
Tellurium and arsenic	53	154	Sweden 52; U.S.S.R. 6.
Other	555	543	West Germany 320; France 100.
Pyrophoric alloys	6	6	United Kingdom 3; Austria 2.
Base metals including alloys, all forms, n.e.s	13,014	11,228	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	196,641	141,733	West Germany 138,449; Italy 327; United States 281.
Dust and powder of precious and semi-precious stones, natural and manufactured, including diamond—kilograms	1,094	1,384	Netherlands 577; United States 369.
Grinding and polishing wheels and stones	2,153	2,484	France 1,544; West Germany 311.
Asbestos	54,839	70,068	Canada 40,443; Republic of South Africa 12,698.
Barite and witherite	6,464	6,559	France 4,752; West Germany 171.
Boron materials:			
Crude natural borates	36,749	50,591	Netherlands 36,753; Turkey 10,300.
Oxide and acid	2,435	3,290	France 1,934; West Germany 586.
Bromine—kilograms	43,400	14,400	NA.
Cement	50,564	84,105	West Germany 30,401; United Kingdom 26,776; France 13,003.
Chalk	80,908	92,064	France 61,664.
Clays and clay products:			
Crude clays:			
Bentonite	9,410	10,466	West Germany 5,696; United Kingdom 1,705.
Kaolin	229,848	208,622	United Kingdom 81,361; West Germany 65,879; Netherlands 48,146.
Other	306,678	246,834	West Germany 139,808; France 46,165; Netherlands 26,692.
Products:			
Refractory (including nonclay bricks)	133,333	144,246	West Germany 81,176; France 19,555; Austria 17,329.
Nonrefractory	226,861	227,060	Netherlands 83,949; West Germany 71,019; Italy 31,935.
Cryolite and chiolite	436	347	Denmark 345.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Diamond (except powder):			
Gem:			
Unworked—thousand carats	8,612	9,484	United Kingdom 7,156.
Worked—do	1,184	988	India 194; Israel 140; Republic of South Africa 119.
Industrial:			
Unworked—do	8,214	8,890	United Kingdom 3,296; Switzerland 1,788; Ireland 924.
Worked—do	3	9	West Germany 2; Republic of South Africa 1.
Diatomite and other infusorial earths	5,325	6,335	France 2,303; United States 1,428.
Feldspar, leucite, nepheline and nepheline syenite	56,908	44,099	Norway 20,278; France 13,738.
Fertilizer materials:			
Crude:			
Nitrogenous	12,577	13,282	Chile 13,012.
Phosphatic—thousand tons	1,900	2,001	Morocco 1,287; United States 325; U.S.S.R. 209.
Potassic	63,155	46,692	France 24,390; West Germany 22,160.
Manufactured:			
Nitrogenous	210,903	264,370	West Germany 120,331; France 57,523; Yugoslavia 24,378.
Phosphatic	10,124	33,642	Tunisia 17,707; Morocco 9,674; Netherlands 5,580.
Potassic—thousand tons	1,178	837	France 245; West Germany 238; U.S.S.R. 201.
Other including mixed	154,877	153,496	France 90,610; West Germany 41,426; Netherlands 16,172.
Ammonia	448,669	269,090	NA.
Flourspar	17,267	14,284	France 8,671; East Germany 2,242; West Germany 2,008.
Graphite, natural	719	778	France 406; West Germany 116.
Gypsum and plasters	488,583	474,524	France 411,558; West Germany 16,357.
Lime	187,437	177,716	France 144,862; West Germany 32,129.
Magnesite	8,712	10,591	Brazil 5,204; Austria 1,734; Czechoslovakia 1,471.
Mica:			
Crude including splittings and waste	2,176	1,515	United Kingdom 428; Malagasy Republic 371; India 286.
Worked including agglomerated splittings	86	82	East Germany 16; France 14; Switzerland 10.
Pigments, mineral including processed iron oxides	8,168	7,965	West Germany 6,900; Austria 135; France 121.
Precious and semiprecious stones:			
Natural (except diamond):			
Unworked—kilograms	781	610	West Germany 326; United States 68.
Worked:			
Gem—do	490	7,819	Netherlands 6,265; West Germany 612; France 364.
Industrial—do	62	3	NA.
Manufactured (including diamond):			
Unworked—do	2,376	1,087	United States 983; Ireland 92.
Worked—do	31	48	NA.
Pyrite (gross weight)	407,724	297,811	Spain 151,644; Portugal 141,072.
Salt and brine—thousand tons	1,414	1,595	West Germany 861; Netherlands 691; France 25.
Sodium and potassium compounds, n.e.s	34,199	24,939	West Germany 10,093; Sweden 2,186; Netherlands 1,237.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	r 153,781	137,643	France 54,300; Italy 17,796; Portugal 16,089.
Worked	r 31,178	32,869	Italy 10,503; France 6,572; Portugal 6,032.
Dolomite	25,340	42,227	France 29,986; West Germany 6,426.
Gravel and crushed rock—thousand tons	5,347	4,408	Netherlands 2,675; West Germany 526; United Kingdom 394.
Limestone (except dimension)	203,135	223,638	France 130,170; United Kingdom 83,030.
Quartz and quartzite	70,104	82,985	West Germany 64,397; Netherlands 2,566; Norway 2,399.
Sand excluding metal bearing—thousand tons	8,450	7,391	Netherlands 6,724; West Germany 26.
Sulfur:			
Elemental, all forms	333,809	429,777	United States 258,095; Canada 68,099; West Germany 35,592.
Sulfur dioxide	4,242	3,080	West Germany 2,768.
Sulfuric acid	218,544	285,732	West Germany 189,366; Netherlands 60,120.
Talc, steatite, soapstone, and pyrophyllite	39,751	26,009	United States 10,618; Norway 5,117; France 4,021.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Other nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, jet	20	--	
Lithium minerals	2,408	653	Netherlands 632.
Vermiculite, perlite, chlorite	24,652	24,397	U.S.S.R. 18,762; Greece 4,240.
Other	73,865	72,446	Netherlands 42,775; West Germany 19,249.
Slag, dross and similar waste; not metal bearing	256,800	339,356	Netherlands 234,735; France 68,022; West Germany 34,779.
Oxides and hydroxides of magnesium, strontium and barium	2,990	2,702	Netherlands 1,301; France 246.
Halogens (other than chlorine and bromine)	151	104	Japan 51; Chile 27.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	43,288	43,413	West Germany 17,825; Netherlands 7,085; France 6,592.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6,017	20,769	Netherlands 18,931; West Germany 581.
Carbon black and gas carbon:			
Carbon black	24,080	25,520	West Germany 9,104; Netherlands 8,436; France 3,682.
Gas carbon	1,224	1,564	France 1,088; West Germany 415.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	7,706	5,542	West Germany 2,879; United States 830; Poland 618.
Briquets of anthracite and bituminous coal do	282	194	Netherlands 182; West Germany 9.
Lignite and lignite briquets do	100	95	Mainly from West Germany.
Coke and semicoke do	5,211	4,392	West Germany 4,122; Netherlands 139; France 65.
Hydrogen, argon and other rare gases	2,634	3,544	West Germany 2,265; Netherlands 945.
Peat, including peat briquets and litter	60,401	50,464	Netherlands 28,617; West Germany 20,533.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 224,330	223,809	Saudi Arabia 39,985; Kuwait 30,812; Libya 28,616.
Refinery products:			
Gasoline motor do	7,911	8,585	Netherlands 3,321; U.S.S.R. 2,215; France 964.
Kerosine do	1,435	2,454	United Kingdom 950; Netherlands 792; U.S.S.R. 487.
Distillate fuel oil do	r 12,675	16,046	Netherlands 9,698; U.S.S.R. 2,283; Italy 1,349.
Residual fuel oil do	17,776	24,096	Netherlands 16,976; West Germany 3,124; France 1,974.
Lubricating oils and grease do	2,692	5,583	Netherlands 3,748; United States 519; United Kingdom 499.
Mineral jelly and wax do	94	104	West Germany 48; France 21; Netherlands 15.
Other:			
Liquefied petroleum gas do	43,952	60,366	Netherlands 59,578; West Germany 552; France 171.
Nonlubricating oils, n.e.s. do	r 11	14	Netherlands 11; France 2.
Pitch, pitch coke, petroleum coke do	962	598	United States 564.
Bitumen and other residues do	r 275	205	France 166.
Bituminous mixtures, n.e.s. do	217	273	Netherlands 145; West Germany 75; France 28.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	125,064	95,110	Netherlands 63,769; France 20,903; West Germany 8,445.

r Revised. NA Not available.

COMMODITY REVIEW

Metals.—*Aluminum.*—The plan for construction of the first primary aluminum production facility in Belgium at Amay has been dropped, at least until 1975. Accordingly, Belgium continued to import its primary aluminum, with the Netherlands replacing France as the largest supplier. Production of wrought aluminum products in 1972 increased 14% compared with that of 1971, with over 80% of the product exported, and 57% of the exported product shipped to EEC countries.

Other Metals.—*Iron and Steel.*—Production of steel achieved the record rate of 14.5 million tons in 1972, with a yield of 11.7 million tons of steel products, an increase of 14.8% compared with that of 1971; it was the sharpest increase among the EEC countries. Approximately 75% of the product was exported. Investment projects included a continuous casting machine for slabs to serve the plate mill of S.A. Forges de Clabecq and a capacity increase of 500,000 tons and a new blast furnace to lower costs of pig iron production at Société Metallurgie Hainut-Sambre at Coiullet. Both projects are to be completed late in 1974.

The overall production of nonferrous metals increased by 7% in 1972 compared with that of 1971. Zinc production increased substantially as a new electrolytic zinc plant of Société de Prayon, S.A., at Ehein went into production at midyear, and exports increased 40% compared with that of 1971.

The Union Miniére and Cié Royale Asturiéne des Mines have formed an association to prospect for nonferrous metal and associated minerals in Belgium. Modern techniques of aerial surveys and geophysical and geochemical analysis have never been utilized in Belgium.

Metallurgie Hoboken-Overpelt completed construction on a new 100,000-ton-per-year complex for continuous casting of copper and allied facilities for the production of copper wire. The facility is operated jointly with Usine à Cuivre et à Zinc de Liège.

Nonmetals.—Production of limestone increased substantially to supply the increasing needs of the domestic steel industry and for export. Swiss and French companies, with domestic producers, engaged in quarrying limestone in the Tournaisis and Limbourg basins. Cement production increased 2.3% compared with that of 1971, although the general industrial construction index showed no significant change compared with that of 1971.

Production of chemicals increased in volume 13% over the 1971 level, aided by startup of new plants erected in the interval 1970–1972 and higher utilization of overall capacity.

Mineral Fuels.—Coal production in 1972 totaled 10.5 million tons, a decrease of 4.2% from that of 1971; as production was concentrated in the more efficient mines. Imports totaled 6.4 million tons, with emphasis on coking coals from West Germany, the United States, Poland, and the Netherlands. Imports of crude oil were at an all time high as well as production and export of refinery products. Esso Belgium N.V. at Antwerp initiated construction of a new refinery of 12 million tons annual capacity that will replace the existing refinery in 1976. The National Iranian Petroleum Co. is conducting a feasibility study for a refinery at Liege, which would become the first refinery in Western Europe owned and operated by a Middle East oil-producing country.

The newest and ultimately the largest thermoelectric powerplant in Belgium, located at Kallo, West Flanders, was inaugurated in December with startup of two 280-megawatt units fueled with Dutch natural gas. Several more units of 600-megawatt capacity are planned at the same site.

Construction is nearing completion on the first commercial nuclear powerplant at Doel, a 380-megawatt pressurized water unit. Construction has been initiated on two additional units, one at Tihange of 890 megawatts scheduled for operation early in 1975 and the second unit at Doel to be operational in late 1975. Total nuclear capacity is projected as 2,600 megawatts by 1980 or 20% of installed capacity. Belgium-Luxembourg is also participating in a breeder reactor prototype project (SNR), as a Benelux initiative with West Germany. Construction has started on the 300-megawatt unit located in Kaskar, West Germany.

LUXEMBOURG

The steel industry, which dominates the industrial economy of Luxembourg, operated at near capacity in 1972. Iron ore mines operated by the largest steel company, Aciériés Réunies de Burbach-Eich-Dudelange (ARBED), produced a total of 11.2 million tons of iron ore in 1972, 3.5 million tons from four mines in Luxembourg and the remainder from captive mines over the French border. In addition, 7.0 million tons of direct shipping ore was imported from Sweden. Coke for steelmak-

ing was imported from captive mines and coke ovens in West Germany.

Total steel production of 5.46 million tons in 1972 represented a 4.1% increase over that of 1971 and equivalent to the record year of 1970. Production of finished and semifinished steel of 4.3 million tons equaled the previous record. Ninety-five percent of production was exported, and 65% of the exports were shipped to the original EEC partners. Exports to the United States increased by 19% to 274,000 tons, 6% of the export tonnage.

ARBED has established a $10 million steel tire cord plant at Bettembourg (S.A. Fan Luxembourg) in conjunction with National Standard Co. of Niles, Mich., to participate in the anticipated expansion of the wire market associated with radial tire production.

Luxembourg is collaborating with Belgium and France in the establishment of water basin control authorities to manage the construction of water treatment facilities. The Belgian and Luxembourg Governments have alloted $33 to $47 million annually for the next 15 years for construction of sewage and waste water treatment facilities. By yearend the first large water treatment plant on the Albert Canal had been designed. Several other projects were in the planning and contractor-selection phases of the public-facility acquisition process.

Table 4.—Luxembourg: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Iron ore and concentrate		5,722	4,507	4,116
Pig iron (including blast furnace ferroalloys)		4,814	4,588	4,671
Steel:				
Crude		5,462	5,241	5,458
Semimanufactures		4,278	4,092	4,302
NONMETALS				
Cement, hydraulic		245	262	309
Gypsum and anhydrate, crude	metric tons	5,062	5,351	4,890
Fertilizers, manufactured, phosphatic, Thomas slag, gross weight		795	841	908
Quartz, quartzite and glass sand	metric tons	15,400	8,625	36,825
Stone, sand and gravel, n.e.s.:				
Sand:				
Molding		17	15	5
Other, industrial		614	742	612
Stone:				
Building stone:				
Rough cut	thousand cubic meters	8	7	15
Facing	thousand square meters	42	53	1
Cut stone, crude	cubic meters	539	198	195
Crushed rock		248	609	566
Dolomite, n.e.s.		325	200	129
Limestone, n.e.s.		14	249	NA
Paving blocks	thousand pieces	36	27	51
Slate slabs	thousand square meters	14	13	13
MINERAL FUELS AND RELATED MATERIALS				
Manufactured gas	million cubic feet	[r] 111,664	97,786	NA

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

[1] In addition to the commodities listed, Luxembourg also produces refractory clays and manufactured phosphatic fertilizers other than Thomas slag, but data are not published and information is inadequate to make reliable estimates of output levels.

The Mineral Industry of Bolivia

By V. Anthony Cammarota, Jr. [1]

The mineral industry of Bolivia contributed 11.2% to the gross domestic product (GDP) in 1972 compared with 11.9% in 1971. Petroleum and natural gas accounted for 4.9% of the GDP. The mineral industry provided 78%, and petroleum and natural gas provided 19% of the total value of Bolivia's exports.

On October 27, 1972, the Bolivian peso was devalued from 11.875 pesos to 20 pesos for each U.S. dollar. The companies in the Medium Miners Association were significantly affected by the new 20% tax on the net c.i.f. value of mineral exports imposed by the Government after devaluation. Supreme Decree No. 10635 of December 15, 1972, softened the severe effects of the tax by allowing deductions for fees and contributions to state entities and repealing the 5% sales tax on imported machinery, equipment, and materials.

A list of the more important Supreme Resolutions (S.R.), Supreme Decrees (S.D.) and Decree Laws (D.L.) passed in 1972 affecting the mining and smelting industries follows:

S.D. 10069, January 7, 1972: Authorizes the Ministry of National Defense to become a partner in a joint venture with the Gibraltar Huari-Huari Mining Corp. to work the Huari-Huari tin-silver-zinc mine in the Department of Potosí.

S.D. 10207, April 14, 1972: For 2 years no National, Departmental, Municipal or University taxes will be paid by Corporación Minera de Bolivia (COMIBOL) for the acquisition of charcoal or residual wood to be used in COMIBOL's bismuth smelter at Telamayu.

S.D. 10262, May 19, 1972: Authorizes COMIBOL to use part of the Soviet credit of $27.5 million to purchase and install a tin volatilization plant in the city of Potosí at the Unificada mine site.

S.D. 10379, July 28, 1972: Eliminates payment of fees, established by S.D. 09028, for 5 years to the Banco Minero de Bolivia (BAMIN) on copper mineral exports and modifies export taxes on copper minerals or concentrates.

S.D. 10403, August 11, 1972: Authorizes Empresa Nacional de Fundiciones (ENAF) to acquire from Skoda Export, a Czechoslovakian firm, an electric furnace, which is in addition to equipment purchased from Skoda Export for the construction of the antimony smelter.

S.D. 10521, October 3, 1972: Establishes the National Policy of the iron and steel industry. The decree states that Mutún's minerals, including iron and manganese, are the exclusive property of the Government of Bolivia, and that the Mutún mineral deposit, because of its strategic location and its geopolitical significance, may not be bestowed, partially or wholly, to private entities or mixed societies. Mutún's development and exploitation must be realized by Bolivian Government agencies, which may form mixed societies for the installation and management of industrial plants if it is in the National interest.

S.D. 10607, December 1, 1972: Fixes indemnification for nationalization of the Matilde Mine Corp. at $13.4 million. COMIBOL becomes the sole and definitive owner of all of Matilde's assets in Bolivia.

S.D. 10611, December 1, 1972: Establishes a new gold policy, annuling the old policy expressed in S.D. 10315 of June 23, 1972. The new decree annuls the royalties of the old decree but applies a 2% tax on the gross value of gold production to amortize the Gold Cooperatives' debts to BAMIN. It further levies an additional 2% tax on the gross value to amortize the Gold Cooperatives' debt to the Corporación Boliviana de Fomento (Bolivian Development Corp.).

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

PRODUCTION

Of the 12 metals mined in Bolivia in 1972, six showed increases. The largest gains were reported for iron ore, 771%; antimony, 12%; tungsten, 7%; and tin, 5%. The largest declines were registered for bismuth, 7%; lead, 1%; zinc, 7%; and gold, 9%. Gypsum and sulfur were produced in greater quantities in 1972. Natural gas production continued its upward trend with a 49% increase over that of 1971. Crude oil production reached an all-time high of 15,967,000 barrels.

Table 1.—Bolivia: Approximate production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS [2]				
Aluminum, bauxite and concentrates		19	--	--
Antimony:				
Mine output, metal content		11,766	11,878	13,319
Metal [3]		33	--	NA
Bismuth:				
Mine output, metal content		608	682	632
Metal [3]		8	--	NA
Cadmium, mine output, metal content [4]		69	87	137
Copper, mine output, metal content		8,759	7,512	8,459
Gold, mine output, metal content [5]	troy ounces	30,603	22,193	20,145
Iron ore, gross weight		4,217	5,970	[e] 52,000
Lead:				
Mine output, metal content		25,397	20,600	20,377
Metal, including alloys		8	18	NA
Manganese ore, gross weight		84	713	93
Mercury [3]	76-pound flasks	12	--	--
Silver, mine output, metal content	thousand troy ounces	6,816	5,369	5,659
Tin:				
Mine output, metal content [6]	long tons	[r] 28,944	29,533	31,056
Metal, including alloys [7]	do.	301	7,116	6,405
Tungsten, mine output, metal content		1,845	2,090	2,233
Zinc, mine output, metal content		46,483	45,077	42,066
NONMETALS				
Cement, hydraulic	thousand tons	115	206	151
Fluorspar [3]		--	--	17
Gypsum, crude [3]		500	2,000	2,308
Mica		6	--	--
Stone:				
Calcite [3]		--	63	32
Quartz [3]		--	750	--
Sulfur, elemental [3]		16,313	10,000	18,214
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural:				
Gross production	million cubic feet	29,000	81,101	120,965
Marketable production [e]	do.	4,000	1,427	36,917
Natural gas liquids:				
Natural gasoline	thousand 42-gallon barrels	95	46	67
Liquefied petroleum gas	do.	32	48	51
Petroleum:				
Crude oil	do.	8,820	13,206	15,967
Refinery products:				
Gasoline	do.	1,869	2,174	2,111
Jet fuel	do.	99	115	129
Kerosine	do.	799	845	923
Distillate fuel oil	do.	642	1,625	1,847
Residual fuel oil	do.	941		
Lubricants	do.	47	45	55
Liquefied petroleum gas	do.	36	50	70
Other	do.	4	4	16
Refinery fuel and losses	do.	128	97	59
Total	do.	4,565	4,955	5,210

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

[1] In addition to the commodities listed, salt and a variety of construction materials such as clays, stone, and sand and gravel are produced, but information is inadequate to make reliable estimates of output levels.

[2] Unless otherwise specified, data shown represent the sum of production by COMIBOL and exports by medium and small mines.

[3] Total national exports.

[4] Contained in zinc concentrates produced by COMIBOL.

[5] Sum of placer production, COMIBOL production (in ores and concentrates of other metals) and medium and small mines' exports (in ores and concentrates of other metals).

[6] Total of COMIBOL output, COMIBOL purchases from lessees operating in COMIBOL mines, sales to ENAF by medium and small mines, and exports by medium and small mines.

[7] Production by ENAF, Pero, and Metabol smelters.

TRADE

Preliminary figures indicated an export value of $144.4 million [2] f.o.b. for minerals and $34.5 million for petroleum and natural gas in 1972. This is a decrease from 1971 figures of $0.9 million for minerals but an increase of $14.7 million for petroleum and natural gas. Greater exports of petroleum to Argentina, Brazil, Chile, and Peru, and the inclusion of natural gas exported to Argentina through the new pipeline were responsible for the gain.

In 1972 the private mining sector exported minerals valued at $46.7 million, down from $62 million in 1971. Lower metal prices and the exclusion of mine production from the nationalized Matilde Mine Corp. contributed to the decrease. COMIBOL's exports amounted to $77.4 million. Exports of tin by ENAF were valued at $20.3 million.

The value of all exported mineral commodities except copper, tin, zinc, gypsum, and sulfur decreased. Bolivia's tin exports of 30,087 long tons in 1972 were the highest since 1953. In addition increased quantities of antimony, copper, tungsten, gypsum, and sulfur were exported. Tin accounted for 65% of the total mineral export value in 1972 compared with 61% in 1971. The tin portion of the total export market decreased to 49% from 51% in 1971.

The relation of mineral trade to total trade for 1970–72 is shown in the following tabulation:

[2] Because of fluctuating exchange rates, a meaningful conversion from Bolivian pesos (B$) to U.S. dollars is impractical. At yearend, however, the exchange rate was 20B$=US$1.00.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports (f.o.b.):		
1970	172	r 192
1971	145	174
1972 p	144	186
Imports (c.i.f.):		
1970	NA	e 159
1971	NA	171
1972	NA	p 186

e Estimate. p Preliminary. r Revised.
NA Not available.

Table 2.—Bolivia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1970
METALS [1]			
Antimony:			
In ore and concentrate and as metal (including alloys)	11,576	11,673	United States 9,792; Japan 1,128; United Kingdom 421.
Bismuth in ore and concentrate	623	677	Peru 336; Belgium-Luxembourg 212; United Kingdom 44.
Cadmium in ore and concentrate	66	87	All to United States.
Copper in ore and concentrate	8,853	7,809	Japan 4,961; United States 3,128; Peru 397.
Gold troy ounces	4,990	638	Switzerland 3,938; United States 502; Peru 325.
Iron in ore and concentrate	4,217	3,618	All to Argentina.
Lead in ore and concentrate	25,756	23,336	United Kingdom 9,668; United States 9,422.
Manganese in ore	84	214	All to Argentina.
Mercury 76-pound flasks	1	--	All to United States.
Silver in ore and concentrate thousand troy ounces	5,967	5,530	United States 3,347; United Kingdom 1,280; Belgium-Luxembourg 739.
Tin:			
In ore and concentrate long tons	r 27,400	23,093	United Kingdom 20,861; United States 3,505; West Germany 1,183.
Metal do	--	6,707	
Tungsten in ore and concentrate	1,912	2,092	United States 1,828; Netherlands 52; West Germany 16.
Zinc in ore and concentrate	46,538	45,412	Japan 38,403; United States 8,064.
NONMETALS			
Gypsum	500	2,000	All to Brazil.
Mica	6	--	All to Argentina.
Stone:			
Calcite	--	63	
Quartz	--	750	
Sulfur, elemental	16,313	10,000	Chile 15,666.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, crude thousand 42-gallon barrels	4,662	8,447	Argentina 3,331; United States 1,331.

r Revised
[1] All data on metal exports are in terms of metal content of material shipped.
Source: State Department Airgrams A-150, LaPaz, June 26, 1971, and A-76, LaPaz, Apr. 3, 1971.

Table 3.—Bolivia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1968	1969
METALS			
Aluminum:			
Oxide and hydroxide	kilograms	348	596
Metal and alloys, all forms		484	382
Arsenic oxide and acids		1	4
Chromium oxide and hydroxide		8	29
Copper metal and alloys, all forms		293	143
Iron and steel:			
Pig iron, sponge iron, iron and steel granules, powder and scrap		1	600
Ferroalloys		635	501
Steel, primary forms		42	12
Steel semimanufactures, common steel:			
Bars, rods, angles, shapes, sections		9,653	10,972
Plates and sheets		11,390	12,567
Hoop and strip		103	88
Railroad track and accessories		1,400	9,220
Wire		3,016	4,449
Pipes, tubes and fittings		17,332	13,666
Castings and forgings		64	61
Steel semimanufactures, high carbon and alloy steel		1,981	2,121
Lead:			
Oxides		19	19
Metal, all forms		8	10
Magnesium metal, all forms		7	(1)
Manganese oxide	kilograms	12	1
Mercury	76-pound flasks	10	7
Molybdenum metal, all forms	kilograms	179	1,295
Nickel metal, all forms		2	6
Platinum-group metals, all forms	troy ounces	322	32
Selenium metal	kilograms	--	3
Silver metal, all forms	troy ounces	12,410	--
Tin metal and alloys, all forms	long tons	2	15
Titanium oxide		100	98
Tungsten metal, all forms	kilograms	202	474
Zinc metal, all forms		4	14
Other:			
Ashes, slags and residues of metallurgical operations:			
Base metals n.e.s	kilograms	2	4
Precious metals	do	37	--
Alkali and alkali earth metals		1,018	1,066
NONMETALS			
Abrasives, natural, except diamond		7	6
Asbestos	kilograms	115	166
Barite		606	507
Boric acid and oxides	kilograms	88	509
Cement, hydraulic, including clinker		46,017	51,578
Clays:			
Bentonite		6,137	2,497
Declorizing earths		15	34
Fire clay		25	54
Kaolin		41	97
Other		25	29
Diamond, industrial	carats	10,000	--
Diatomite		63	120
Fertilizers, manufactured:			
Nitrogenous (including natural Chilean nitrates)		1,879	2,400
Phosphatic		2,271	631
Potassic		70	22
Mixed		1,354	2,907
Graphite		8	20
Lime		88	18
Magnesite		60	(1)
Mica	kilograms	356	--
Pigments, mineral		47	38
Precious and semiprecious stones	kilograms	88	757
Salt		113	74
Sand		213	171
Sodium and potassium compounds n.e.s., sodium and potassium oxides and hydroxides		1,024	1,419
Stone:			
Dimension		10	30
Other	kilograms	48	8,254
Sulfur:			
Elemental		45	50
Sulfuric acid		115	24
Talc, soapstone and pyrophyllite		22	30
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		1,431	2,242
Carbon black		72	110
Coal, all grades		963	852
Coke, all types		231	623
Gases, helium, and other inert		9	5

See footnotes at end of table.

Table 3.—Bolivia: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1968	1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude oil	thousand 42-gallon barrels	(1)	(1)
Refinery products:			
Gasoline	do	132	116
Lubricants	do	6	7
Other	do	31	13
Total	do	169	136

[1] Less than ½ unit.

COMMODITY REVIEW

METALS

Bismuth.—In May COMIBOL inaugurated its new bismuth smelter, which was built at Telamayu by the Belgian firm Poudriere Reunione Belgique. The smelter, with monthly input capacity of 400 to 500 tons of bismuth concentrate averaging 13% to 15% bismuth and 8% to 10% copper, will be able to produce 60 to 70 tons of 99.995% metallic bismuth in 1974. In its first 6 months of operation, the smelter produced 239 tons of 92% to 94% bismuth, 13,035 troy ounces of silver, and 156 troy ounces of gold. Its operating costs averaged $2.55 per pound of bismuth produced. Blister copper and calcium arsenate are byproducts.

Iron Ore.—COMIBOL operated the 50-ton-per-hour beneficiation plant at the Mutún iron ore deposit in preparation for a 50,000-ton shipment of concentrate to Argentina beginning in January 1973. A feasibility study of the Mutún iron ore deposit was completed by Arthur D. Little, Inc. The report covered proposals to install a sponge iron and an iron oxide pellet plant at Mutún. The study included a detailed analysis of the market for sponge iron, a basic evaluation of the Mutún deposit, an estimate of the total investment required for establishing a pellet plant and a sponge iron plant, and an evaluation of the economic impact of an iron industry on the national economy. A direct-reduction process would be employed. The report sugested the construction of a natural gas pipeline from the Santa Cruz gasfields to Mutún.

Representatives of the Belgian firm Sybetre visited Bolivia and expressed great interest in the development of the Mutún deposit.

Tin.—Of the 31,056 long tons of tin-in-concentrates produced in 1972, COMIBOL contributed 21,246 long tons, the medium miners contributed 5,832 long tons, and the small miners contributed 3,978 long tons. COMIBOL's marketable tin output, up 6.3% from that of 1971, originated mostly from ore containing 0.76% tin, but also included purchases from independent small miners and from lessees and cooperative organizations working COMIBOL's small mines, and tin as a volatilization product from several plants. COMIBOL's costs to produce and market tin continued to rise, reaching $1.61 per pound in 1972 compared with $1.58 in 1971 and $1.50 in 1970. After the Bolivian currency devaluation of October 27, 1972, the costs in November and December decreased to $1.37 and $1.30, respectively. However, the new 20% tax on the value of exported tin imposed at the time of devaluation added 19 cents to the costs. The most important COMIBOL mine, Siglo XX, which produced about 32% of COMIBOL's tin output, reportedly is running out of low-grade tin mineralized ore, which it mines by block caving methods. This mine's largest tin reserve exists in its mill tailings. COMIBOL estimated its ore reserves at about 300,000 long tons of contained tin as of January 1, 1972. These reserves do not include alluvial deposits or tailings and dump materials that may be processed in the future.

Representatives from Klöckner-Humboldt-Deutz of West Germany and ENAF discussed plans to increase the capacity of the Vinto smelter from 7,400 long tons to 19,700 long tons, but no final decision was reached. ENAF has operated the plant for 2 years but has not overcome the problem of low tin recovery. In addition to ENAF's

smelter, there are two small tin smelters in Oruro, the Pero smelter and Metalurgia Oruro. Both smelters produce a volatilization product. The small Hormet smelter in La Paz produces a small amount of metallic tin.

Table 4.—Bolivia: Exports of tin by grade, group, and company, 1972

(Kilos of contained tin)

Grade	COMIBOL	Medium mines	BAMIN (small)	Other	Total
0–10	410,291	--	--	--	410,291
10–15	52,877	13,332	55,022	34,184	155,415
15–20	1,717,569	120,155	254,301	70,221	2,162,246
20–25	1,571,846	676,269	654,876	15,028	2,918,019
25–30	283,311	569,554	272,971	14,735	1,140,571
30–35	646,357	516,706	27,831	34,150	1,225,044
35–40	2,010,219	364,183	26,687	46,198	2,447,287
40–45	2,068,900	524,247	434,659	--	3,027,806
45–50	3,006,110	271,472	626,970	--	3,904,552
50–55	3,600,913	763,029	1,080,552	141,473	5,585,967
55–60	698,279	228,305	92,173	21,546	1,040,303
60–65	--	241,781	15,750	25,537	283,068
65–70	--	50,299	--	62,745	113,044
70–80	--	--	--	157,342	157,342
Over 99	--	16,854	--	5,982,662	5,999,516
Total	16,066,672	4,356,186	3,541,792	6,605,821	30,570,471

Source: Ministerio de Mineria y Metalurgia.

Table 5.—Bolivia: Exports of tin, by group

(Long tons of contained tin)

Group	1970	1971	1972 p
Tin-in-concentrates:			
Corporación Minera de Bolivia (COMIBOL)	16,653	13,988	15,813
Medium Miners Association	r 6,526	4,936	4,329
Banco Minero de Bolivia (BAMIN)	3,729	3,662	3,430
Smelter products:			
Refined metal and solder	r 6	6,707	6,200
Volatilization products	236	506	315
Total	r 27,150	29,799	30,087

p Preliminary. r Revised.

Michimen Co., Ltd., and Senju Metal Industry Co., of Japan signed a contract with ENAF to buy 590 long tons of electrolytic tin as a trial purchase to estimate the market. If successful, Japan will consider establishing a tin industry in one of the Andean Pact countries using Bolivian electrolytic tin.

Early in the year COMIBOL and International Metal Processing Corp. (IMPC) agreed to form a joint venture company Empresa Metalurgica Boliviana (EMBOSA) to operate the tin tailings concentration plant at Catavi with COMIBOL owning 55% of EMBOSA and IMPC owning 45%. The general manager of COMIBOL signed agreements with the U.S.S.R. for the installation of a tin volatilization plant at Potosí and an $8 million loan for mining equipment. Plans called for plant construction to begin in April 1973 with completion by June 1974. It was also agreed to examine the possibility of installing at a later date a tin volatilization plant in Oruro and Quechisla.

Zinc.—Bolivia's zinc marketing arrangement with Intermill Products Corp., a U.S. company, ran into difficulty early in the year. The problem arose from an Intermill request to renegotiate its contract to lower the price being paid for the concentrate because of pressure from its Japanese buyers. While negotiations continued, Intermill paid COMIBOL 80% of the original contract price for the production from the Matilde mine.

Soviet experts concluded a feasibility study for a zinc smelter, in which they suggested that the smelter be built at Guaqui or Calacoto de Carangas, near Corocoro. Zinc reserves for Bolivia were estimated at 850,000 tons. The smelter annually would take 119,000 tons of zinc concentrate and produce 50,000 to 65,000 tons of zinc metal and large amounts of sulfuric acid. About 65% of the acid

would be used by a copper lixiviation plant at the Corocoro mine.

MINERAL FUELS

Petroleum and Natural Gas.—Total crude petroleum production increased from 13,205,744 barrels in 1971 to 15,967,272 barrels in 1972, an increase in 1972 of 21% over that of 1971. The increase was the direct result of larger sales to Argentina and Chile, and a new marketing contract effective on July 1, 1972, with Brazil for the purchase of 12,000 barrels per day for a period of 2 years. Total petroleum exports in 1972 were 10,944,793 barrels. The wellhead value of the petroleum exported was reported by Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) to be $2.90 per barrel.

The capacity of the refinery at Cochabamba was increased from 8,842 barrels of petroleum per day in 1971 to 9,135 barrels in 1972. Plans had been made to process 13,000 barrels per day in 1972, but YPFB decided to obtain a loan to purchase the necessary equipment to increase the treatment capacity to 20,000 barrels per day. The loan also would be used to pay for the installation of a lubricating plant at Cochabamba and to increase the capacity of the Santa Cruz refinery from about 2,400 barrels per day to 12,000 barrels per day.

YPFB's drilling operations declined from a total of 173,657 feet drilled in 1971 to 110,785 feet drilled in 1972. Only five development wells and eight exploration wells were completed compared with 14 development wells and four exploration wells in 1971.

Table 6.—Bolivia: Crude petroleum production by company and field
(Thousand 42-gallon barrels)

Company and field	1971	1972 p
Yacimientos Petrolíferos Fiscales Bolivianos (YPFB):		
Monteagudo	3,046	3,583
Rio Grande	3,459	3,529
Caranda	3,920	3,172
La Peña	90	2,132
Colpa	787	1,899
Camiri	958	806
Tatarenda	729	552
San Alberto	1	114
Bermejo	99	80
Toro	74	61
Camatindi	30	26
Tigre	13	12
Total	13,206	[1] 15,967

p Preliminary.
[1] Data may not add to total shown because of independent rounding.
Source: Ministry of Energy and Hydrocarbons.

Table 7.—Bolivia: Consumption [1] of petroleum refinery products
(Thousand 42-gallon barrels)

Product	1971	1972
Jet fuel	109	121
Gasoline, aviation [2]	109	112
Gasoline, motor	1,797	1,888
Kerosine	825	884
Diesel oil	663	721
Fuel oil	714	765
Lubricants	r 58	e 65
LPG	r 86	115

e Estimate. r Revised.
[1] Figures refer to actual civilian and military consumption through sales to consumer and including YPFB consumption.
[2] Imports.

Payments by YPFB to Gulf Oil Co. to cover the expropriation of its properties in October 1969 were scheduled to start on January 1, 1973. YPFB will pay Gulf 25% of the value of its petroleum and natural gas exports from the Colpa, Caranda, and Rio Grande fields. Another 10% of the value of the exports of hydrocarbons from these fields will be used to pay Gulf's old standing debts. Bolivia and YPFB paid their old debts to Gulf and have to pay $7,484,477 more in the next 2½ years to cancel their old obligations, which now mainly consist of Gulf's loan to YPFB to construct a pipeline from Sicasica, Bolivia to Arica, Chile.

Representatives of various foreign oil companies were in Bolivia in late 1972 to discuss obtaining operating contracts with YPFB under the General Law of Hydrocarbons (D.L. 10170, March 28, 1972). An important aspect of the new law is the abolition of authority to award petroleum concessions to private companies. Henceforth, the role of private companies in conjunction with YPFB will be governed by terms of specific agreements to be negotiated in each case. Union Oil Co. of California was close to signing an operating contract with YPFB.

A significant event in 1972 was the completion by Williams Brothers Overseas Co. Ltd. of the 24-inch natural gas pipeline from the hydrocarbon fields around the city of Santa Cruz to the Argentine border town of Pocitos, which enabled YPFB to start pumping gas to Argentina on April 28, 1972. YPFB in 1972 delivered a total of

35,496,554,000 cubic feet to Argentina. Total natural gas production was 120,964,699,000 cubic feet compared with 81,101,322,000 cubic feet in 1971.

YPFB plans to install close to the city of Santa Cruz a liquid petroleum gas (LPG) plant with an output capacity of 1,200 barrels per day. The domestic consumption of LPG has increased from 86,000 barrels in 1971 to 115,000 barrels in 1972, an increase of 34%. Howe Baker Engineering, Inc., in November 1968 constructed a small LPG plant in Camiri with an annual output capacity of 32,300 barrels, which has been increased to about 51,600 barrels. The plant's output is no longer sufficient or as economically viable as that of a larger plant constructed in a more commercially advantageous location.

Gas reserves are expected to be sufficient to supply the internal needs of Bolivia for a long time, including the present natural gas sales commitment to Argentina for the next 20 years. Present sales to Argentina average about 150,000,000 cubic feet per day. Total indicated gas reserves in Bolivia are estimated to be about twice the total to be purchased by Argentina at the present rate of gas sales, or a total reserve of 2.2 trillion cubic feet. This includes the reserves estimated from the development of the new La Peña petroleum-gasfield and the discovery of a small gasfield, Enconada, in 1972 in the Department of Santa Cruz. There are also inferred gas reserves such as the one at Yapacani that have not been developed. These may eventually increase the indicated reserves by as much as 1 trillion cubic feet.

YPFB expects petroleum reserves to be enough to guarantee internal consumption at a rate of 15,000 barrels per day for a period of 10 years. This amount would indicate a present total reserve of only 54,750,000 barrels. A more accurate estimate of total petroleum reserves on December 31, 1972, may be made by using Gulf's data of 1969. These data, after subtracting production of the intervening years, indicate that barring losses of petroleum reserves caused by loss of gas cap drive during 3 years following Gulf's nationalization, the Caranda, Colpa, Rio Grande, and La Peña fields should have a total reserve on December 31, 1972, of 162 million barrels. In addition, on December 31, 1972, YPFB's original fields probably contained about 20 million barrels of questionable economically extractable reserves.

Petrochemicals.—Bolivia and Peru planned to erect a petrochemical plant at the border town of Desaguadaro. The feedstock is estimated at 10,000 barrels per day of LPG from the Santa Cruz LPG plant and 4,000 barrels per day of naphtha from the Cochabamba refinery. The Bolivian Intermediary Products Plant section will have an annual capacity of 53,000 tons of styrene, 12,000 tons of polystyrene, 28,000 tons of high-density polyethylene, and 25,000 tons of polypropylene.

Argentina and Bolivia agreed to build a binational pesticide-insecticide plant in the town of Oruro with an annual output capacity of 7,100 tons. Bolivia has started preliminary discussions with Brazil regarding the construction of a binational fertilizer plant reportedly to be located close to the city of Santa Cruz.

The Mineral Industry of Brazil

By F. W. Wessel [1]

The mineral industry of Brazil completed its seventh consecutive year of expanded production, keeping pace with the economy as a whole. Domestic and foreign investors and the Government itself were active in exploration and development of and production from mining properties throughout the country, including important deposits in rapidly developing Amazônia.

The Brazilian Government created and maintained a political and financial climate favorable to such activity. The Government also continued its long and generally successful campaign to slow the rate of inflation while bringing about an annual economic growth rate of 8% to 10%, and to reduce the negative balance of trade by fostering industries that (1) will produce materials heretofore imported, and (2) will produce for the export market.

On October 14, President Médici signed two bills designed toward improving the country's trade balance. Decree-Law 1240 offers partial or total exemption from income taxes to those companies mining ores in excess of domestic needs for export. To qualify, the company must have over 50% Brazilian ownership, its fiscal structure and technical capability must be approved by the appropriate government agency, at least half of the quantity produced must be for export, and the f.o.b. value of the beneficiated or otherwise treated ore must be at least 50% higher than the value of raw ore at the same shipping point. The Decree-Law also permits a qualifying company to deduct part or all of the tax normally paid on dividends to non-Brazilians; the money is credited to the company in a special fund earmarked for two purposes only: development of mining property, and payment of other federal taxes.

Decree 71,248 provides for government financing of companies attempting to produce minerals which are in short supply in Brazil. The Government will provide financing in amounts up to twice the funds invested by the company in bringing the property to production. The minerals specified in the decree are copper, zinc, nickel, sulfur, phosphates, sodium compounds, and coking coal.

In April, Cia. de Pesquisa de Recursos Minerais (CPRM), the Government's mineral exploration agency, contracted with Texas Instruments, Inc., for a detailed survey of Brazil's mineral potential. In October, Litton Industries' Aero Service Division completed an aerial survey of 1.7 million square miles of the Amazon Basin. The use of side-looking airborne radar was the basis for producing maps of an initial accuracy of one-eighth mile. A private multinational investment company, Adela Empreendimentos e Consultoria, Ltda., began a 5-year exploration program for mineralization, concentrating on Brazil's Precambrian areas.

Brazil is devoting much effort to the infrastructure. The Trans-Amazon Highway, a 3,100-mile link between João Pessoa on the Paraíba coast to the Peruvian border runs roughly parallel to and about 200 miles south of the Amazon River. The road will provide improved communication with the Rondônia tin district and, because of its intersection with the Belem–Brasilia highway, will link Amazônia with both northeastern and southeastern industrial centers and ports. The road is to be completed in 1974.

Much effort was also invested in developing hydroelectric power and river transportation in the Paraná basin. The Sete Quedas hydroelectric project, on the border of Paraguay about 500 miles west of São Paulo, is planned to produce 10 million kilowatts of electric power. Interna-

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tional implications exist, and Brazil and Argentina concluded an agreement for consultation and cooperation during the year, in order that no action be taken upstream that would adversely affect the Paraná River downstream in Argentina.

Brazil's gross national product (GNP) in 1972 was equivalent to $46.85 billion,[2] an increase of 13.6%. The estimated value of Brazil's mineral production was $786 million, or 1.73% of the GNP. The value of petroleum produced was roughly estimated at one-fourth of the total, and that of iron ore one-third or a little more.

PRODUCTION

The value of Brazil's mineral industry production in 1972 was estimated at $786 million. Commodities recording substantially increased production in 1972 included aluminum, zinc, and iron and steel; of the major metals, only copper production declined seriously. Production of iron ore and of petroleum decreased by about 1½% each. Table 1 shows mineral production data for the years 1970 through 1972.

[2] Because of fluctuating exchange rates a meaningful conversion to U.S. dollars is impractical. At yearend, however, the exchange rate was New Cruzeiros (NCr$) 6.215=US$1.00.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 [p]
METALS			
Aluminum:			
Bauxite, gross weight	500,000	538,600	605,700
Alumina	118,600	166,800	192,027
Metal, primary	r 56,147	80,647	97,412
Antimony [2]	43	2	e 1
Arsenic, white	298	148	164
Beryllium, beryl concentrate, gross weight [3]	3,333	2,500	1,551
Chromium, chromite, gross weight	27,614	e 28,000	e 30,000
Columbium and tantalum ore and concentrate, gross weight:			
Columbite [3]	41	63	4
Tantalite [3]	209	290	149
Pyrochlore	13,285	6,094	9,635
Copper:			
Mine output, metal content	3,840	5,100	4,305
Metal, smelter (blister) [4] [e]	r 3,800	3,900	4,800
Gold [5] troy ounces	171,331	157,378	165,544
Iron and steel:			
Iron ore and concentrate [e] thousand tons	40,200	42,700	42,100
Pig iron excluding ferroalloys do	4,205	4,686	5,300
Ferroalloys:			
Ferrochromium	5,871	10,186	11,656
Ferrocolumbium	(6)	1,475	2,437
Ferromanganese	r 42,160	72,217	73,097
Ferronickel	r 10,844	10,524	10,179
Ferrosilicon	r 18,704	13,147	23,898
Silicomanganese	r 15,456	18,712	16,996
Other	651	521	839
Total	r 93,686	126,782	139,102
Steel, crude, excluding castings thousand tons	5,390	6,011	6,518
Steel semimanufactures [7] do	3,984	4,554	5,155
Lead:			
Mine output, metal content	27,578	28,302	29,600
Metal, smelter, primary	19,184	25,646	25,033
Manganese ore and concentrate (marketable), gross weight thousand tons	1,880	2,602	2,608
Nickel:			
Mine output, metal content [e]	2,900	2,800	3,600
Ferroalloy, nickel content	r 2,506	2,587	e 2,600
Rare earth, monazite concentrate, gross weight	2,308	1,363	2,225
Silver thousand troy ounces	357	624	319
Tin:			
Mine output, metal content long tons	r 3,553	2,065	2,769
Metal, smelter, primary do	r 3,051	3,370	3,526
Titanium:			
Ilmenite concentrate, gross weight	20,644	9,894	3,492
Rutile concentrate, gross weight	234	117	412
Tungsten, mine output, metal content	1,156	1,398	1,247
Zinc:			
Mine output, metal content [e]	12,600	r 16,920	17,800
Metal, smelter [e]	r 11,000	r 15,000	17,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 [p]
METALS—Continued				
Zirconium concentrate, gross weight:				
Zircon		3,838	4,168	4,578
Baddeleyite-caldesite		229	328	
NONMETALS				
Abrasives, natural n.e.s., corundum and emery		2,998	e 3,000	e 3,000
Asbestos, fiber [8]		16,000	20,000	33,000
Barite [9]		25,600	42,659	46,242
Cement, hydraulic (including pozzolanic)	thousand tons	9,002	9,802	11,381
Diamond: [10] e				
Gem	thousand carats	160	160	150
Industrial	do	160	160	160
Total	do	320	320	310
Fertilizer materials:				
Crude phosphates, phosphate rock (includes apatite):				
Gross weight		r 172,968	212,422	299,930
P_2O_5 content		58,989	72,536	e 100,000
Manufactured, nitrogenous:				
Gross weight		r 46,365	157,400	e 175,000
Nitrogen content		22,177	67,711	e 75,000
Fluorspar e		35,000	40,000	40,000
Graphite, all grades		2,500	2,733	3,137
Gypsum and anhydrite, crude e		290,000	290,000	290,000
Lime e	thousand tons	1,800	2,000	2,000
Lithium minerals [3]		[11] 3,651	[11] 6,348	NA
Magnesite e		235,000	269,000	249,000
Mica, all grades [3]		2,019	2,403	2,550
Precious and semiprecious stones, except diamond:				
Agate, rough [3]		904	791	1,032
Other stones, uncut [3]		872	1,073	751
Quartz, crystal, all grades [3]		5,908	4,588	3,405
Salt, marine	thousand tons	r 1,826	1,477	2,178
Stone, n.e.s.:				
Dimension stone, marble		NA	NA	NA
Crushed and broken, dolomite		NA	NA	NA
Sulfur, elemental, byproduct		8,950	9,200	9,200
Talc e		130,000	130,000	130,000
Vermiculite e		4,240	4,500	4,500
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		48,800	57,100	e 60,000
Coal, bituminous (washed)	thousand tons	2,367	2,491	2,491
Coke:				
Metallurgical	do	r 1,615	1,345	1,670
Gashouse	do	187	e 162	45
Gas:				
Manufactured, all types	million cubic feet	14,196	13,349	11,021
Natural:				
Gross withdrawal	do	44,638	41,565	43,861
Marketed production e	do	8,000	8,300	8,500
Natural gas liquids	thousand 42-gallon barrels	956	1,373	1,495
Petroleum:				
Crude	do	59,969	62,000	61,088
Refinery products:				
Gasoline	do	60,083	64,306	72,088
Jet fuel	do	5,143	5,670	6,400
Kerosine	do	4,887	4,501	4,214
Distillate fuel oil	do	43,827	44,555	54,382
Residual fuel oil	do	54,763	62,354	73,815
Lubricants	do	45	16	76
Other	do	6,794	6,332	24,025
Refinery fuel and losses	do	10,589	6,154	4,077
Total	do	186,131	193,888	239,077

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to the commodities listed, molybdenite, bismuth, diatomite, feldspar, and a variety of crude construction materials (common clay, 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.

[2] Includes a small quantity of metal contained in antimonial lead.

[3] Exports.

[4] Includes secondary metal.

[5] Officially reported and estimated. Much placer gold produced eludes statistical coverage.

[6] Revised to none.

[7] Excludes castings and forgings.

[8] As reported by one major producer in Brazil. Asbestos is produced in three other states, but data are not available.

[9] Includes both ore and concentrate.

[10] By far the larger part of Brazil's diamond production is not reported statistically; hence the estimates tabulated are based only on very general marked information.

[11] 1970—of which 2,500 metric tons petalite exported; 1971—petalite exported.

TRADE

As in 1969 and 1970, the United States and West Germany held first and second rank as Brazil's foreign trade partners. The leading mineral commodity exported was iron ore; exports were valued at $237 million. Petroleum and petroleum products imported were valued at $460 million.

Exports of iron ore increased 11%, and those of manganese ore and concentrate increased 13% in 1971. Among the nonmetallics exported magnesite increased 132%, barite increased 39%, and exports of gem diamond and fluorspar also showed increases. Decreases were noted in exports of pig iron, which decreased 32%, and of primary steel and steel semimanufactures, which declined 58% and 52% respectively.

In 1971 imports of steel increased 155% and those of refined copper and slab zinc were up 39% and 15% respectively. Aluminum imports, reflecting Brazil's growing domestic capacity, declined 11%. Imports of the platinum-group metals were up 51%, and imports of chromite doubled.

In the nonmetallic sector, sulfur imports increased 38% and imports of phosphate rock increased 43%; imports of manufactured phosphatic fertilizers declined correspondingly by 41%. Caustic soda imports were 48% less in 1971 than in 1970, but imports of soda ash, sodium sulfate, and bromine showed sharp increases. Cement imports were down 17%. Reflecting greater home consumption and reduced exports of steel, coal imports were 13% less than in 1970. Imports of crude oil showed the usual increase of about 18%.

Table 2.—Brazil: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	3,414	4,005	Uruguay 2,300; Argentina 1,693.
Oxide (alumina) and hydroxide	r 2,327	2,979	Argentina 1,432; Mexico 1,192.
Metal, including alloys:			
Unwrought	(1)	94	Argentina 51; Uruguay 43.
Semimanufactures	18	96	Paraguay 91.
Antimony, metal, crude	14	3	All to Colombia.
Beryl, ore and concentrate	3,333	2,501	United States 2,321.
Chromium:			
Ore and concentrate	160	5,750	Japan 5,500.
Metal	10	(2)	NA.
Columbium, tantalum and pyrochlore, ore and concentrate:			
Columbite	41	63	United States 60.
Tantalite	209	290	United States 196.
Pyrochlore	8,500	1,640	United States 674; Japan 345; United Kingdom 300.
Other	--	5	All to United States.
Copper, metal, including alloys, all forms	962	824	Belgium-Luxembourg 420; Uruguay 217.
Iron and steel:			
Ore and concentrate thousand tons	27,943	31,020	Japan 9,132; West Germany 7,661; France 2,163.
Scrap	r 343	--	
Pig iron and similar materials	165,842	112,919	Argentina 44,870; United States 38,676.
Sponge iron, powder and shot	27	180	Argentina 140.
Ferroalloys:			
Ferromanganese	4,570	6,361	Venezuela 4,890; Colombia 1,350.
Ferroaluminum	--	192	All to Belgium-Luxembourg.
Ferrosilicon	1,417	--	
Ferrochrome	2,320	2,109	United States 1,219.
Ferronickel	7,400	5,572	Japan 2,807; Canada 1,207.
Other ferroalloys	2,011	6,646	Venezuela 5,150.
Steel:			
Primary forms	212,137	89,071	Argentina 68,477; Uruguay 10,497.
Semimanufactures	374,162	179,253	United States 77,238; Argentina 43,154; Uruguay 25,564.
Lead:			
Ore and concentrate	4,500	5,750	Japan 5,500.
Metal, including alloys, all forms	55	9	Paraguay 6.
Manganese:			
Ore and concentrate	1,588,079	1,797,039	United States 699,783; Norway 289,505; Canada 132,783.
Metal, including alloys, all forms	1	(2)	NA.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Nickel metal including alloys, all forms	1	11	United Kingdom 8.
Platinum-group metals and silver:			
Platinum group—troy ounces	--	6,719	Spain 4,855; Argentina 965.
Silver—do	78,480	69,092	United States 64,301.
Rare-earth metals:			
Ore and concentrate, except monazite	--	1,605	Austria 599; Japan 508; United Kingdom 314.
Metal, ferrocerium—kilograms	2,000	8,000	Italy 5,000; United Kingdom 3,000.
Tin:			
Ore and concentrate—long tons	--	10	All to United States.
Metal, including alloys, all forms—do	1,051	1,032	Argentina 644; United States 170.
Titanium oxide	6	(2)	NA.
Tungsten:			
Ore and concentrate	r 1,644	2,268	Netherlands 835; Sweden 550; West Germany 325.
Metal, including alloys, all forms—kilograms	1,874	4,450	Japan 3,048.
Zinc:			
Ore and concentrate	--	101	All to Belgium-Luxembourg.
Metal, including alloys, all forms	103	6	Chile 4; Paraguay 2.
Uranium and thorium, ore and concentrate	1,881	--	
Other:			
Ore and concentrate, n.e.s	40	3 7,415	United States 6,348.
Ash and residue containing nonferrous base and precious metals	29	32	All to United Kingdom.
Metals, including alloys, all forms	r 1	--	
NONMETALS			
Abrasives, natural:			
Crude emery, corundum and pumice 4	10	14	Mainly to Argentina.
Grinding and polishing wheels and stones	143	230	Chile 99; Peru 36; Argentina 22.
Asbestos	--	400	Argentina 200; France 100.
Barite and witherite	18,367	25,495	Trinidad and Tobago 19,217; Venezuela 6,096.
Cement	557	1,124	Paraguay 835.
Clays and clay products:			
Crude clays:			
Bentonite	491	10	All to Argentina.
Kaolin	1,503	2,180	Uruguay 1,510; Chile 600.
Refractory clay	30	--	
Other	16	32	United Kingdom 20.
Products:			
Refractory	r 300	6,604	Argentina 6,074.
Nonrefractory	2,967	4,142	Paraguay 3,660.
Diamond:			
Gem, uncut and cut, but unset—carats	20,865	35,315	Netherlands 23,775; United States 3,900.
Industrial—do	25,695	25,705	Mainly to Netherlands.
Diatomite and other infusorial earth	--	(2)	NA.
Feldspar	2	--	
Fertilizer materials:			
Crude, phosphatic	--	1	All to Panamá.
Manufactured	91	59	Paraguay 57.
Fluorspar	20,650	22,095	Japan 22,070.
Graphite	12	--	
Lime	15	--	
Lithium minerals	3,651	(3)	NA.
Magnesite	17,513	40,595	United Kingdom 9,750; Spain 6,700; Argentina 5,500; Belgium-Luxembourg 4,800.
Mica, all forms	2,027	2,543	Norway 1,130; United States 931.
Precious and semiprecious stones, except diamond:			
Crude and worked, except dust and powder:			
Agate—kilograms	r 904,193	793,706	United States 328,683; Japan 201,381.
Amethyst—do	88,341	253,627	Japan 64,339; West Germany 61,253; United States 53,182.
Aquamarine—do	708	3,511	Switzerland 1,762; West Germany 1,282.
Cat's eye—do	18	20	Hong Kong 14.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Precious and semiprecious stones, except diamond—Continued			
Crude and worked, except dust and power—Continued			
Citrine—do	6,366	15,116	West Germany 9,003; United States 2,278; Japan 2,012.
Emerald—do	4,006	12,946	United Kingdom 10,639.
Garnet—do	441	4,580	Japan 2,269; West Germany 1,031; Austria 1,030.
Opal—do	46	359	West Germany 195; United States 106.
Ruby—do	5	9,508	West Germany 9,500.
Sapphire—do	1	(2)	NA.
Topaz—do	332	4,774	United States 4,011.
Tourmaline—do	1,052	8,272	West Germany 2,960; Switzerland 2,471; Netherlands 1,000.
Turquoise—do	(2)	(2)	NA.
Other—do	655,405	767,548	United States 172,945; Japan 146,091; West Germany 130,336.
Dust and powder, not further identified—do	106,600	NA	
Quartz crystal:			
Electronic and optical grade	176	98	Japan 49; United Kingdom 24.
Other (lasca)	5,732	4,491	West Germany 1,595; Japan 865; France 613.
Salt	7	18	All to Paraguay.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	14,029	17,259	Italy 9,384; Japan 2,093; Spain 1,876.
Worked	1,458	958	Japan 471; United States 275.
Dolomite	1,026	1,413	Argentina 1,113.
Gravel and crushed stone	--	27	Paraguay 26.
Quartz and quartzite	--	136	Belgium-Luxembourg 133.
Sand, excluding metal bearing	1	46	Argentina 45.
Talc, steatite, soapstone and pyrophyllite	597	251	Colombia 170; Argentina 35.
Vermiculite	100	30	All to Portugal.
Other nonmetals, n.e.s.:			
Slag and similar waste from the manufacture of iron and steel	120	60	All to Argentina.
Other	1	--	
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	1,122	338	Uruguay 265; Chile 68.
Coal, coke and lignite	10	6	All to Bolivia.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	479	6,342	Netherlands Antilles 3,457; Argentina 1,344; Bahamas 1,298.
Refinery products:			
Gasoline—do	--	9	All to Paraguay.
Kerosine—do	888	391	Argentina 139; Uruguay 123.
Distillate fuel oil—do	877	1,261	Argentina 992.
Residual fuel oil—do	4,750	2,177	United States 1,538.
Lubricants—do	(2)	(2)	NA.
Other—do	r 48	210	Mainly to Netherlands Antilles.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	20	378	Argentina 373.

r Revised. NA Not available.
1 Revised to none.
2 Less than ½ unit.
3 Lithium minerals are apparently included in ore and concentrate, n.e.s.
4 Revised to exclude artificial corundum.

Table 3.—Brazil: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	1,616	--	
Oxide (alumina) and hydroxide	1,113	1,378	West Germany 965; United States 241.
Metal:			
Scrap	8	(1)	NA.
Unwrought	28,437	25,436	Canada 12,887; United States 3,583; France 3,499.
Semimanufactures	4,114	3,802	United States 1,516; Belgium-Luxembourg 623.
Antimony:			
Ore and concentrate	96	374	Mexico 101; United States 78; Austria 62.
Metal, including alloys, all forms	49	286	Japan 90; Belgium-Luxembourg 69; Mexico 60.
Arsenic, trioxide and regulus	492	319	France 131; Sweden 98; West Germany 38.
Bismuth, metal, including alloys, all forms—kilograms	14,067	12,999	Mexico 5,222; West Germany 4,803.
Cadmium metal, including alloys, all forms—do	r 55,172	89,591	Mexico 51,677; West Germany 22,364.
Chromium:			
Chromite	8,245	16,688	Philippines 15,708.
Metal, including alloys	15	16	Japan 7; United Kingdom 5; United States 4.
Cobalt:			
Oxide and hydroxide	56	63	United Kingdom 39; Belgium-Luxembourg 22.
Metal, including alloys, all forms	148	96	Belgium-Luxembourg 93.
Columbium and tantalum, metal	1	(1)	NA.
Copper:			
Copper sulfate	2,669	--	
Metal:			
Scrap	264	325	United States 240.
Unwrought:			
Refined, unalloyed	50,637	70,437	Zambia 18,359; United States 18,189; Chile 10,389.
Alloys	--	477	Canada 309; United States 168.
Master alloys	8	20	Belgium-Luxembourg 10; United Kingdom 6.
Semimanufactures	2,573	1,052	West Germany 393; United Knigdom 186; United States 176.
Gold metal, unworked or partly worked—troy ounces	121,954	135,162	United Kingdom 76,101; Canada 38,002.
Iron and steel:			
Ore and concentrate	1	4	Mainly from United States.
Metal:			
Scrap	84	229	United States 69; United Kingdom 68; West Germany 47.
Sponge iron, powder and shot	2,008	3,703	United States 2,423; Japan 820.
Ferroalloys	4,983	23,025	United States 7,559; France 3,770; Canada 3,206.
Ingot and semimanufactures	462,792	1,181,188	Japan 483,772; United States 159,951; West Germany 118,652.
Lead:			
Oxides	322	424	Mexico 351.
Metal, including alloys, all forms	1,382	8,325	Mexico 5,835; Peru 1,912.
Magnesium metal, including alloys, all forms	6,765	6,820	United States 5,145.
Manganese:			
Ore and concentrate	541	4,353	Gabon 3,500.
Oxide	1,350	1,555	Japan 1,178.
Metal	215	170	Japan 103.
Mercury—76-pound flasks	3,104	3,443	Mexico 3,420.
Molybdenum:			
Ore and concentrate	312	291	United States 168; Canada 114.
Metal, including alloys, all forms	13	13	United States 7; Netherlands 3; West Germany 2.
Nickel, metal:			
Matte, speiss and similar materials	--	1	All from Netherlands.
Unwrought	655	849	United States 485; Netherlands 115.
Semimanufactures	767	660	France 175; United States 174; France 70.
Platinum-group metals, including alloys, all forms:			
Platinum [2]—troy ounces	6,495	2,283	United States 1,479; West Germany 547.
Other—do	12,216	25,881	Netherlands 15,754; United States 8,005.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Rare-earth metals—grams	861	7,000	All from United States.
Selenium, elemental—kilograms	7,464	10,307	West Germany 3,303; United States 3,248; Mexico 2,750.
Silicon, metal	1,327	1,891	Norway 826; United States 716.
Silver metal, including alloys thousand troy ounces	1,718	1,942	West Germany 549; Peru 493; United Kingdom 335.
Sodium, metal—kilograms	12,890	10,987	West Germany 8,749.
Tellurium, elemental—do	123	305	Canada 100; Netherlands 100; United Kingdom 100.
Tin:			
Ore and concentrate—long tons	--	1,400	Bolivia 836.
Oxides—do	63	70	West Germany 37; United Kingdom 33.
Metal, including alloys, all forms do	7	11	United States 10.
Titanium:			
Ores and concentrates, rutile and ilmenite	11,170	12,889	Australia 11,320.
Oxides	18,307	16,946	United Kingdom 5,019; Finland 3,234; West Germany 3,204.
Metal, including alloys, all forms	--	31	United States 17; Italy 13.
Tungsten	10	20	United Kingdom 9; United States 6.
Uranium and thorium, isotopes and compounds—value	$481,740	$174,406	United States $69,743; Canada $47,151; West Germany $36,916.
Vanadium metal, including alloys, all forms	--	10	All from United States.
Zinc:			
Oxide	128	166	Netherlands 63; West Germany 55; United States 37.
Metal:			
Unwrought	43,977	50,557	Mexico 18,658; Peru 14,577.
Semimanufactures	49	141	Belgium-Luxembourg 55; United States 39.
Zirconium and hafnium:			
Ore and concentrate	2,507	5,083	Australia 4,634.
Metal, including alloys, all forms	--	14	Mainly from United States.
Other:			
Ash and residue containing nonferrous metals	123	138	Mainly from United States.
Metal, including alloys, all forms	57	3	Do.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, tripoli, etc	1,063	1,127	Italy 965.
Grinding flints	524	232	West Germany 102; United States 48; Italy 28; Spain 21.
Dust and powder of precious and semiprecious stones—grams	44,712	87,000	Denmark 38,000; United States 33,000.
Asbestos	23,413	23,614	Canada 14,741; Republic of South Africa 4,657.
Barite	30	63	All from United States.
Boron materials:			
Crude natural borates	3,452	6,702	United States 4,060; Netherlands 1,520.
Oxide and acid	1,717	1,456	United States 1,031; Netherlands 379.
Bromine—kilograms	22,214	35,660	Israel 35,429.
Cement	334,510	279,195	U.S.S.R. 92,838; Uruguay 71,720; Colombia 30,791.
Chalk, natural	3,084	2,337	France 1,336; East Germany 330; Belgium-Luxembourg 300.
Clays and products:			
Crude, n.e.s.:			
Bentonite	9,911	12,916	United States 9,296; Argentina 3,595.
Fire clay	100	230	United States 116; West Germany 74.
Kaolin	6,235	6,947	United States 6,705.
Other	1,079	1,763	United States 1,759.
Products, refractory	r 16,505	17,606	Japan 5,338; France 3,639; United States 3,609.
Cryolite, natural	2,171	919	Mainly from Denmark.
Diamond:			
Gem, not set or strung—carats	9,675	5,000	All from Ireland.
Industrial—do	8,175	90,000	Belgium-Luxembourg 45,000; Ireland 25,000.
Diatomite, and other infusorial earth	1,234	625	United States 336; West Germany 239.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Nitrogenous, nitrates, natural	23,710	23,692	All from Chile.
Phosphatic, phosphate rock	428,158	611,467	United States 530,871.
Manufactured:			
Nitrogenous	840,659	624,260	Netherlands 211,561; United States 202,887; West Germany 169,733.
Phosphatic:			
Thomas slag	7,998	9,205	West Germany 5,956; Belgium-Luxembourg 3,249.
Other	477,121	277,371	United States 229,883.
Potassic	511,235	584,307	United States 181,949; West Germany 160,436; Israel 74,512.
Other, including mixed	15,594	300,024	United States 290,144.
Ammonia	25,515	7,451	United States 7,431.
Graphite, natural	191	106	West Germany 60; United Kingdom 20; Madagascar 20.
Gypsum and plasters	1,088	2,333	Bolivia 2,250.
Iodine—kilograms	40,534	45,885	Chile 31,400; Belgium-Luxembourg 6,000.
Magnesite—do	--	7,045	Mainly from West Germany.
Mica:			
Crude, including splittings and waste—do	21,350	45,525	Mainly from United States.
Worked—do	18,966	17,811	Switzerland 7,888; United States 5,389.
Phosphorus, elemental	104	132	West Germany 67; United Kingdom 57.
Pigments, mineral, including processed iron oxides	2,088	2,329	West Germany 1,711; Spain 452.
Precious and semiprecious stones, except diamond—grams	353,588	2,993,000	West Germany 2,500,000.
Pyrite, gross weight	24	163	West Germany 131.
Salt	4	6	Mainly from United Kingdom.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	164,185	85,931	United States 50,872; Italy 13,418; West Germany 7,922.
Caustic potash	2,251	1,464	France 577; United States 439.
Soda ash	3,097	27,156	Romania 9,000; France 8,017; Poland 7,697.
Sodium sulfate	35,594	52,859	Mexico 32,286; Chile 19,589.
Stone, sand and gravel:			
Dimension stone, marble	1,019	668	Italy 467.
Dolomite	1,247	2,302	Italy 1,882; Argentina 400.
Quartz and quartzite	11	69	Spain 50; France 10.
Silex or flint	524	201	France 175.
Other	465	112	United States 83.
Sulfur, elemental, all forms	261,611	360,968	United States 245,162; Canada 41,922.
Talc, soapstone, and pyrophyllite	91	29	United States 22.
Other nonmetals [3]	15	2	Mainly from West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	864	862	United States 768.
Carbon black	4,956	6,525	United States 2,860; Colombia 1,796.
Coal, all grades, including briquets	1,988,624	1,721,007	United States 1,690,966.
Coke and semicoke	112,292	116,389	West Germany 57,036; United States 41,291
Petroleum:			
Crude—thousand 42-gallon barrels	117,454	138,888	Saudi Arabia 45,773; Iraq 22,743; Venezuela 15,676.
Refinery products:			
Gasoline—do	662	704	All from Netherlands Antilles.
Kerosine—do	64	142	Mainly from Trinidad and Tobago.
Distillate fuel oil—do	--	1,341	Saudi Arabia 488; People's Democratic Republic of Yemen 274; Kuwait 223.
Residual fuel oil—do	--	2,890	Kuwait 1,927.
Lubricants—do	2,967	2,317	United States 1,439; Trinidad and Tobago 476; Netherlands Antilles 367.
Liquefied petroleum gas—do	4,362	4,634	Venezuela 2,461; Saudi Arabia 1,229.
Naphtha—do	10,978	13,867	Trinidad and Tobago 3,230; Saudi Arabia 3,019; Venezuela 2,101.
Mineral jelly and wax—do	64	78	Japan 24; United States 21; West Germany 16.
Asphalt and bitumen—do	8	2	Mainly from United Kingdom.
Petroleum coke—do	216	242	United States 221.
Other—do	55	107	United States 78.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Mineral tar and other hydrocarbon-based chemicals	113,055	152,855	United States 141,960.

r Revised.
1 Less than ½ unit.
2 Excludes jewelry and other ornamental items.
3 Includes some material not identified by commodity in source, and commodities not listed separately in table.

COMMODITY REVIEW

METALS

Aluminum.—Production of bauxite, alumina, and primary aluminum increased 12.5%, 15.1%, and 20.8%, respectively, in 1972. The increasing efficiency of the industry was demonstrated by its consumption of 6.22 tons of bauxite per ton of metal, down from 6.68 tons in 1971 and 8.74 tons in 1970, and its alumina-to-metal ratio of 1.97, down from 2.07 in 1971.

Four smelters operated during the year. Cia. Brasileira de Alumínio (CBA), a Votorantim-group company, produced aluminum at Sorocaba; Cia. Mineira de Alumínio produced primary metal at Poços de Caldas; and Cia. Alumínio Minas Gerais produced aluminum at both Saramenha and Aratú; the latter plant used alumina produced at Saramenha. With development of additional bauxite reserves, several smelters were planning expansion, notably CBA, which has as its goal a 70,000-ton capacity by 1977 and 100,000 tons by 1980.

The numerous teams exploring for bauxite in the lower Amazon Basin suspended activities about midyear as a result of a slump in world demand for aluminum; this condition was regarded as temporary. Prominent in the field was Mineração Rio do Norte, S.A., which has been examining deposits in Pará, north of the Amazon River and west of the Trombetas River, and has measured 130 million tons of alumina contained in bauxite. An annual production of 2 million tons of bauxite, mostly for export, is targeted for 1975. The company, originally a subsidiary of Alcan Aluminium, Ltd., transferred some of its holdings to the Cia. Vale do Rio Doce (CVRD). Several companies were prospecting in the Paragominas area of Pará, south of the Amazon River and east of the Belem–Brasilia highway.

Chromite.—A newly formed Japanese company, Brazilian Chrome Resources Development Co., joined with Cia. de Ferro-Ligas da Bahia, S.A. (FERBASA), to expand Brazilian production of chromite and ferrochromium. Exploration increased reserves at Campo Formoso, Bahia, and from this deposit the Pedrinhas mine of FERBASA supplied that company's ferroalloy furnaces and shipped concentrates to Salvador for export to Japan. Annual production of 100,000 tons of chromite and 5,000 tons of low-carbon ferrochromium, in addition to the present 10,000 tons of high-carbon alloy, was sought; however, ore reserves may support only a more limited expansion.

Columbium.—Late in the year Cia. Brasileira de Metalurgia é Mineração (CBMM) and Cia. Agrícola de Minas Gerais (CAMIG), a state-government corporation, formed a new company, Cia. Mineradora do Pirocloro de Araxá (COMPIRA), to exploit their adjoining mining concessions. The concessions were leased to COMPIRA for a nominal fee. COMPIRA will sell its ore to CBMM at cost plus 10%, and CBMM will process the ores and market the products.

Copper.—Mine production of copper declined to 4,300 tons, a decrease of 16%. Cia. Brasileira do Cobre was the sole producer.

Copper has been known at Caraiba, Bahía, since 1870. The most recent resource estimate is 40 million tons of ore at a grade of not quite 1%; gold and silver are present and can be concentrated with the copper. Caraiba Metais was formed to conduct additional drilling and to start de-

velopment. Several government agencies were involved, and it became apparent about midyear that these agencies disapproved the inactivity of the company. Production of copper at Caraiba was scheduled for 1974; meanwhile, Brazil must import $90 million worth of copper annually.

Iron Ore.—Production of iron ore decreased 1.4% in 1972, while exports increased 10.4% to 30.8 million tons. CVRD continued as the largest producer and exporter, accounting for 84% of total iron ore exports. CVRD's production of 26.9 million tons came from its mines at Itabira in the following quantities: Caué mine, 19.0 million tons; Conceção mine, 7.6 million tons; and the Picarrão mine (opened in June), 300,000 tons. CVRD announced that production of "gravel" and run-of-mine fines will cease in 1973. Its concentrator and washing plant at Itabira will produce instead washed fines products, consisting of sinter feeds (plus 1 millimeter, minus 1 millimeter plus 0.6 millimeter, and minus 0.6 millimeter plus 70 micrometers) and pellet feed (minus 70 micrometers). As production at the Caué mine declines, the 20-million-ton washing plant will be fed with increasing quantities of fines from the 30-million-ton stockpile, which has accumulated over a number of years.

The Picarrão property contains a reserve of 35 million tons of ore and will produce 3 million tons annually. Some of the ore is itabirite (44% Fe), and research into applicability of wet high-intensity magnetic separation is being conducted.

The joint CVRD-U.S. Steel Co. drilling of an iron deposit in Serra dos Carajas, Pará, was completed in January. A reserve of 1.6 billion tons of 67% grade was measured, and an additional 9.5 billion tons indicated and inferred. The ore body, which lies between the Xingu and the Tocantins Rivers, consists of both hard and earthy hematite, the hard hematite amounting to about 25% of the total. Production may begin in 1977 if problems of transport are solved.

Early in 1972, Vale do Rio Doce Navegação S.A. (Docenave), the ore carrier fleet subsidiary of CVRD, placed the *M.V. Doceangra* in service. The ship, at 56,500 deadweight-tons, was the largest built in Latin America. In May, a record 168,530 tons of iron ore was loaded on the *M.V. Berge Istra.* In July a monthly record of 2,822,521 tons was loaded out in 39 vessels.

CVRD nevertheless intends expanding its port facilities at Tubarão from the present 28-million-ton level to 50 million tons per year, and eventually 80 million tons. The railroad from Itabira to the port area is now being double-tracked. Facilities under construction at Tubarão in 1972 included land reclamation, a 2-million-ton ore yard, a 16,000-ton-per-hour sampling plant, an ore-loading berth, an approach channel, and a turning basin designed for 250,000-ton ore carriers. A pelletizing plant, capable of producing 2 million tons per year, is now in full operation. Construction of 3.2 million tons of additional capacity will begin early in 1973, and further expansion to an ultimate 11 million tons is planned.

S.A. Mineração da Trindade (SAMITRI) has joined with the Marcona Corp. to form Samarco Mineração S.A., which will evaluate SAMITRI's low-grade reserves. In addition to a present annual export capacity of 6.5 million tons, SAMITRI intends to produce 4.4 million tons from its properties at Alegría, Minas Gerais.

A deposit of iron ore reportedly larger than that in the Serra dos Carajas has been discovered in the northern part of Amapá territory. The deposit, of grade similar to that at Carajas, is much nearer to water transportation.

CVRD conducted a resolute campaign to sell Brazilian iron ore abroad. As a result, 44 million tons of CVRD ore will be delivered to various furnaces in West Germany over a 15-year period. Ferteco, S.A., a Brazilian iron mining company affiliated with German steel interests, obtained as part of the agreement the right to export 64 million tons during the same period, using CVRD's railroad and port facilities at Tubarão. As a further result, Brazil is to obtain power-station equipment from Czechoslovakia in return for $50 million worth of iron ore, delivered over a 12-year period at about 300,000 tons per year.

Minerações Brasileiras Reunidas, S.A. (MBR) conducted preliminary work at the Aguas Claras mine near Belo Horizonte, and began building port facilities on Guaiba Island in Sepetiba Bay, west of Rio de Janeiro. The port will accommodate ships of up to 250,000-ton capacity.

The mine is expected to begin producing in 1973. Japan will receive 7 million tons of the 11.5-million-ton annual iron ore production for a 15-year period. The iron-ore-oriented assets of St. John d' El Rey Mining Co. were transferred to MBR during a 15-month period ending March 31, 1972, in exchange for a 49% interest in MBR. St. John d' El Rey is in turn 55.4% owned by Hanna Mining Co., which intends increasing this share to 61.4%.

MBR shipped 1.5 million tons of iron ore during the year from present properties, the Mutuca II and the Pico de Itabirito mines.

Iron and Steel.—Production of steel ingot continued to grow during 1972, realizing an 8% increase over that of 1971. Pig iron production and production of rolled steel each increased 14%.

The Conselho Consultivo da Industria Nacional de Siderúrgica (CONSIDER), guiding body of Brazil's steel industry, established as additional policy its refusal to financially aid any expansion plans depending (1) on the use of charcoal for blast furnace fuel, since the expense of reforestation is increasing, or (2) on utilizing scrap as an electric steel furnace charge, since Brazil has insufficient scrap, and further imports would adversely affect the trade balance.

Nippon Steel Corp. contracted with Cia. Siderúrgica Nacional (CSN) to build blast furnace No. 3 at Volta Redonda. This furnace, of 2,830-cubic-meter working volume, is expected to come onstream in 1975. In addition, Nippon Steel is to build two 250-ton basic oxygen furnaces, to expand CSN's raw steel capacity to 2.5 million tons per year. Another Japanese firm, Kawasaki Heavy Industries, is building the offgas cleaner for the basic oxygen shop. CSN has also bought $9 million worth of Japanese equipment to convert its hot strip mill from semicontinuous to continuous operation; the conversion will be completed near the end of 1975.

As another part of the planned expansion of Brazilian steelmaking capacity, a blast furnace of 2,700-cubic-meter working volume and 6,000-ton output daily to be built by Ishikawajima-Harima Heavy Industries Co. (IHI) for Usinas Siderúrgicas de Minas Gerais (USIMINAS). Production is expected in mid-1974. USIMINAS intends increasing raw steel production from 1 million tons annually to 2.4 million; the World Bank has approved a $63 million loan for the purpose.

The third major steel company in which the Brazilian Government is a financial partner, Cia. Siderúrgica Paulista (COSIPA), intends expanding its raw steel production from 1 million tons per year to 2.3 million. The World Bank has approved a $64.5 million loan to COSIPA to expand its facilities at Cubatão, near Santos. IHI was negotiating for the contract to build a new blast furnace, to be ready in mid-1974.

For the entire program, Brazil has been granted $320 million in joint loans from the World Bank and the Inter-American Development Bank, and will receive $300 million in credits from nine major steel-equipment-producing countries.

Cia. Siderúrgica Belgo-Mineira modernized its Monlevade plant, expanding its wire-rod capacity from 300,000 tons per year to 450,000 tons, and its wire capacity from 240,000 tons to 360,000 tons per year. Wire capacity at the Belo Horizonte plant was expanded to 30,000 tons, and other improvements were instituted at a total cost of $18 million. The plant at Sabara, including the foundry, was also enlarged.

International Finance Corp. (IFC), Société Financiere Europeenne, August Thyssen Hütte A.G., and the Brazilian Gerdau Group are financing a new steel venture undertaken by Cia. Siderúrgica da Guanabara (COSIGUA). At Sepetiba Bay, 45 miles west of Rio de Janeiro, COSIGUA is building and will operate a scrap-based steel plant and rolling mill. The plant, to be completed by April 1973 at a cost of $43 million, will produce 220,000 tons of wire rod and reinforcing rod annually. The Gerdau Group also operates Siderúrgica Açonorte, Siderúrgica Riograndense, and Siderúrgica Guaira. Production at Açonorte is also being expanded.

Thyssen interests were studying the feasibility of a 350,000-ton direct-reduction plant to be built at Tubarão and to include an electric-arc melting furnace and continuous casting of the product.

Aços Villares, S.A., Brazil's only producer of rolling-mill rolls and an important producer of special steels, invested $19.5 million to expand its facilities to meet the demands of new rolling-mill installations elsewhere in Brazil. Similarly, Aços Anhan-

guera, S.A., proposed a $35 million project to increase its annual production of low-alloy steel ingot from 72,000 tons to 300,000 tons by 1976.

Lead.—Both mine and smelter production continued at 1971 levels. One of the two producers, Cia. Brasileira de Chumbo (COBRAC) became a wholly owned subsidiary of the Le Nickel Peñarroya Mokta group (LNPM). The Soc. Minera y Metallurgica de Peñarroya, S.A., before its merger into LNPM, owned a share of COBRAC. LNPM bought out the other major shareholder, Prest-O-Lite Corp.

Nickel.—Based on nickel reserves in the Niquelandia area of Goías, estimated at 100 million tons of laterite ore, the Cia. Niquel Tocantins (CNT), a subsidiary of S.A. Industrias Votorantim, began building a pilot plant. Finland's nickel producer, Outokumpu Oy, has licensed its nickel electrowinning process to CNT. If results are favorable, a 2,500-ton-per-year plant will be built to being operations in 1974.

Tin.—The Rondônia tin district includes the entire State of Rondônia and small adjacent portions of Amazonas and Mato Grosso. Production of cassiterite concentrate in 1970 reached about 5,000 long tons. In that year, the Government, attempting to stop wasteful mining practices, prohibited mining of tin by any except legally authorized and well-equipped organizations. For entry into the area, the Government required that a company shall have invested not less than $2 million in prospecting and, should the prospecting have been successful, another $2 million in a mining plant.

Mining companies presently operating in the district include Mineração Brasileira (MIBRASA), affiliated with W. R. Grace & Co., Mineração Jacunda, Minérios de Rondônia, Mineração Angelim, and Mineração Aracazeiro, affiliated with NL Industries Inc. Mineração Aracazeiro purchased an integrated movable mining plant, adapted from the equipment used in mining coastal sands on Australia's east coast. The plant was built by Mineral Deposits, Ltd., an Australian affiliate of NL Industries.

Brazilian army units neared completion of construction of 75 miles of road linking the tin areas with the Mato Grosso highway system for access to the East Coast smelters.

Uranium.—The Comissão Nacional de Energia Nuclear (CNEN) ordered a survey of recently discovered uranium deposits near Brumadinho, Minas Gerais, 36 kilometers southwest of Belo Horizonte in the Serra da Moeda, and within the Quadrilatero Ferrífero. Aerial geophysical work was followed by surface scintillometer examination, disclosing about 100 anomalies. Core drilling by CPRM indicated mineralization in the Moeda conglomerate, at three horizons within 200 meters of the surface. Analysis of cores showed U_3O_8 contents from 0.1% to 0.3%.

NONMETALS

Cement.—Production in 1972 was 16% greater than that of 1971. All elements of the total production showed increases, except blast furnace slag cement, which declined 5% to 769,000 tons.

Present output was said to have met current demand. The industry's major problem, however, was unused capacity in the north, inability to meet total demand in the south, and uneconomic transportation to move cement between the two. Projected public and private construction will require a greater supply of cement in the years ahead, and the Nation's near-term expansion of capacity, being mainly in Minas Gerais, São Paulo, and Rio de Janeiro, may solve part of the problem.

Cement production capacity was 10.7 million tons (a revised figure) at yearend 1971. During 1972, 1.5 million tons of capacity at six new plants came onstream. Two of these plants were in Bahia and one each in the Federal District, Maranhão, Rio Grande do Norte, and São Paulo; the latter, built by Camargo Corrêa Industrial S.A. at Apiai, was the largest, with 600,000 tons capacity. Another 1.5 million tons of capacity was added during the year by expanding existing operations. In various stages of planning, financing, and construction were 17 plants having a total capacity of at least 5.9 million tons, about 3.4 million of which was expected onstream by yearend 1973 at six locations.

Sodium Compounds and Chlorine.—In anticipation of demand arising from rapid expansion of petrochemical production, construction of two chlorine-caustic soda plants began during 1972. At Recife, Cia. Argo Industrial Igarassu contracted for construction of a 15,000-ton-per-year plant

using local brines, and at Maceio, Salgema Industrias Quimicas, S.A., an affiliate of E.I. duPont de Nemours & Co., was building a plant to have initial annual capacity of 250,000 tons of caustic soda and 220,000 tons of chlorine.

MINERAL FUELS

Coal.—Production of raw coal in 1972 was 5% higher than in 1971, but there was little change in production of washed coal. In Santa Catarina only 31% of the raw coal was usable. Data on production follow, in thousand metric tons:

State	Production			
	1971		1972	
	Run-of-mine	Washed	Run-of-mine	Washed
Paraná	346	198	343	200
Santa Catarina	4,353	1,437	4,600	1,415
Rio Grande do Sul	948	856	978	876
Total	5,647	2,491	5,921	2,491

Steam coal accounted for 57% of the washed coal from Santa Catarina.

Brazil and Colombia formed a joint commission to study the possibility of exporting Colombian coal to Brazil. In view of expanding iron and steel capacity, it is estimated that Brazil will need 30 million tons of coal, mostly coking coal, during the next 8 years.

Petroleum and Natural Gas.—Production of crude petroleum, at 61.1 million barrels in 1972, was 1.5% less than in 1971. Natural gas output increased 5.5% to 43,860 million cubic feet. Production of natural gas liquids reached 1,495,000 barrels, a gain of 9% over 1971. Production of crude oil originated in Bahia (82.5%) and in Alagoas and Sergipe (17.5%). Secondary recovery methods were used in 10 fields in Bahia and in two fields in Sergipe. Production from offshore wells amounted to 3,466,000 barrels, or about 6% of the total.

At yearend, reserves of petroleum stood at 799 million barrels, and natural gas reserves at 922.3 billion cubic feet. Exploration for additional supplies continued during the year. Significant results included confirmation of the Camorim field, offshore in Sergipe, as a potential producer, and drilling of two wells showing oil and gas at Fazenda Cedro, Espirito Santo. Development of the offshore Guaricema and Caioba fields continued; these fields are expected to begin producing during the first half of 1973.

Drilling activities of Petróleo Brasileirá, S.A. (PETROBRÁS), are summarized as follows:

	1971	1972
Wells drilled:		
Exploratory:		
Oil	13	11
Gas	6	2
Dry	68	67
Subtotal	87	80
Development:		
Oil	54	68
Gas	1	1
Dry	29	26
Subtotal	84	95
Total	171	175
Footage drilled—thousand feet	722	906

PETROBRÁS operated six refineries during the year, with a throughput of 207.1 million barrels, and the private refineries consumed an additional 21.4 million barrels. Imported crude made up 76% of the total. The Planalto refinery at Campinas, São Paulo, was completed and placed in service on May 12, making PETROBRÁS's total capacity 673,000 barrels daily. The refinery includes units for distillation, cracking, treatment of lighter fractions, and sulfur removal; pollution control measures were extensive. Crude is delivered from São Sebastião through a 234-kilometer pipeline.

Three storage tanks containing liquefied petroleum gas were destroyed by fire and explosions at PETROBRÁS's Duque de Caxias refinery in March. Property damage was estimated at $1.7 million. Normal refinery operations were not affected. Late in June a crude oil pipeline from the ocean terminal on Ilha d'Agua in Guanabara Bay to the refinery developed a leak, causing a serious pollution problem.

In February PETROBRÁS created two new subsidiaries, and became a participant in a third. The Cia. Petróleo da Amazônia (COPAM) was formed to take over the operation and expansion of a refinery in which PETROBRÁS had obtained a 67% interest. The refinery, in Manaus, had been owned by the Sabbá group and had a capacity of about 8,000 barrels per day. At yearend, COPAM was expanding facili-

ties at Manaus by construction of a 9,000-barrel-per-day catalytic cracking unit.

The company in which PETROBRÁS became a participant was named Petrocoque S.A. Indústria e Comercio and will produce petroleum coke at Cubatão at a rate ranging from 150,000 tons to 240,000 tons, depending on the nature of the petroleum feed. A major product will be electrodes for aluminum smelters.

The second subsidiary formed was Petrobrás International S.A. (BRASPETRO). It has become obvious that Brazil cannot meet refinery crude oil requirements from the production of its oil wells, and that imports would be necessary. BRASPETRO's activities will therefore include promoting joint exploration and production efforts with foreign countries and companies whose petroleum might economically flow to Brazil.

BRASPETRO began buying crude oil from Iraq National Oil Co., which took over, without compensation to date, certain oilfields in Iraq. BRASPETRO was advised of possible legal action on the part of the displaced concessionaires. BRASPETRO will undertake exploration of three oilfields in southern Iraq on a joint venture basis, and has obtained a contract for delivery of 2 million tons of Iraqi crude over a 5-year period.

PETROBRÁS ordered more than 50,000 tons of steel plates of various gages from British Steel Corp., to be used in fabricating storage tanks.

Petrochemicals.—There are two major petrochemical complexes in Brazil: One at São Paulo, largely privately owned, although Petroquisa S.A. has a 26% share, and one in Bahia, which Petroquisa owns and operates. At São Paulo the core plant, run by Petroquimica União S.A., went onstream in June, buying naphtha from Petroquisa and making olefins and aromatics. At least 15 plants are operating or planned for this area.

The other major complex is at Camaçari in Bahia. Several intermediate and end-product plants are already operating. A subsidiary of Petroquisa S.A., Cia. Petroquimica do Nordeste (COPENE) was allotted $206 million to build a core plant. The utilities unit is expected onstream in 1974, and the cracking and raw materials units a year or two later.

The core plant in São Paulo is capable of producing 560,000 tons annually. The core plant at Camaçari is planned for 645,000-ton capacity. Demand for end products is projected to exceed the total capacity of both complexes. In view of the 4- to 5-year lead time required, PETROBRÁS and private industry were discussing a third complex of a minimum capacity of 300,000 tons, possibly in Rio Grande do Sul.

The Mineral Industry of Bulgaria

By Bernadette Michalski [1]

Economic measures designed to shift the base of the Bulgarian industrial economy from small-scale to large-scale industrial units were implemented in 1971 and began to show promising results by yearend 1972. Bulgarian reports reveal an increase in labor productivity of 74% over that of the previous year, whereas industrial output rose by 9.2% and national income rose by 7.9%. The declining production levels in coal, iron ore, and several nonferrous metals were reversed with the abandonment of small marginal operations. Construction of new facilities and expansion and modernization of existing facilities at the Kremikovtsi iron and steel plant and the Lenin metallurgical plant were reflected in moderately increased production of pig iron, crude steel, and semimanufactured products. Production of nonferrous metals registered only slight increases but modernization and expansion activities at the Plovdiv, Kurdzali, and Pirdop smelters should reflect increased nonferrous metal output by the close of the sixth 5-year plan in 1975.

PRODUCTION

Gains were reported in the production of most mineral commodities in 1972. Production of crude petroleum and natural gas, however, continued to decline increasing Bulgaria's dependence upon imported fuels.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Bulgaria: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Cadmium, smelter output [e] ---metric tons--	200	200	200
Copper:			
Mine output, metal content ---do---	r 40,300	43,000	48,000
Blister, including secondary ---do---	43,700	45,000	48,000
Refined electrolytic, including secondary ---do---	38,300	41,000	45,000
Iron and steel:			
Iron ore and concentrate	2,409	3,001	3,207
Pig iron, including blast furnace ferroalloys	1,251	1,378	1,562
Crude steel	1,800	1,947	2,121
Semimanufactures	r 1,534	1,888	2,185
Lead:			
Mine output, metal content ---metric tons--	95,500	100,000	102,000
Smelter, including secondary ---do---	r 98,640	102,240	102,000
Manganese:			
Gross weight	33	41	30
Metal content	e 10	12	9
Molybdenum mine output, metal content [e] --metric tons--	120	140	140
Zinc:			
Mine output, metal content ---do---	r 76,440	79,920	e 80,500
Smelter, including secondary ---do---	76,100	78,400	80,000
NONMETALS			
Asbestos	3,000	2,900	1,500
Cement, hydraulic	3,668	3,880	3,910
Clays, kaolin	127	138	142
Fertilizer materials, manufactured:			
Nitrogenous:			
Gross weight	1,523	1,473	1,416
Nitrogen content	r 602	562	523
Phosphatic:			
Gross weight	409	415	396
Phosphorus pentoxide content	r 148	146	130
Gypsum and anhydrite:			
Crude	169	131	171
Calcined	20	22	28
Lime (quicklime)	940	940	950
Pyrite:			
Gross weight	156	e 150	e 150
Sulfur content	66	e 64	e 64
Salt, all types	135	93	104
Sulfur, elemental, recovered ---metric tons--	5,463	5,773	6,677
MINERAL FUELS AND RELATED MATERIALS			
Coal (marketable):			
Anthracite	161	160	155
Bituminous	236	228	229
Lignite and brown	28,854	26,620	26,894
Total	29,251	27,008	27,278
Coke	837	1,091	1,190
Natural gas, marketed production --million cubic feet--	16,723	11,560	7,786
Petroleum:			
Crude oil:			
As reported	334	305	248
Converted [e] ---thousand 42-gallon barrels--	2,438	2,227	1,816
Refinery products:			
Gasoline ---do---	9,800	11,900	NA
Kerosine ---do---	976	1,008	NA
Distillate fuel oil ---do---	13,240	12,921	NA
Residual fuel oil ---do---	17,424	24,782	NA
Lubricants ---do---	368	e 390	NA
Asphalt, including natural ---do---	742	927	1,200
Total ---do---	42,550	e 51,928	e 60,000

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

[1] In addition to the commodities listed, bismuth, chromite, gold, silver, barite, fluorspar, magnesite, palladium, platinum, and tellurium are also produced, but information is inadequate to make reliable estimates of output levels.

TRADE

Bulgaria enjoyed a favorable balance of trade with total exports for 1971 reported at $2,182 million and imports at $2,120 million.[2] Mineral and metal commodities constituted about 22% of all exports by value and 49% of all imports by value in 1971. Mineral and metal exports from the U.S.S.R., Bulgaria's principal trade partner, were valued at an estimated $425 million.[3] Crude petroleum and refined petroleum product deliveries accounted for nearly one-third of the Soviet exports to Bulgaria or $129 million compared with $114 million in 1970. The value of petroleum deliveries from the U.S.S.R. in 1972 is estimated at $133 million. Deliveries of solid fuels from the U.S.S.R. were valued at $87 million in 1971 compared with $68 million in the previous year. Solid fuel deliveries from the U.S.S.R. in 1972 were estimated at a value of $90 million. Deliveries of most mineral and metal commodities from the U.S.S.R. attain new peak levels yearly, deliveries of steel semimanufactures have been declining. The value of deliveries in 1972 were estimated at $78 million, in 1971 at $81 million, and in 1970 at $86 million.

[2] Where necessary values have been converted from Bulgarian levas to U.S. dollars at the rate of 1 leva = US$1.17.

[3] Where necessary, values have been converted from U.S.S.R. rubles to U.S. dollars at the rate of 1 ruble = US$1.11; however, values are probably derived by negotiated agreement between the U.S.S.R. and Bulgaria resulting in the above figures being more representative of a general range than of actual world market price value for the mineral commodities.

Table 2.—Bulgaria: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971 [2]
METALS			
Aluminum and alloys:			
Scrap	193	771	Yugoslavia 586; West Germany 185.
Unwrought and semimanufactures	8,115	2,645	Yugoslavia 1,309; Italy 735; Japan 376.
Cadmium metal, all forms	102	577	Belgium-Luxembourg 287; West Germany 231; France 32.
Copper and alloys:			
Scrap	120	37	All to West Germany.
Unwrought and semimanufactures	6,156	4,634	Yugoslavia 4,288; West Germany 1,316; Italy 800.
Iron and steel:			
Scrap	5,297	1,733	Yugoslavia 924; Italy 696; Japan 100.
Pig iron [3]	40,600	25,900	NA.
Ferroalloys	18,061	5,922	Italy 4,930; Belgium-Luxembourg 922.
Steel, primary forms ..thousand tons..	56	169	Italy 105; Belgium-Luxembourg 35; West Germany 26.
Semimanufactures:			
Bars, rods, sections ..do..	173	135	U.S.S.R. 54; Yugoslavia 30.
Plates and sheets ..do..	355	522	Italy 110; U.S.S.R. 91; Romania 81; West Germany 72.
Hoop and strip ..do..	2	2	France 1; Yugoslavia 1.
Wire ..do..	6	3	NA.
Pipes and tubes ..do..	62	69	Yugoslavia 35; Poland 17.
Total ..do..	598	731	
Lead:			
Oxides	704	353	Italy 340; West Germany 10.
Metal and alloys, unwrought and semimanufactures	[3] 22,188	13,708	U.S.S.R. 8,654; Austria 2,272; Italy 2,054.
Nickel and alloys, unwrought (including matte) and semimanufactures	7	23	All to Italy.
Silver and alloys, unworked and partly worked ..thousand troy ounces..	972	1,511	France 964; West Germany 547.
Zinc:			
Oxides	60	NA	
Metal and alloys, unwrought and semimanufactures	[3] 48,503	32,740	United Kingdom 19,100; Italy 5,078; France 3,735.
Other metal bearing slag, ash and dross	15	9	West Germany 6; France 2.

See footnotes at end of table.

Table 2.—Bulgaria: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971 [2]
NONMETALS			
Asbestos	4,665	NA	
Barite	20,200	24,800	All to U.S.S.R.
Cement [3] thousand tons	153	71	Yugoslavia 54.
Clays and products:			
Crude clay, kaolin	12,715	10,279	Italy 9,123; Yugoslavia 1,156.
Products, nonrefractory	NA	28,213	All to Yugoslavia.
Fertilizer materials, manufactured, nitrogenous [3]	106,449	196,024	Greece 39,399.
Fluorspar	100	NA	
Salt	21	NA	
Sodium and potassium compounds, n.e.s., soda ash	23,100	30,000	All to U.S.S.R.
Stone, dimension	3,614	5,262	West Germany 5,087; Belgium-Luxembourg 175.
Sulfur, sulfuric acid [3]	10,340	21,203	Romania 18,633; East Germany 2,570.
Talc	48,700	18,900	All to U.S.S.R.
Other, crude	1,071	5,482	West Germany 5,459.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor thousand 42-gallon barrels	--	183	All to Greece.
Distillate fuel oil do	[3] 606	NA	
Residual fuel oil do	[3] 275	NA	
Lubricants [3] do	--	26	Yugoslavia 5.

NA Not available.
[1] Compiled from official export statistics of Bulgaria and from import data of selected trading partner countries.
[2] Compiled from import data of selected trading partner countries.
[3] Data from official Bulgarian export statistics.

Sources: Official trade returns of Bulgaria, Japan, Poland, the U.S.S.R. and Yugoslavia; United Nations Statistical Papers. Commodity Trade Statistics, 1971 ed. V. 21, Nos. 2 and 8, 1973; United Nations, Economic Commission for Europe. Statistics of World Trade in Steel, 1970 and 1971 ed. 1971 and 1972; and European Community, Statistical Office. Analytical Tables NIMEXE, 1970 and 1971 ed. Luxembourg, 1971 and 1972.

Table 3.—Bulgaria: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971 [2]
METALS			
Aluminum:			
Bauxite	404	NA	
Oxide	644	678	Italy 539; West Germany 121; France 18.
Metal and alloys, unwrought and semimanufactures [3]	26,749	25,130	U.S.S.R. 21,209; Austria 1,067; Hungary 761.
Antimony	863	411	All from U.S.S.R.
Copper and alloys, unwrought and semimanufactures	5,087	2,795	Austria 1,205; U.S.S.R. 754; Italy 512.
Iron and steel:			
Iron ore [3] thousand tons	1,133	1,192	U.S.S.R. 1,026.
Pig iron [3] do	295	280	U.S.S.R. 210; East Germany 39; West Germany 5.
Ferroalloys do	21	13	All from U.S.S.R.
Steel, primary forms do	10	NA	
Semimanufactures: [4]			
Bars, rods, sections do	465	411	U.S.S.R. 340; Czechoslovakia 31; Poland 14.
Plates and sheets do	324	299	U.S.S.R. 222; Italy 34; Czechoslovakia 12.
Hoop and strip do	25	21	Hungary 5; Italy 4; Japan 3; West Germany 3; U.S.S.R. 3.
Railway materials do	58	64	U.S.S.R. 50; Yugoslavia 10.
Wire do	16	11	U.S.S.R. 7.
Pipes, tubes, fittings do	81	110	U.S.S.R. 54; Italy 32; Czechoslovakia 6; Poland 6.
Castings and forgings do	6	1	All from U.S.S.R.
Total do	975	917	
Manganese:			
Ore and concentrate	80,000	110,000	All from U.S.S.R.
Oxide	90	142	Japan 100; France 35.

See footnotes at end of table.

Table 3.—Bulgaria: Imports of selected mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971 [2]
METALS—Continued			
Mercury ——76-pound flasks	696	261	All from Italy.
Nickel and alloys, unwrought and semimanufactures	124	338	All from West Germany.
Platinum-group metals _value, thousands	$38	$4	West Germany $3.
Tin:			
Oxides ——long tons	16	18	All from West Germany.
Metal and alloys, unwrought and semimanufactures ——do	NA	25	All from Spain.
Titanium oxide	1,359	1,300	Italy 1,195; West Germany 105.
Zinc:			
Ore and concentrate	NA	55	All from U.S.S.R.
Oxides ——long tons	22,147	51,483	Do.
Other, unspecified metal and alloys, unwrought and semimanufactures	--	2,492	U.S.S.R. 2,433; Belgium-Luxembourg 53.
NONMETALS			
Asbestos	21,200	22,800	All from U.S.S.R.
Cement ——thousand tons	94	158	Do.
Clay products, refractory	23,826	42,824	U.S.S.R. 34,500; Austria 3,109; Yugoslavia 3,000.
Diamond, industrial ——value, thousands	$213	$171	All from Belgium-Luxembourg.
Feldspar	625	957	Yugoslavia 757; West Germany 200.
Fertilizer materials: [5]			
Crude:			
Phosphatic (apatite concentrate)	341,300	342,500	All from U.S.S.R.
Potassic (salts)	38,300	84,300	Do.
Manufactured:			
Phosphatic	213,428	257,313	U.S.S.R. 219,200; Yugoslavia 38,113.
Mixed	NA	2,098	Yugoslavia 2,095.
Fluorspar	145	235	All from West Germany.
Gypsum	NA	99	All from Yugoslavia.
Magnesite	NA	256	Austria 216; Yugoslavia 40.
Pigments, mineral, iron oxide	108	83	France 68; West Germany 15.
Sulfur	11,100	2,963	All from U.S.S.R.
Other crude nonmetals, n.e.s	202	428	Netherlands 383; West Germany 45.
MINERAL FUELS AND RELATED MATERIALS			
Carbon, black [3]	13,286	14,269	U.S.S.R. 9,897; Italy 2,575; East Germany 935.
Coal, all grades ——thousand tons	5,065	5,981	All from U.S.S.R.
Coke [3]	465	355	U.S.S.R. 244; Czechoslovakia 39; Poland 29.
Petroleum:			
Crude oil [3] thousand 42-gallon barrels	41,858	55,093	U.S.S.R. 42,630.
Refinery products:			
Gasoline [3] ——do	2,270	NA	
Distillate fuel oil [3] ——do	3,820	NA	
Residual fuel oil ——do	[3] 11,775	209	Yugoslavia 204; Italy 5.
Lubricants ——do	[3] 610	35	United Kingdom 18; France 6; Netherlands 4.
Crude chemicals from distillation of coal, gas, or oil	13,974	17,531	U.S.S.R. 16,979; West Germany 552.

NA Not available.

[1] Compiled from official import statistics of Bulgaria and from export data of selected trading partner countries.

[2] Compiled from export data of selected trading partner countries.

[3] Data from official Bulgarian import statistics.

[4] Official import statistics report the receipt of only 457,000 tons in 1970 and 413,000 tons in 1971, but these represent receipts of only a select few categories of semimanufactures. Because of the incomplete nature of these data, export statistics of trading partner countries have been used for the entire steel semimanufacture section.

[5] Official import statistics report the receipt of 866,000 tons of all types of fertilizers in 1970 and 995,000 tons in 1971, quantities which considerably exceed the totals for the commodities listed below, which are derived from trading partner export statistics. However, official import statistics do not break down the total by type. Among the source countries listed in official import statistics, but not covered by trading partner export data was Tunisia, which reportedly supplied 121,000 tons in 1970 and 210,000 tons in 1971, all of which was presumably phosphate rock.

Sources: Official trade returns of Bulgaria, Japan, Poland, the U.S.S.R. and Yugoslavia for 1970 and 1971. United Nations, Statistical Office. Supplement to the World Trade Annual, 1971 ed. V. 1, 1974; United Nations, Economic Commission for Europe. Statistics of World Trade in Steel, 1971 ed. 1972; European Community, Statistics Office. Analytical Tables NIMEXE, 1970 and 1971 ed. Luxembourg, 1971 and 1972.

COMMODITY REVIEW

METALS

Aluminum.—Metal and alloy requirements are met through imports principally from the U.S.S.R. However, plans are under consideration for constructing an aluminum mill for the manufacture of sheets, bars, and profiles. Shoumen has been selected as the preliminary construction site for the 50,000-ton-annual-capacity plant to be in operation by 1975.

Copper.—The Medet copper mine in central Bulgaria is the source of an estimated 80% of the total copper output of the nation. Under development for nearly a decade, the Medet open pit mine attained its planned capacity of 8 million tons of ore per year in 1972. Medet ores average 0.36% copper and 0.008% molybdenum. Copper mining operations are also conducted at Burgas, Panagyurishte, Chelopech, and Tirnovo. About 1 million tons of ore is extracted annually from underground mines. Bulgarian sources report copper ore bodies mined at depths of 600 to 700 meters. Copper smelting capacity was reported at 55,000 tons.

Iron and Steel.—Indigenous sources supply about one-third of Bulgarian iron and steel requirements. The remainder is supplied by imports, principally from the Soviet Union, in the forms of iron ore, pig iron, and steel semimanufactures. The largest of Bulgaria's two steel operations, the Kremikovtsi iron and steel plant near Sofia, produced 1.4 million tons of pig iron, 1.6 million tons of steel, and 1.6 million tons of rolled products in 1972. The Lenin metallurgical works at Pernik produced 0.3 million tons of crude steel and 0.3 million tons of steel semimanufactures. Both plants were under expansion during the year to support a crude steel production goal and a downline processing capacity of 3 million tons by 1975. A third steel plant is planned for 1980 bringing crude steel production to 5 million tons in that year.

Lead and Zinc.—Lead-zinc ore extraction is entirely by underground mining methods from ore bodies at depths of 350 to 400 meters. About 75% of Bulgarian lead-zinc output is derived from the Gorubso mining enterprise in South-Central Bulgaria. Lead and zinc smelting capacity is reported at 100,000 tons and 80,000 tons, respectively. Research conducted at the Kurdzali lead-zinc smelter resulted in the adoption of a new method of hydrometallurgical processing of zinc waste. The process allows extraction of zinc ferrites and simultaneous removal of compounds of iron, arsenic, and other elements.

NONMETALS

Cement.—The cement manufacturing industry has maintained a steady growth pattern, keeping output in line with growing consumption. In addition, limited quantities of cement were available for export annually. Modernization and expansion activities are scheduled for each of the nation's six major cement plants during the sixth 5-year plan (1971–75) period. During 1972, the 1-million-ton-annual-capacity Reka Devnya cement plant was under expansion; capacity is scheduled to be doubled by 1975. The Bulgarian's anticipate cement production capacity at 6 million tons annually by the close of the sixth 5-year plan.

Fertilizer Materials.—Production of mineral fertilizers has been accelerated with the construction and expansion of the chemical combines at Demitrovgrad, Stara Zagora, Vratsa, and Varna. By 1975, mineral fertilizer production is anticipated at 1.5 million tons in terms of pure nutrients, placing the nation at the level of self-sufficiency. However, raw materials in the form of natural gas, potash, and phosphate rock will continue to be imported.

MINERAL FUELS

Coal.—The development of mechanized, large-volume operations reversed the trend of declining coal output in Bulgaria. Rotor dredges, excavators, drift mining machines, face working equipment, and conveyor systems imported from the U.S.S.R., East Germany, and Czechoslovakia were placed in operation at the surface mines in the Maritza-Iztok Basin and at the underground operations in the Marbas Basin. An announcement made through the Ministry of Heavy Industry anticipates coal output at 33 million tons annually by 1975.

Natural Gas.—Natural gas production was reported at 7.8 billion cubic feet in 1972. Production is derived principally from the Chiren Fields. Total estimated reserves are 1 trillion cubic feet.

Petroleum.—Domestic crude oil output continued to decline, dropping to 4,962 barrels per day in 1972. Most of Bulgaria's production is derived from the Dolni Dubnik Field in the northwest. Exploratory activities launched jointly with the Soviet Union continued in the Bulgarian area of the Black Sea. Two dry holes have been reported in the area thus far.

With declining production and exploratory efforts yielding little promise for the immediate future, the bulk of the nation's liquid fuels requirements will continue to be imported. Crude petroleum is imported for refining in the nation's three refineries, and petroleum products are imported to supplement domestic refinery output. Liquid fuel consumption was estimated at 240,000 barrels per day in 1972. Total requirements for diesel fuel and 70% of the requirements for fuel oil were satisfied by domestic refineries. The largest of the nation's refineries, the 140,000-barrel-per-day-capacity Burgas refinery, is located on the Black Sea coast with access to an unloading terminal for tankers carrying crude from the U.S.S.R., Iraq, Libya, and Iran. A single 50,000-deadweight-ton unloading berth was in operation at Burgas in 1972; however, expansion plans for the Burgas terminal include construction of berths for simultaneous unloading of two 150,000-deadweight-ton tankers and a single-buoy mooring system to accommodate 150,000-deadweight-ton tankers by 1980.

Two additional refineries, each with a 20,000-barrel-per-day-capacity, were onstream during 1972, bringing total refining capacity to 180,000 barrels per day. With the U.S.S.R. providing technical assistance, Bulgarian refining capacity is scheduled to expand to 250,000 barrels daily by 1976, providing about 90% of the nation's petroleum product requirements.

The Mineral Industry of Burma

By Donald C. Wininger [1]

Burma's mineral industry showed moderate improvement during 1972. Production from the Bawdwin nonferrous metal mine near Lashio recorded a slight increase over 1971 output; however, production of refined lead and silver from this mine declined owing to the continuing decline in the grade of the ore. Production of tin and tungsten recorded a substantial increase in 1972. However, output from the Mawchi tin-tungsten mine declined during the year. The U.N. Development Program has provided $2 million to Burma to help reopen other tin and tungsten mines in southern Burma.

Offshore exploratory drilling was begun during the year but was interrupted in September by a blowout in which the drilling rig was destroyed. External government-to-government assistance continued to be provided to the Burmese petroleum sector by Japan and West Germany, and by the Export-Import Bank (Eximbank).

The mineral industry of Burma has become very much a government business. In fiscal 1971–72 (October through the following September), 11.5% of the Government capital expenditure was designated for the mining sector as follows: Myanma Oil Corp. (MOC), $17.9 million; [2] Myanma Bawdwin Corp. (MBC), $1.9 million; and Mineral Development Corp. (MDC), $5.7 million.

PRODUCTION

"Mineral" output totaled $43.6 million in fiscal year 1970–71 and $46.9 million in 1971–72, according to official Burmese national budget estimates.[3] Crude oil and limestone are included, but not the value added derived from mineral and metal processing. Thus, products like salt, cement, refined oil, and processed metals are excluded either in total or in part.

[1] Physical scientist, Division of Nonmetallic Minerals.

[2] Where necessary, values have been converted from Burma Kyats (BKs) to U.S. dollars at the rate of BKs 5.3487=$1.00. In the open market, the kyat is worth much less; actually, $1.00 can buy 15 kyats or more.

[3] Ministry of Planning and Finance. Report to the People by the Government of the Union of Burma on the Financial, Economic and Social Conditions for 1972–73.

Table 1.—Burma: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 p
METALS			
Antimony, mine output, metal content	65	128	131
Copper:			
Mine output, metal content e	70	r 80	80
Matte, gross weight	167	175	179
Iron and steel:			
Crude steel e	21,000	21,000	20,000
Semimanufactures e	25,000	25,000	30,000
Lead:			
Mine output, metal content e	r 8,000	r 9,000	10,500
Smelter:			
Refined lead	r 7,761	8,687	9,930
Antimonial lead (18% to 20% antimony)	239	309	331
Manganese ore, gross weight	e 110	112	279
Nickel:			
Mine output, metal content	21	24	26
Speiss, gross weight	84	94	104
Silver, mine putput, thousand troy ounces	r 620	685	1,155

See footnotes at end of table.

Table 1.—Burma: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS—Continued				
Tin, mine output:				
Metal content of tin ores	long tons	[r] 174	345	450
Metal content of tin-tungsten ores	do	[r] 254	327	282
Total	do	[r] 428	672	732
Tungsten, mine output:				
Metal content of tungsten ores		44	154	213
Metal content of tin-tungsten ores		[r] 177	228	197
Total		[r] 221	382	410
Zinc, mine output, metal content		[r] 3,953	4,020	5,390
NONMETALS				
Barite		13,463	22,963	25,970
Cement, hydraulic	thousand tons	156	197	185
Clays:				
Ball clay		[2] 7,638	[2] 13,506	14,428
Bentonite		[2] 1,027	[2] 347	1,305
Fire clay		[2] 1,490	[2] 1,411	[3] 2,477
Industrial white clay		[2] 537	[2] 1,431	3,505
Pottery clay		635	2,256	NA
Feldspar		812	[2] 713	799
Fluorspar		[r e 2] 165	[2] 201	225
Graphite		78	152	217
Gypsum		5,334	12,193	14,895
Precious and semiprecious stones:				
Jadeite	kilograms	[r] 2,083	2,444	2,750
Rubies and sapphires	carats	10,881	18,000	NA
Salt	thousand tons	193	161	210
Sand:				
Glass sand, brown		NA	[2] 4,822	2,093
Glass sand, white		NA	[2] 2,279	4,491
Stone:				
Dolomite [2]		786	654	914
Limestone, crushed and broken	thousand tons	604	609	596
Quartz		[2] 106	[2] 274	221
Talc and related materials, soapstone		213	215	[e] 220
MINERAL FUELS AND RELATED MATERIALS				
Coal		15,259	19,711	21,456
Gas, natural, gross production	million cubic feet	[e] 2,500	1,628	4,200
Petroleum:				
Crude	thousand 42-gallon barrels	6,388	6,652	7,466
Refinery products:				
Gasoline, aviation	do	24	--	--
Gasoline, other	do	1,476	1,414	1,481
Jet fuel	do	167	243	234
Kerosine	do	1,810	2,246	1,624
Distillate fuel oil	do	1,667	2,226	2,182
Residual fuel oil	do	929	1,609	1,501
Other	do	366	709	679
Refinery fuel and losses	do	328	193	NA
Total	do	6,767	8,640	NA

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

[1] In addition to the commodities listed Burma also produces common sand, gravel, other varieties of crude construction stone, and other varieties of gem stones, but available information is not adequate to make reliable estimates of output levels.

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

[3] Includes fire clay powder.

TRADE

Burma's overall foreign trade declined from $299 million (revised from $216 million shown in the Minerals Yearbook, V. III, 1971) in fiscal year 1970–71 to about $238 million in 1971–72. Although total exports at $113 million showed only a slight decline, from $124 million in 1970–71, total imports declined $49 million to $126 million according to preliminary estimates. In fiscal 1970–71, Burma exported $5.55 million in base metals and ores and $1.28 million in silver. In 1971–72, base metal exports were unchanged, but silver exports were down by nearly 50% from the previous year.

Burma's imports of mineral and related products dropped from $31 million in 1970–71 to $18 million in 1971–72. The largest item was base metals and manufactures, which reached $24 million in 1970–71 but declined to possibly only $18 million in 1971–72. Coal and coke imports showed the greatest change, declining from about $4 million in 1970–71 to less than $1 million in 1971–72.

Table 2.—Burma: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Antimony ore and concentrate	--	562	Belgium-Luxembourg 250; Japan 159; West Germany 152.
Copper matte	220	239	All to Belgium-Luxembourg.
Lead metal, unwrought:			
Refined	2,688	7,423	India 5,282; People's Republic of China 2,000; Japan 100.
Antimonial	--	427	India 221; United States 206.
Nickel matte and speiss	166	2,207	All to West Germany.
Silver, unwrought--thousand troy ounces	1,057	451	All to Netherlands.
Tin ore and concentrate [1]--long tons	456	1,604	Japan 1,008; Spain 307; Netherlands 139.
Tungsten:			
Straight tungsten concentrate	275	260	India 150; Japan 110.
Mixed tin-tungsten concentrates	51	340	West Germany 127; United Kingdom 98; Spain 60.
Zinc ore and concentrate	5,530	4,757	All to Japan.
NONMETALS			
Gem stones other than diamond:			
Jade:			
Uncut--thousand carats	80	174	All to Hong Kong.
Cut but not set--do	23	94	Hong Kong 69; Chile 15; Japan 10.
Rubies:			
Uncut--do	1,238	22	All to Hong Kong.
Cut but not set--do	2	2	Mainly to Hong Kong.
Sapphires:			
Uncut--do	521	38	Hong Kong 33; Switzerland 5.
Cut but not set--do	9	5	Mainly to Switzerland.
Precious and semiprecious stones, n.e.s.:			
Uncut--do	99	--	
Cut but not set--do	2	1	Mainly to France.
Salt	--	16,153	Malaysia 11,882; Singapore 4,271.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline--42-gallon barrels	--	1	NA.
Kerosine--do	(2)	1	NA.
Distillate fuel oil--do	18,436	15,881	NA.
Residual fuel oil--do	11,316	42,978	NA.
Lubricants--do	33	62	NA.
Other--do	99,227	117,603	Japan 28,389; United Kingdom 23,434; Singapore 18,789.

NA Not available.

[1] See also tungsten for mixed tin-tungsten concentrates.

[2] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	5	10	Japan 9.
Metal including alloys:			
Unwrought	634	613	Poland 611.
Semimanufactures	1,561	1,594	U.S.S.R. 514; West Germany 411; Japan 400.
Arsenic trioxide, pentoxide, and acids	27	5	West Germany 4; United Kingdom 1.
Chromium oxides, hydroxide	--	4	East Germany 2; West Germany 1.
Copper:			
Copper sulfate	67	(2)	All from West Germany.
Metal, including alloys:			
Unwrought	263	100	United Kingdom 99.
Semimanufactures	335	366	U.S.S.R. 128; United Kingdom 91; Belgium-Luxembourg 52.
Iron and steel, metal, including alloys:			
Pig iron, including cast iron	2,571	2,073	Norway 1,176; West Germany 767; United Kingdom 122.
Sponge iron, powder and shot	3	247	Japan 205; United Kingdom 41.
Ferroalloys	20	92	West Germany 70; United Kingdom 22.
Steel, primary forms	13,484	14,216	France 14,181; Belgium-Luxembourg 19.
Semimanufactures	r 61,493	81,727	United Kingdom 31,170; Japan 23,936; Belgium-Luxembourg 12,712.
Lead:			
Oxides	1	--	
Metal, including alloys, unwrought and semimanufactures	18	49	Japan 32; West Germany 13; United Kingdom 2.
Manganese:			
Oxides	681	222	Japan 154; Netherlands 66; United Kingdom 2.
Ores and concentrates	--	4	All from United Kingdom.
Mercury, 76-pound flasks	2,290	899	West Germany 676; United Kingdom 169; Japan 53.
Nickel metal, including alloys, all forms	3	30	United States 28.
Platinum-group metals, including alloys, all forms, troy ounces	29	10	All from United Kingdom.
Silver metal, including alloys, all forms, do.	1,873	542	Do.
Tin:			
Oxides, long tons	(2)	1	Do.
Metal, including alloys, unwrought and semimanufactures, do.	6	37	Belgium-Luxembourg 22; West Germany 8; United Kingdom 7.
Titanium oxides	204	84	Mainly from West Germany.
Tungsten metal, including alloys	--	(2)	All from United Kingdom.
Zinc:			
Oxides	42	43	Japan 31; United States 5; Netherlands 4.
Metal, including alloys, all forms	602	170	Japan 139; Belgium-Luxembourg 17; United Kingdom 11.
Other:			
Ores and concentrates, n.e.s.	24	--	
Oxides, hydroxides and peroxides of metals, n.e.s.	43	22	United Kingdom 19; West Germany 2.
Base metals, including alloys	(2)	--	
NONMETALS			
Asbestos	1,465	278	South-West Africa 224; Republic of South Africa 47; Japan 7.
Boric acid	37	7	India 4; United Kingdom 3.
Bromine	1	1	Mainly from United Kingdom.
Cement	1,019	2,688	West Germany 1,293; Japan 971; United Kingdom 340.
Chalk	24	23	India 16; East Germany 7.
Clays and clay products:			
Crude clays, n.e.s.:			
Kaolin (china clay)	44	24	Japan 11; Netherlands 8; United Kingdom 5.
Other	103	424	United Kingdom 331; Japan 52; India 30.
Products:			
Refractory, value, thousands	$116	$215	Japan $133; West Germany $58; United Kingdom $17.
Nonrefractory, do.	$26	$9	Japan $5; People's Republic of China $3; India $1.
Diamond:			
Gem, not set or strung, carats	--	70	All from United Kingdom.
Industrial, value, thousands	--	$2	Do.
Diatomite and other infusorial earths, do.	--	$5	All from United States.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Fertilizer materials:			
Manufactured:			
Nitrogenous	1,250	7	Belgium-Luxembourg 6; Spain 1.
Phosphatic	1,016	51	All from United Kingdom.
Potassic	20	1	All from Netherlands.
Mixed	2,212	1	All from United Kingdom.
Ammonia	56	105	Netherlands 40; West Germany 34; Belgium-Luxembourg 19.
Graphite, natural	96	117	United Kingdom 73; Japan 18; West Germany 17.
Iodine	6	1	Mainly from Singapore.
Mica, all forms	1	(2)	Mainly from Japan.
Precious and semiprecious stones, except diamond:			
Jade—carats	902	--	
Manufactured—thousand carats	r 427	4,550	All from Belgium-Luxembourg.
Salt	3	2	All from United Kingdom.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	3,012	5,793	United Kingdom 1,830; Netherlands 1,171; West Germany 1,116.
Caustic potash, sodic and potassic peroxides	23	25	West Germany 8; France 6; Sweden 5.
Stone, sand and gravel:			
Gravel and crushed rock	2	--	
Quartz and quartzite	59	(2)	All from West Germany.
Sulfur:			
Elemental	1,331	406	Mainly from West Germany.
Sulfuric acid	12	16	Japan 14; West Germany 2.
Other nonmetals, n.e.s.:			
Crude, other	213	104	India 80; West Germany 20; Japan 2.
Oxides, hydroxides of magnesium	(2)	--	
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	507	35	United Kingdom 30; Japan 5.
MINERALS FUELS AND RELATED MATERIALS			
Carbon black	250	50	Japan 44; West Germany 6.
Coal and briquets:			
Anthracite and bituminous	206,829	210,602	All from India.
Lignite and lignite briquets	82	112	All from United States.
Coke and semicoke	--	740	All from West Germany.
Hydrogen, helium, and inert gases	5	1	Mainly from Japan.
Petroleum:			
Crude—thousand 42-gallon barrels	1,473	2,009	Brunei 1,153; Malaysia 856.
Refinery products:			
Gasoline, aviation—do	5	2	Mainly from Iran.
Kerosine and jet fuel 42-gallon barrels	1	392	United Kingdom 266; West Germany 126.
Residual fuel oil—do	10	50,273	All from British Arabian States.
Lubricants thousand 42-gallon barrels	126	116	Singapore 62; Japan 22; United Kingdom 21.
Mineral jelly and wax 42-gallon barrels	527	1,755	Netherlands 1,107; Japan 354; Hungary 118.
Other:			
Nonlubricating oils, n.e.s. thousand 42-gallon barrels	7	8,823	Mainly from Iran.
Petroleum asphalt and pitch 42-gallon barrels	53,713	109,209	Malaysia 97,564; Japan 8,506.
Bituminous mixtures, n.e.s do	48	43	West Germany 29; East Germany 9; United Kingdom 4.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9	373	All from United Kingdom.

r Revised.
[1] Imports for consumption only; does not include imports into bond by commodity.
[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Antimony.—Small-scale extraction of antimony ore and concentrate continued. A decline in antimony prices from the high level of early 1970 apparently did not have too adverse an effect on operations since actual production has continued to rise.

Copper.—Full-scale geophysical prospecting at the Monywa copper mine is sched-

uled to begin in January 1973, by the Metallic Minerals Exploration Agency of Japan. Preliminary prospecting, so far, indicates reserves of approximately 26 million tons averaging 1.3% to 1.5% copper.[4] About 179 tons of copper matte was produced in 1972, as a byproduct of refined lead from the Bawdwin mine.

Iron and Steel.—The Ywama steel plant remained the country's only steel producer. Domestic scrap iron was used as feed for the furnace. Rated at 40,000 tons of products annually, the steel plant has been running at about half capacity. Bars and rods were the main products, followed by wire nails, galvanized iron, and barrel sheets. No further developments have been reported on the plans to build additional facilities for wire netting, roller extension, tubes, and sheets at Ywama or on the plans to build an integrated steel plant.

Lead, Zinc, Copper, Silver, and Nickel.—The Government-owned Bawdwin enterprise in Northern Shan State, operated by the MBC, continued to be Burma's sole significant producer of nonferrous metals. Zinc concentrate produced has been sold as such, mostly to Japan, whereas lead and other materials have been sent to nearby Namtu for smelting before marketing abroad, primarily to India as in the case of refined lead. As of yearend 1970, this mining complex, was capable of producing annually approximately the following: refined lead, 15,000 tons; zinc concentrate, 10,000 tons; silver, 1 million ounces; antimonial lead, 300 tons; copper matte, 200 tons; and nickel speiss, 130 tons.

The average grade of ore at Bawdwin apparently continued to decline. Output of concentrates from the mine increased; however, the quantity of lead and silver recovered declined. The old Namtu smelter with surplus capacity reportedly produced 9,930 tons of refined lead in 1972, indicating about a 14% increase from the previous year due to increased shipments of concentrates received from the newer mines.

In the Taunggyi District, the small Bawsaing mine also under MBC, which controls all nonferrous base metal operations in the country, was being expanded to produce about 1,000 tons each of sulfide lead ore, carbonate lead ore, and lead slag annually. The little so far produced has been sent to Namtu for smelting.

At the Yadana Tehingi mine in the Nawnghkio District, Northern Shan State, expansion to produce over 40,000 tons of silver-lead-zinc ore annually continued. A powerplant, a mill, and a 32-mile road from the mine to Ohnmathi on the Mandalay-Lashio highway have been constructed.

Tin and Tungsten.—MDC continued to control most of the country's tin and tungsten mines, and government policy calls for the eventual takeover of the remaining private mines as soon as their licenses expire. Tin and tungsten concentrates were produced separately or in mixed form, and their combined annual output has been about 1,100 tons of concentrates during the last 2 years, far below pre-World War II levels. Although statistics are conflicting, Burma has been producing, in terms of metal content, approximately 400 to 750 tons of tin and 200 to 400 tons of tungsten yearly. Most production has come from the Tavoy and Mergu Districts in the Tenasserim Division near the Thai border. Additional concentrates are purchased by the Government from small miners at relatively low prices.

Under the 4-year technical assistance agreement between MDC and the Soviet Union to rehabilitate the Mawshi tin-tungsten lode mine, a Soviet team of five experts continued to evaluate reserves which were calculated at 831,000 tons of recoverable reserves grading 0.97% Sn and 0.52% WO_3.[5] The initial goal of the program is to produce about 100 tons of concentrates monthly—roughly twice the monthly levels late in 1970. A decline in tin and tungsten concentrate production was reported during 1972, indicating that the rehabilitation program may still be having problems.

NONMETALS

Cement.—Burma has two cement plants operated by the Industrial Development Corp. One plant, located at Thayetmyo, has two wet-process rotary kilns capable of producing about 180,000 tons per year. The second plant, supplied by Kawasaki Heavy Industries of Japan, is located in the Kyangin area in the upper reaches of

[4] Japan Metal Journal. Dec. 11, 1972, p. 5.
[5] Job, Arthur Leslie. Burma's Mines and Mineral Potential. World Mining, v. 26, No. 1, January 1973, pp. 34–38.

the Irrawaddy River and has a capacity of about 800 tons per day.

Fertilizer Materials.—Prior to 1970, Burma's annual fertilizer requirements were all imported. In 1970 the first of two similar fertilizer plants was completed. The second plant was completed in early 1972, bringing an end to the large-scale imports of nitrogen fertilizers. Complex or mixed fertilizers, however, will still be imported.

Both plants are located near the Chauk oilfields in central Burma in order to utilize the natural gas there. The yearly capacities of each plant, costing approximately $14 million each, are 40,000 tons of ammonia and an associated 65,000 tons of urea.

Gem Stones.—Uncut Burmese jade continued to be of importance in world jewelry circles. Annual output had ranged from 52,300 to 93,300 kilograms of uncut jadeite. But since nationalization, reported output has amounted to only about 2,000 to 3,000 kilograms annually. Burma also produces ruby, sapphire, spinel, other "precious stones," and cultured pearls. The jade, precious stone, and pearl industries are totally nationalized.

Salt.—Burma Salt Industries, the sole operator harvesting salt from brine pits located along the Indian Ocean coast, produced about 210,000 tons during 1972. This output was sufficient to meet domestic requirements.

Other Nonmetallics.—An Industrial Raw Materials Committee helps MDC supervise various small nonmetallic industries that include fire clay from Pegu Yomas east of Minhla and from Kyaukpadaung; fluorspar from Kalaw; soapstone from Katha; graphite from Wapyudaung; manganese dioxide from Kyaukpadaung; bentonite from Shwebo; gypsum from Chauk; dolomite from Kalaw and feldspar from Thazi and Taungtha for the Syriam glass factory; quartz from Choungzon in Amherst District; and barite from Kyaukse and elsewhere. Barite and bentonite extraction has increased because of growing demand by MOC.

MINERAL FUELS

Coal.—The Kalewa coalfield in the northwest, sole producer in Burma, produced 21,456 tons of low-grade coal during 1972, compared with only 19,711 tons during 1971. Burma's imports of coal are about 200,000 tons of coal annually.

Petroleum.[6]—The major development of 1972 was the beginning of offshore exploratory drilling, interrupted in September by a blowout in which the drilling rig was destroyed. The three holes drilled produced natural gas, but at yearend it remained uncertain whether the third hole also contained oil. Onshore exploration also continued, but there were no major new finds. Financial assistance continued to be provided to the Burmese petroleum sector by the Governments of Japan and West Germany and by the Eximbank.

Onshore, crude production continued to rise, but was wholly attributable to the new Mann field near Minbu, which nearly quadrupled its output. The old fields at Chauk and Yenangyaung and the newer small fields at Myanaung and Prome continued to decline.

Output of refined products at MOC's two refineries at Syriam and Chauk fell significantly during the year, causing local shortages and distribution problems in many parts of Burma. Apparently the decline reflects operating problems as well as increasing reliance on crude from the Mann field. Mann crude has an exceptionally high wax content, and produces a different mix of refined products than crude from the other fields. Production of kerosine, a basic household necessity to many Burmese, was particularly affected during the year.

Although onshore crude oil production continued to rise, it remained too low to meet domestic demand, and Burma continued to import small quantities of crude oil. During the year refinery output fell and demand exceeded refining capacity, leading to shortages and a decision to import certain refined products until an extension to the Syriam refinery can be completed.

Burma's first offshore exploratory well was spudded January 15 in the Gulf of Martaban 80 miles south of Rangoon. It was completed in early April at a depth of 13,926 feet and showed traces of hydrocar-

[6] U.S. Embassy, Rangoon, Burma. State Department Airgram, A-016 (Annual Petroleum Report—Burma), Feb. 2, 1973, pp. 1–9.

bon gas but no petroleum. A second well, closer inshore, was begun May 8 and completed in July, at a depth of 13,036 feet, with results similar to the first well. The third well, about 30 miles southeast of Cape Negrais, was begun August 24 and blew out on September 8 after striking high-pressure gas at the 7,700-foot level. A possible oil slick was observed at the site, but there was no confirmation that petroleum was present in the test well. An active program of offshore seismic and geophysical surveys continued during 1972, and additional exploratory drilling was planned for 1973.

Onshore exploratory drilling during the year was focused in the Rangoon area. Two wells struck natural gas in less-than-commercial quantities but reportedly confirmed the view that oil can be found in the structures near Rangoon. The drilling south of Thayetmyo so far has been unsuccessful. However, a test well in an area about 20 miles south of Prome, on the east bank of the Irrawaddy, reportedly has produced oil in commercial quantities.

The Mineral Industry of Canada

By John A. Rathjen [1]

In 1972, the value of Canada's mineral production reached a record level of $6.4 billion,[2] an increase of approximately $418 million or 7% over that for 1971. This gain represents the 14th consecutive annual increase in Canadian mineral production. The value of minerals produced has grown at a rate of almost 9% over the last 20-year period. In 1972, the value of mineral fuels produced, showed strong gains offsetting lower advances in the other categories. Preliminary statistics indicate that the value of the metallic mineral sector amounted to approximately $3.0 billion, a gain of 2% over that of 1971. The nonmetallic group was valued at $530 million, a gain of 6%, while output of structural materials added $532 million for a gain of 4% over 1971 values. In the mineral fuels sector, the annual value of production amounted to $2.3 billion, a gain of 13% over that of 1971. These four sectors accounted for 47%, 8%, 8%, and 37%, respectively, of the total mineral production value in Canada.

In terms of gross national product (GNP), Canadian mineral production provided about 6.2% of the estimated $10.2 billion total. This compares to a mineral contribution of 6.4% in 1971. Based on an estimated population of 21.8 million, the per capita value of mineral production increased $15.83 to a new record of $291.31, one of the highest in the world.

In the first 9 months of 1972, compared with the corresponding time period for 1971, actual exports of mineral commodities in both crude and fabricated form increased almost 6% to about $3,920.5 million at the end of September. The increase in value of exports was attributable almost entirely to the fuels sector, where substantial gains were registered in both crude and refined areas. The combined value of fuel exports came to $1.2 billion, constituting a weighted average increase of 33.2% over the corresponding period in 1971. Nonmetallic exports registered a gain of $437.3 million, or about 5.6% over 1971 figures. Exports of both ferrous and nonferrous minerals and metals declined during the period. Crude and fabricated shipments of nonferrous material decreased a nominal 1.2%. However, export of ferrous products declined over 12%. This decline was reflected mainly in the shipment of iron ore, which was interrupted by strikes in Labrador and Quebec. It is expected that mineral exports for the balance of 1972 will continue at a rate equal to the first 9 months, and that the total value of shipments will exceed $5.5 billion.

The Canadian index of real domestic product, a measure of overall production in Canada as opposed to the GNP which reflects the income of Canadians, was up about 3% in 1972. Overall growth was much slower than that of preceding years. The 1972 mineral index reached 175.5 compared with 169.6 in 1971, or an increase of about 3% (1961 base=100). Manufacturing and utilities were up strongly in 1972 indicating a growth in the domestic economy. Other categories were up modestly with the exception of agriculture, fishing and trapping, and forestry which registered declines on the index.

Canada reported the production of 62 mineral commodities in 1972. Of these, 10 minerals represented 84% of the total production value or approximately $5,312 million. In 1972 the minerals ranked as follows in terms of value with respect to the total: Petroleum $1,542 million (24%); nickel $806 million (13%); copper $694 million (11%); iron ore $561 million

[1] Minerals specialist, Division of Nonferrous Metals—Mineral Supply.

[2] Because of fluctuating exchange rates, a meaningful conversion to U.S. currency is impractical. At yearend 1972, however, the exchange rate was Can$0.9956=US$1.00, which ratio has been used to convert to U.S. currency.

(9%); zinc $503 million (8%); natural gas $379 million (6%); asbestos $244 million (4%); cement $219 million (3%); natural gas byproducts $209 million (3%); and lead $155 million (2%). In addition to the above minerals, but excluded from official mineral production statistics, Canada also produced primary aluminum metal from imported bauxite and alumina. The value of the 1972 production is estimated to be in excess of $473 million.

In 1972, Canada continued as the world's leading producer of zinc, asbestos, silver, nepheline syenite, nickel, and maintained a position as the second largest producer of gypsum, molybdenum, potash, and sulfur.

Mineral production declined in 1972 in Ontario, Quebec, Manitoba, Nova Scotia, and Prince Edward Island. All other Provinces, the Yukon, and the Northwest Territories recorded increases. Typical of production in recent years, over 75% of value came from Alberta, Ontario, Quebec, and British Columbia in decreasing order of importance. Slightly more than one-half of the total value was produced in Alberta and Ontario. About 95% of the value of Alberta's output resulted from the production of crude petroleum, natural gas, and natural gas byproducts. The contribution from Ontario was mainly from the production of nonferrous metals and their byproducts. Of the $6.4 billion produced in 1972, the 10 Provinces and two Territories contributed on a percentile basis as follows: Alberta 30.2%, Ontario 23.8%, Quebec 12.0%, British Columbia 10.5%, Saskatchewan 6.6%, Newfoundland 5.5%, Manitoba 4.9%, New Brunswick 2%, Northwest Territories 2.1%, Yukon 1.6%, and Nova Scotia and Prince Edward Island, each with less than 1%.

Capital investment and repair expenditures were up approximately 3% over the 1971 total, with an aggregate outlay of about $2.5 billion for construction, machinery, and equipment. The figures reflect a high level of activity in exploration for petroleum and natural gas where over $856 million was spent. Investment in metal mines totaled $1,100 million, in nonferrous smelting and refining $303 million, and in nonmetal mines $181 million, which accounted for most of the balance.

The generally low level of mineral exploration that prevailed during 1971 continued through 1972, reflecting uncertainty as to provincial and federal legislation, high operating costs, and instability of worldwide economic and fiscal systems. Work continued at the base metal discovery in the Canadian high arctic, on Little Cornwallis Island. The formidable logistics of operating in this remote area were under careful study. Oil and gas exploration in the arctic also continued in an effort to define the reserves indicated by earlier discoveries on Melville Island and the surrounding area. New discoveries in the Mackenzie Delta and on Sable Island off the coast of Nova Scotia during 1972 have added a substantial although undetermined amount to the overall Canadian petroleum and natural gas reserves. Accelerated energy demands throughout the world have also stimulated the search for and development of new sources of coal. Exploration programs in Alberta, Saskatchewan, and Nova Scotia during 1972 were directed toward the expansion of coal production in those Provinces.

PRODUCTION

Mineral production in Canada is reported from all 10 Provinces and the two Territories. A brief review of the value contribution and principal minerals of each is given below in order of descending importance.

Alberta contributed a total of $1.9 billion during 1972, increasing output by 17% over that of 1971. Crude petroleum, natural gas, and natural gas byproducts provided 94% of the revenue with the balance coming from coal, structural materials, and elemental sulfur.

The value of Ontario's mineral production declined by $32.7 million in 1972, to a level of $1.5 billion. Nickel and copper made up 53% of the total with structural materials, iron ore, and zinc providing 35%. The balance was attributed to gold, platinum, and silver.

Production value of minerals in Quebec for 1972 declined by 0.3% to $764 million. The principal contributing minerals were copper and asbestos, split about evenly and totaling 44%. Structural materials and iron ore accounted for 31%. The balance came

from zinc, titanium dioxide, remelt iron, and gold.

In 1972 the value of mineral production in British Columbia reached a record of $671 million, a gain of 24% over that of 1971. Output of copper was up over 60%, and provided 37% of the total value. Coal provided 11%, and petroleum 10% of the total value of production. Structural materials, zinc, natural gas, molybdenum, and lead accounted for the remaining mineral value.

Saskatchewan's mineral production reached $420 million in 1972, up 2.9% from 1971. Crude petroleum provided 52% of the value, followed by potash with 33%; the remainder came from the production of structural materials, natural gas, copper, coal, and zinc.

Newfoundland's total mineral production was valued at $348 million. The major mineral contributing to the output was iron ore which provided 83% of the total value. Asbestos, copper, zinc, structural materials, and lead provided the balance.

Manitoba's mineral production value was $310 million in 1972, a decline of 5.6% from that of 1971. The two leading commodities, nickel and copper, which were valued at $178 million and $59 million, respectively, accounted for 76.5% of the total mineral value. Other minerals produced in the Province included structural materials, zinc, crude petroleum, tantalum, cesium, cobalt, and gold.

The mineral output of New Brunswick is closely related to the production of zinc and associated metals. In 1972 mineral production increased substantially by 23.4% from that of 1971, to $132 million. Zinc and its coproducts and byproducts, lead, copper, silver, cadmium, bismuth, and gold represented over 86% of the total mineral value. Structural materials and coal accounted for the remainder.

In the Northwest Territories, mineral output increased in value to $126 million from $115 million in 1971. Over 83% of the value was attributable to lead and

Table 1.—Canada: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Alumina, thousand tons	1,105	1,140	e 1,134
Metal, refined, do	972	1,017	907
Antimony [1]	r 330	150	213
Arsenic, white	64	45	27
Bismuth [2]	268	123	182
Cadmium [3]	1,954	1,843	1,700
Calcium, kilograms	201,193	161,137	216,363
Cobalt [4]	2,068	1,961	1,883
Columbium concentrate (pyrochlore), gross weight	4,462	2,218	3,707
Copper:			
Mine, recoverable	610,279	654,470	726,310
Smelter, refined	488,700	477,543	404,869
Gold, thousand troy ounces	2,409	2,261	2,079
Iron and steel:			
Iron ore, thousand tons	47,459	42,957	46,003
Pig iron, do	8,243	7,816	8,494
Ferroalloys, do	190	193	227
Crude steel, do	11,200	11,040	11,859
Rolled steel, do	8,241	8,997	e 9,669
Lead:			
Mine production	357,195	392,964	379,870
Refined, primary	r 185,598	168,333	189,257
Magnesium	9,392	6,562	5,302
Mercury, 76-pound flasks	24,400	[5] 18,500	[5] 14,600
Molybdenum	15,319	10,280	11,269
Nickel [6]	r 277,491	267,022	232,663
Platinum-group metals, troy ounces	482,428	475,169	399,000
Silenium, refined, kilograms	387,573	325,879	297,103
Silver, thousand troy ounces	44,251	46,024	48,488
Tantalum concentrate, gross weight	269	204	147
Tellurium, refined, kilograms	29,317	11,108	21,772
Tin, mine, long tons	r 120	142	161
Titanium:			
Ilmenite, gross weight	2,257,657	e 2,285,000	e 2,467,800
Titanium slag (70–72 percent TiO_2)	766,300	773,829	834,973
Tungsten concentrates (W content)	1,387	1,664	1,783
Uranium (U_3O_8)	3,723	3,726	4,443
Yttrium (Y_2O_3) (shipments), kilograms	33,112	NA	--

See footnotes at end of table.

Table 1.—Canada: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Zinc:			
Mine output, Zn content	1,253,095	1,133,739	1,200,793
Refined, primary	417,907	371,973	472,000
NONMETALS			
Asbestos—thousand tons	1,507	1,483	1,535
Barite	133,583	109,556	66,225
Cement, hydraulic [7]—thousand tons	7,208	8,225	9,081
Clays and products [8]—value, thousands	$39,461	$48,583	$48,998
Diatomite (shipments)	e 440	e 455	NA
Feldspar (shipments)	9,667	9,774	9,072
Fluorspar	124,100	e 72,600	e 120,000
Gypsum and anhydrite—thousand tons	5,732	6,080	7,205
Lime—do	1,495	1,450	1,457
Lithium minerals [9]	424	--	--
Magnesite and brucite—value, thousands	$3,082	$2,673	$2,555
Nepheline syenite	441,497	469,187	508,024
Potash (shipments, K_2O equivalent)	3,102,573	3,628,296	3,746,674
Pyrite and pyrrhotite:			
Gross weight	329,008	288,420	117,862
Sulfur content	159,232	140,643	54,460
Salt—thousand tons	4,862	5,028	5,021
Sand and gravel—do	183,846	193,494	195,589
Sodium sulfate	445,017	437,190	637,751
Stone [10]—thousand tons	65,323	66,692	67,313
Strontium minerals e	16,000	54,000	59,000
Sulfur, elemental, byproduct: [11]			
From smelter gases—thousand tons	640	561	572
From processing of crude oil, natural gas and nickel sulfide matte—do	3,219	2,857	2,967
Talc, soapstone and pyrophyllite (shipments)	65,367	59,478	72,575
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	77,000	84,500	89,000
Coal:			
Bituminous and subbituminous—thousand tons	r 11,598	13,728	16,046
Lignite—do	r 3,465	2,994	2,978
Coke, high temperature—do	5,143	4,631	4,724
Natural gas:			
Gross production—million cubic feet	2,625,927	2,825,904	3,316,058
Marketed production—do	2,277,109	2,499,024	2,913,645
Natural gas liquids:			
Gross production:			
Propane—thousand 42-gallon barrels	21,344	24,269	29,716
Butane—do	13,846	15,439	19,284
Pentanes plus—do	43,306	45,992	60,588
Condensate—do	846	880	1,107
Total—do	79,342	86,580	110,695
Production returned to formation, all types—do	671	543	NA
Peat moss—thousand tons	r 291	306	336
Petroleum:			
Crude—thousand 42-gallon barrels	461,180	492,739	554,328
Refinery products:			
Gasoline—do	164,745	168,161	183,724
Kerosine and jet fuel—do	35,756	39,165	40,945
Distillate fuel oil—do	127,756	138,924	146,620
Residual fuel oil—do	70,851	89,631	107,498
Lubricants—do	2,623	2,726	2,976
Other products—do	35,934	39,736	42,872
Refinery fuel and losses—do	29,262	31,226	39,771
Total—do	466,927	509,569	564,406

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Antimony content of antimonial lead alloys, flue dust and dore slag.

[2] Refined metal and bullion plus recoverable bismuth content of concentrate exported.

[3] Refined metal from domestic ores plus cadmium content of some exported ores and concentrate.

[4] All forms except cobalt in nickel sinter shipped to the United Kingdom by International Nickel Co., but including cobalt from Falconbridge nickel-copper matte shipped to Norway.

[5] Output of Cominco only; excludes production (if any) by other producers.

[6] Refined nickel plus nickel content of oxide produced plus recoverable nickel in matte exported.

[7] Cement shipped and/or used by producers.

[8] Includes value of bentonite and products from common clay, stoneware clay, fire clay, and other types of clays.

[9] U.S. imports of lithium minerals from Canada.

[10] Crushed, building, ornamental, paving and others for similar uses.

[11] Shipments, only; excludes sulfur content of pyrite which was included here in previous editions (see under pyrite). Actual output was estimated at 7.4 million tons in 1972, with the considerable difference between this figure and shipments being accounted for by stocks, chiefly held by sour gas producers.

zinc. Gold and silver provided virtually all of the remainder.

Mineral production in the Yukon also increased during 1972, reaching $102 million compared with $93 million in 1971. Over 86% of the mineral value was provided by the metals, lead, zinc, and silver. Asbestos provided slightly over 13% of the total.

Nova Scotia's mineral output was valued at $54 million in 1972, a decline of 9.3% from that of 1971. Coal, structural material, and gypsum provided 30%, 29%, and 24%, respectively, followed by salt with 12% of the provincial total. Small quantities of barite and peat moss were also produced; however, the combined total was less than 1%.

Mineral output of Prince Edward Island historically has been confined to structural materials, specifically sand and gravel. Total value of production decreased 18% to $796 thousand.

TRADE

According to preliminary data compiled by the External Trade Division, Statistics Canada, foreign trade in 1972 continued the strong expansion which characterized the decade of the 1960's and has carried into the 1970's. Exports of the minerals sector, including the metallic, nonmetallic, and fossil fuel categories amounted to $6.6 billion, approximately 35% of the total commodity exports, an increase of $1.7 billion over 1971. Except for metal ores and concentrates, which decreased, all mineral exports increased in value during 1972. The largest gains were recorded by petroleum and natural gas exports, the value of which was about $400 million higher in 1972 than that of 1971, reaching almost $1.5 billion. The United States received about $3.5 billion or approximately 53% of the total value of minerals exported.

The principal markets for mineral exports other than the United States were the United Kingdom, the European Economic Community (EEC), and Japan in descending order of importance. Imports during 1972 reflected strong Canadian demand, with growth recorded in all major trading areas. The minerals sector accounted for about $2.8 billion or approximately 15% of the total value of commodity imports. Crude petroleum accounted for the largest part of the mineral total with imports valued in excess of $1 billion. Iron and steel was second with $500 million, and the balance was spread over other mineral and metal commodities. The principal import sources in declining order of importance were the United States, the EEC, Japan, and the United Kingdom.

Table 2.—Canada: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Alumina (excluding abrasive grades, Al content)	21,570	19,224	United States 14,625; Italy 2,560; France 653.
Metal:			
Scrap	42,014	43,740	United States 33,699; Italy 5,038; Japan 2,050.
Unwrought	761,670	806,441	United States 407,789; Japan 95,170; United Kingdom 95,119.
Semimanufactures	14,200	18,042	United States 6,495; Portugal 3,529; New Zealand 3,053.
Cadmium	703	653	Netherlands 224; United Kingdom 198; United States 172.
Calcium—kilograms	78,970	69,354	Israel 24,995; United States 14,152; Belgium-Luxembourg 9,979; People's Republic of China 9,979.
Cobalt:			
Metal	381	340	United States 287; Belgium-Luxembourg 14; Republic of South Africa 14.
Oxides and salts, gross weight	837	1,119	All to United Kingdom.
Columbium concentrate [1]—kilograms	576,226	154,782	All to United States.
Copper:			
Ore and matte, Cu content	162,494	203,988	Japan 151,708; Norway 29,671, United States 7,566.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Copper—Continued			
Slag, skimmings and sludge, Cu content	200	272	United States 215; United Kingdom 57.
Metal:			
Scrap, unalloyed	28,692	16,537	United States 6,672; West Germany 2,975; Spain 2,378.
Scrap, copper alloys	18,941	13,916	United States 8,430; Japan 2,702; West Germany 1,058.
Unwrought, unalloyed	265,264	283,371	United States 107,317; United Kingdom 99,386; West Germany 30,574.
Semimanufactures, unalloyed	37,280	33,485	United States 14,576; Norway 3,262; Pakistan 2,692.
Semimanufactures, copper alloys	15,875	13,820	United States 12,324; Brazil 413; Israel 267.
Iron and steel:			
Iron ore—thousand tons	39,348	34,164	United States 20,419; United Kingdom 4,790; Japan 3,150.
Pig iron and related materials—do	604	516	United States 273; Netherlands 88; Italy 57.
Ferroalloys:			
Ferromanganese	510	346	Venezuela 204; Jamaica 132.
Ferrosilicon	45,345	47,017	United Kingdom 25,527; United States 8,122; Brazil 4,179.
Other	3,715	3,083	United States 2,344; United Kingdom 422; New Zealand 115.
Steel ingots and other primary forms thousand tons	150	183	United States 105; Brazil 51; West Germany 13.
Semimanufactures—do	1,512	1,371	United States 1,118; United Kingdom 39; Pakistan 25.
Lead:			
Ore and concentrate, metal content	150,513	180,815	Japan 107,329; West Germany 28,251; United States 21,933.
Metal:			
Scrap, including alloy scrap	5,209	5,305	Belgium-Luxembourg 2,278; United States 1,286; Netherlands 474.
Unwrought, unalloyed	138,637	124,179	United States 52,945; United Kingdom 42,235; India 14,047.
Semimanufactures	6,011	3,408	United States 3,278.
Magnesium metal	6,957	2,647	United States 862; United Kingdom 736; Mexico 201.
Mercury [1]—76-pound flasks	17,872	18,182	All to United States.
Molybdenum ore and concentrate, Mo content	13,759	10,408	United Kingdom 2,624; Netherlands 2,431; Japan 1,787.
Nickel:			
Ore, matte and speiss, Ni content	87,688	101,700	United Kingdom 46,433; Norway 46,094; Japan 9,153.
Oxide, Ni content	39,822	38,690	United States 25,810; United Kingdom 8,222; Belgium-Luxembourg 3,690.
Metal:			
Scrap	3,916	1,867	United States 841; Italy 462; United Kingdom 205.
Unwrought	138,984	113,725	United States 77,507; United Kingdom 26,536; Japan 1,819.
Semimanufactures	3,311	2,288	United States 1,168; Hungary 348; Brazil 281.
Platinum-group metals:			
Concentrates, residues and matte, metal content—troy ounces	638,504	213,481	United Kingdom 201,478; Norway 12,003.
Metal:			
Scrap—do	30,262	27,324	United Kingdom 13,722; United States 13,602.
Other—do	11,562	11,315	United States 7,043; United Kingdom 3,638; Mexico 605.
Selenium metals and salts, Se content kilograms	311,209	259,227	United States 151,772; United Kingdom 102,330.
Silver:			
Ore and concentrate, Ag content thousand troy ounces	21,028	25,183	United States 16,267; Japan 4,657; West Germany 1,660.
Metal, refined—do	24,200	18,201	United States 16,795; Belgium-Luxembourg 1,163; West Germany 231.
Tin ore and concentrate, Sn content long tons	264	213	Mexico 135; United States 44.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Titanium:			
Ilmenite and ilmenite sand [1 2]	27,727	173,202	All to United States.
Titanium slag 70% TiO_2 [1]	122,466	153,611	Do.
Uranium and thorium concentrates value, thousands	$24,069	$17,687	United Kingdom $11,473; United States $5,899.
Zinc:			
Ore and concentrate Zn, content	767,470	785,870	Belgium-Luxembourg 240,252; United States 213,548; Japan 138,864.
Metal:			
Scrap, dross and ashes	6,714	5,381	United States 1,912; Belgium-Luxembourg 1,551; Netherlands 1,308.
Unwrought	318,834	283,247	United States 143,609; United Kingdom 58,947; India 15,009.
Semimanufactures	7,185	6,294	United States 4,944; Belgium-Luxembourg 588; United Kingdom 240.
NONMETALS			
Abrasives:			
Fused alumina, crude grains	152,548	122,650	United States 111,167; United Kingdom 10,263.
Silicon carbide, crude and grain	96,158	85,148	United States 83,435.
Asbestos:			
Crude	92	104	Japan 44; United States 41; West Germany 9.
Milled fiber, all grades thousand tons	1,417	1,411	United States 413; Japan 99; United Kingdom 97.
Barite, crude	90,305	67,022	United States 64,199.
Cement, Portland	513,940	805,440	United States 805,439.
Clays and clay products, value, thousands	$11,693	$11,250	United States $6,487; French Oceania $748; United Kingdom $729.
Fertilizer materials:			
Nitrogenous, thousand tons	824	733	United States 730.
Potassic, do.	4,966	5,451	United States 3,911; Japan 586; India 285.
Mixed, do.	724	810	United States 660; India 132.
Gypsum, crude, do.	4,403	4,568	United States 4,499.
Lime	181,994	257,403	United States 256,590.
Nepheline syenite	351,940	366,720	United States 350,582.
Salt, value, thousands	$7,430	$7,029	United States $6,940.
Sand and gravel, thousand tons	1,125	703	United States 703.
Sodium sulfate	10,876	111,151	United States 101,752.
Stone:			
Limestone, crude, crushed and refuse thousand tons	1,347	1,433	All to United States.
Quartzite, do.	59	91	United States 91.
Rough building and crude, n.e.s., do.	660	224	United States 222.
Sulfur, crude and refined, do.	2,711	2,402	United States 915; Belgium-Luxembourg 259; Australia 224.
Talc and soapstone [1]	6,474	7,280	All to United States.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous, thousand tons	3,893	7,016	Japan 6,720.
Coke from coal	247,662	288,272	United States 167,035; Netherlands 71,926; West Germany 21,237.
Fuel briquets, coal and coke	20,142	28,829	United States 28,466.
Natural gas, million cubic feet	768,113	903,051	All to United States.
Petroleum:			
Crude, thousand 42-gallon barrels	240,893	270,771	United States 270,770.
Refinery products:			
Gasoline, do.	563	221	United States 210.
Distillate fuel oil, do.	4,727	2,454	United States 2,061; St. Pierre-Miquelon 338.
Residual fuel oil, do.	5,628	12,141	United States 11,861.
Lubricants, do.	16	8	United States 3; St. Pierre-Miquelon 2; Australia 2.
Liquefied petroleum gas, do.	20,788	23,503	United States 20,798; Japan 2,700.
Asphalt, do.	760	449	United States 440.
Petroleum coke, do.	266	83	United States 34; United Kingdom 22; Italy 11.
Petroleum and coal products, n.e.s., do.	264	2,177	United States 2,170.

[1] Partial figures, data given are U.S. imports for consumption only.
[2] Largely if not all used in the production of heavy aggregate.

Table 3.—Canada: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite—thousand tons	2,525	2,463	Guyana 2,075; Surinam 299.
Alumina—do	943	925	Jamaica 335; United States 275; Australia 259.
Metal:			
Scrap including alloys	5,201	5,819	All from United States.
Unwrought	12,179	15,900	United States 9,226; United Kingdom 3,620; Ghana 1,787.
Semimanufactures (including tubes, wire and cable)	80,918	96,835	United States 90,102.
Antimony oxides and salts, Sb content	383	268	United Kingdom 194; United States 36; People's Republic of China 35.
Chromium ore and concentrates, Cr content	27,620	29,679	United States 14,135; U.S.S.R. 6,200; Cyprus 3,128.
Copper:			
Ores, concentrates and scrap, Cu content	10,100	23,257	United States 20,606; United Kingdom 1,383.
Oxides and sulfate	2,249	1,996	United States 1,407; United Kingdom 299.
Metal:			
Unalloyed:			
Unwrought	13,192	19,866	United States 13,276; Chile 5,510; Mexico 757.
Semimanufactures	2,119	4,001	United States 2,706; Japan 420; Yugoslavia 379.
Alloys, unwrought and semimanufactures	7,883	10,612	United States 8,235; United Kingdom 1,491.
Iron and steel:			
Iron ore—thousand tons	2,160	1,384	United States 1,292.
Scrap—do	751	1,077	Mainly from United States.
Pig iron	87	608	All from United States.
Ferroalloys:			
Ferrochrome	20,814	36,202	Republic of South Africa 29,190; Japan 3,809.
Ferromanganese	17,891	19,557	Republic of South Africa 18,028.
Silicomanganese	975	1,624	Norway 1,003; Republic of South Africa 508.
Ferrosilicon	9,476	9,417	United States 7,587; Norway 1,558.
Ferrotungsten	91	101	United Kingdom 67; United States 23.
Ferrovanadium	171	90	United States 38; Austria 33; United Kingdom 19.
Other	6,659	4,920	United States 3,549; United Kingdom 628; France 541.
Steel ingots and equivalent primary forms	227,251	251,162	United States 194,548; Japan 33,085; France 11,871.
Iron and steel semimanufactures:			
Castings and forgings	154,486	117,456	United States 114,280.
Rolled steel, including structural and rails	999,199	1,549,744	Japan 611,767; United States 431,211; West Germany 165,391.
Pipes, tubes, wires and cables	225,574	318,176	Japan 157,434; United States 73,358; United Kingdom 40,824.
Lead:			
Oxide	1,704	2,748	Mexico 1,967; United States 653.
Unwrought and semimanufactures	2,342	4,539	United States 4,436.
Magnesium metal	1,807	1,657	Mainly from United States.
Manganese:			
Ore and concentrate Mn content	1,150,521	100,593	Brazil 48,988; Gabon 16,956; Zaire 13,985.
Metal	2,311	3,196	Republic of South Africa 2,532; Japan 440.
Mercury—76-pound flasks	2,017	1,605	United States 1,075; Mexico 467.
Molybdenum, molybdic oxide, gross weight	34	29	All from United States.
Nickel, unwrought and semimanufactures, including alloys	13,108	15,004	Norway 12,087; United States 2,134.
Platinum-group metals—troy ounces	60,745	53,608	United Kingdom 40,067; Republic of South Africa 11,727; United States 1,814.
Silver—thousand troy ounces	4,319	723	United States 706; United Kingdom 17.
Sodium metal	8,868	7,966	United States 7,957.
Tin, blocks, pigs, bar—long tons	5,111	5,012	Malaysia 3,126; United States 765; Nigeria 504.
Titanium:			
Dioxide, pure and extended	9,940	10,584	United States 7,863; Belgium-Luxembourg 950; United Kingdom 946.
Metal	263	160	United States 112; Japan 45.
Tungsten ore and concentrate W content	83	70	United States 37; Mexico 19; Uganda 14.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Zinc metal:			
Pigs, slabs, blocks, and anodes	334	3,632	All from United States.
Bars, plates, sheets, disks, shells	873	468	United States 214; West Germany 194.
Fabricated materials	439	524	United States 475.
Dust and granules	645	1,205	United States 1,105.
NONMETALS			
Barite, ground	6,827	10,280	United States 10,233.
Bentonite, clays and drilling mud	312,211	314,612	United States 260,808; Greece 53,803.
Cement, hydraulic all types	88,171	50,688	United States 32,769; United Kingdom 9,358; Belgium-Luxembourg 4,126.
Clays, ground or unground	277,251	301,166	United States 269,746; United Kingdom 31,467.
Cryolite, natural	2,248	2,149	Denmark 2,109.
Diamond:			
Gem, unset—thousand carats	77	90	Israel 30; Belgium-Luxembourg 27; United States 6.
Industrial stones—do	1,171	777	United States 653; United Kingdom 58, Belgium-Luxembourg 33.
Dust—do	443	389	United States 377.
Fertilizer materials:			
Nitrogenous, natural and manufactured	57,398	70,591	Belgium-Luxembourg 31,447; United States 29,034; West Germany 9,517.
Phosphatic:			
Phosphate rock—thousand tons	2,241	2,580	United States 2,576.
Manufactured	113,954	93,655	United States 93,509.
Potassic, manufactured	24,678	13,815	All from United States.
Diatomaceous earth	33,877	27,483	Do.
Fluorspar	85,894	204,201	Mexico 143,428; United Kingdom 23,797; Italy 15,275.
Fuller's earth	10,372	9,659	United States 9,655.
Gypsum, crude	35,271	95,965	Mexico 93,168.
Lime	30,649	23,990	United States 23,852.
Magnesium compounds:			
Dolomite, calcined	5,865	3,444	All from United States.
Magnesia dead burned	61,682	47,342	United States 30,616; Greece 9,107; Yugoslavia 4,669.
Mica, crude	3,422	4,757	United States 4,746.
Salt and brine	560,659	836,436	United States 450,129; Mexico 309,665.
Sand and gravel—thousand tons	456	613	United States 613.
Silica sand—do	1,176	1,288	United States 1,267.
Sodium sulfate and Glauber's salt	26,449	19,322	United States 6,762; Finland 4,725; Belgium-Luxembourg 4,153.
Stone:			
Crushed, including stone refuse—thousand tons	50	48	United States 46.
Cut	29,412	25,944	United States 17,282; Republic of South Africa 6,271.
Sulfur, elemental	48,494	27,925	Mainly from United States.
Talc and soapstone	29,999	30,619	United States 30,325.
Vermiculite, crude	25,488	32,354	United States 26,385; Republic of South Africa 5,968.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bituminous materials, crude value, thousands	$252	$343	United States $297; West Germany $25.
Coal:			
Anthracite—thousand tons	321	367	All from United States.
Bituminous and subbituminous—do	16,713	15,997	Do.
Coke from coal, excluding briquets—do	358	586	United States 417.
Fuel briquets, coal and coke	9,222	7,572	All from United States.
Natural gas—million cubic feet	11,878	16,010	Do.
Petroleum:			
Crude—thousand 42-gallon barrels	207,633	244,972	Venezuela 143,566; Iran 35,037; Nigeria 19,848.
Refinery products:			
Gasoline—do	5,200	4,799	Netherlands Antilles 2,499; Leeward and Windward Islands 464; Spain 339.
Jet fuel—do	3,653	1,675	Netherlands Antilles 576; Venezuela 527; Southern Yemen 277.
Kerosine and distillate fuel oil:			
Kerosine and gas oil—do	314	135	Netherlands 79; Netherlands Antilles 56.
Other distillate fuel oil—do	20,049	14,780	Netherlands Antilles 6,053; Bahamas 3,738; Venezuela 3,696.
Residual fuel oil—do	34,733	29,724	Venezuela 16,634; Netherlands Antilles 4,886; United States 4,859.
Lubricants—do	1,178	1,250	United States 1,016; Trinidad-Tobago 229.
Liquefied petroleum gas—do	327	59	Mainly from United States.
Other—do	5,318	7,212	Do.
Other petroleum and coal products	128,919	134,298	United States 86,715; United Kingdom 36,032; Australia 10,091.

COMMODITY REVIEW

METALS

Aluminum.—Smelter production of primary aluminum dropped from 1,017,000 tons in 1971 to 907,000 tons during 1972 indicating a reduction of approximately 11% for the period. This decline can be attributed to continuing voluntary cutbacks which were further aggravated by a 10-week strike at the Baie Comeau plant of Canadian Reynolds Metals. The Aluminium Company of Canada Ltd. (Alcan) operated four smelters in Quebec and one in British Columbia producing a total of 798,000 tons while Canadian Reynolds generated 127,000 tons at their Quebec operation. At yearend the industry was producing at 88% of rated capacity.

Since Canada has no economic deposits of bauxite, an estimated 2,450,000 tons was imported for production of alumina at Alcan's Arvida plant. This raw material came essentially from Guyana, 1,350,000 tons; Surinam, 308,000 tons; and Sierra Leone, 381,000 tons. The balance of 410,000 tons came from Indonesia, Malaysia, and other countries.

In addition, approximately 726,000 tons of alumina was imported from the United States, Jamaica, and Australia. The alumina was utilized at Alcan's Kitimat smelter in British Columbia and at the Canadian Reynolds Baie Comeau smelter in Quebec.

Domestic consumption of aluminum in 1972 was estimated to be 281,000 tons, representing an increase of 10% over that of 1971. This continued growth of domestic demand has precipitated industrial expansion. Announcements by Canadian Reynolds of a $4,800,000 investment in its rolling mill at Cape-de-la-Madeleine, Quebec, and a doubling of capacity at the Laval extrusion works of Alcan appeared during 1972.

Exports of primary ingot during 1972 were down 10% to a total of 726,000 tons. The level of shipments to the United States was maintained but those to the United Kingdom, Japan, and West Germany declined considerably.

Columbium and Tantalum.—St. Lawrence Columbium and Metals Corp. near Oka, Quebec, continued as the sole producer of columbium in Canada. In 1972 the corporation produced approximately 1,769 tons of columbium pentoxide (Cb_2O_5) valued at $4 million. This figure represents a marked increase over the 1971 period when the company produced 1,058 tons valued at $2.4 million.

Following a period of low demand and oversupply which began in 1970 and extended into the first quarter of 1972, demand throughout the world increased sharply. The sudden increase in requirements reflected recovery in the world steel industry and increased use of high-strength low-alloy (HSLA) steel. HSLA is used principally in the manufacture of structural and pipeline steels.

With this increased demand the published price for columbium was increased three times during 1972. In March the price was raised from $0.95 to $1.12 per pound of Cb_2O_5. Continued demand pressure pushed the price up to $1.24 in July and finally to $1.39 per pound of Cb_2O_5 in October, where it remained for the balance of the year.

Most of the columbium produced in Canada is exported to the United States, the United Kingdom, and Western Europe, where it is consumed in the production of specialty and alloy steels. Canada supplies approximately 20% of the world requirements for this commodity.

Canada continued as the world's largest producer of tantalum from the Bernic Lake, Manitoba, mine of the Tantalum Mining Corporation of Canada Ltd. (Tanco), an operating subsidiary of Chemalloy Minerals Ltd. Shipments of tantalum as Ta_2O_5 in 1972 amounted to 325,000 pounds valued at approximately $2.3 million. This is somewhat less than the 1971 shipments which were 450,000 pounds with a value of about $2.9 million.

Tanco is the principal supplier of tantalum to the U.S. market, supplying approximately 46% of requirements. Precise data on tantalum contained in concentrates are difficult to estimate because of its combination with columbium in varying proportions.

Ore reserves have not changed materially since 1971 and at the current rate of production are adequate for 8 to 10 years.

Copper.—Production of copper from Canadian mines continued to rise during 1972 setting a new record of 726,000 tons,

an increase of 11% over the 1971 total. This was the fourth consecutive year of expansion in the copper industry. The value of production was 806 million, about $50 million more than that of 1971. The indicated price for the period was approximately Can$0.506 per pound. The Canadian producers' price fluctuated throughout the year opening at Can$0.504 in January and moving to Can$0.526 on February 28. It dropped to Can$0.498 on July 6 and finally rose to Can$0.505 on December 8. This final move was effected to compensate for the changing value of the Canadian dollar.

Refined copper output during 1972 reached a total of 486,000 tons, an increase of approximately 7,400 tons above 1971. Domestic shipments of refined copper by producers rose 5,800 tons to 209,000 tons while refinery exports declined 3,500 tons to 286,000 tons compared with 1971 totals. Exports of copper in blister, concentrates, and matte continued to rise throughout 1972 with a total of 542,000 tons shipped, an increase of 4,400 tons over the 1971 period.

Most of the copper exported went to Japan in the form of concentrate, accounting for approximately 78% of the total. The balance of the exports went to Norway, West Germany, the United States, Greece, and Western Europe in declining order of volume.

The Province of Ontario continued as the leading producer of copper accounting for 36% of the national total, in spite of a drop in production of some 12,800 tons. New and increased activity in British Columbia generated an aggregate of 225,000 tons representing 31% of the total production and an increase of 77% over the 1971 provincial total. The balance of mine production came from Quebec 22%, Manitoba 7%, and from Saskatchewan, Newfoundland, New Brunswick, and the Northwest Territories a combined 4%.

The decline in Ontario output was primarily due to lower production rates at nickel properties. This reduced output came about as a method of inventory adjustment and is discussed in the section on nickel. British Columbia increased production during 1972 as four major new mines came onstream with a total mill capacity in excess of 84,000 tons per day. This new production was augmented by completion of mill expansion at the Granisle mine, which increased its operating rate at the concentrator to 14,000 tons per day.

During the year Canadian Copper Refiners Ltd. (CCR), a subsidiary of Noranda Mines Ltd., completed basic expansion plans for the Montreal East Copper refinery resulting in an annual capacity of about 381,000 tons of refined copper. In addition, CCR has announced further expansion in excess of 55,000 tons per year of refining capacity. When these plans have been implemented, Montreal East will be the largest copper refinery in the world. Gaspé Copper Mines Ltd. and Noranda Mines Ltd. have indicated projects for expansion of smelter capacity at the Murdochville and Noranda operations, respectively. Murdochville will be producing an additional 27,000 tons of anode copper per year. They also plan a circuit for leaching of low-grade oxide copper ores. The latter plan will utilize some of the acid from a new 300,000-ton-per-year acid plant currently under construction. Expansion at the Noranda smelter will be brought about through the construction of a continuous smelting process reactor. This innovation, which provides for the direct smelting of sulfide copper concentrates, will add approximately 55,000-tons-per-year capacity to the facility.

The Canadian Government adopted an active position in the copper industry during 1972 when Japanese smelters requested a renegotiation of functional contracts. The Japanese arguments for curtailing shipments of concentrates were predicated on excessive costs brought about by air pollution legislation and additional expense associated with the reevaluation of the yen. After completing its investigation, the Canadian Government advised the Japanese Government of its findings and released the companies to continue negotiation directed toward reducing shipments of copper concentrate to Japan. By yearend all adjustments had been completed.

Gold.—Canadian gold production registered the 11th year of decline in 1972 with a total output of 2,079,000 ounces, a reduction of 8% from the 1971 level. Based on the Royal Canadian Mint price for the year of Can$36.58 per ounce, this represents a total value of Can$76 million. The comparative statistics for 1971 show a total value of Can$79 million covering a production of 2,260,730 ounces, at Can$35.34 per ounce. The above total values were

calculated at the average levels established by the Royal Canadian Mint. However, based on an estimated average free market price in 1972 of Can$57.54 per ounce, the total value of Canada's gold output during the year was about Can$119 million.

The most important development in the gold industry during 1972 was the rising trend in the open-market price of gold. The opening price of US$43.725 rose progressively to a high of US$70 on August 2. The price receded from this high and, during the last 3 months, gold traded in the range of US$61 to $65 per ounce.

All of the gold produced at the mines was sold on the open market and, as a result, no mines were eligible for assistance under the provisions of the Emergency Gold Mining Assistance Act. The Act was extended through June 30, 1976, and will provide a floor price of about $48 per ounce to those mines eligible for maximum assistance should the free market price for gold fall below this level.

Lode gold mines accounted for 76.5% of the total gold produced in Canada compared with 79% in 1971. Gold recovered as byproduct from base metal mining accounted for 23.3% and placer mining 0.2%.

Ontario remained the largest producer of gold, accounting for 48.5% of the total, followed by Quebec with 27.3%, and the Northwest Territories with 13.9%. The balance of 10.3% was spread over the other Provinces and Territories.

There were no mine closures or openings in 1972. Twenty-one lode gold mines were in operation at the end of the year. Three properties had been scheduled for closure; however, the higher prices for gold on the open market allowed these properties to continue in operation.

Iron Ore, Pig Iron, and Steel.—In spite of a record-breaking year for steel production in Canada and throughout the world, shipments of Canadian iron ore and byproduct ore dropped to a level of 39.7 million tons during 1972. This represents a decline of some 3.8 million tons, or a reduction of 9% from the 1971 figure. Production of iron ore lagged behind shipments by about 1.2 million tons. The deficit was absorbed by reduction of the stocks at mines and ports. The low level of shipments and production during 1972 was attributed to a general slowdown throughout the industry prompted by an inventory buildup in 1971 and misjudgment of Japanese requirements for 1972. Contrary to estimates, Japanese demand remained strong and, as steel production throughout the world accelerated to peak levels, the Canadian iron ore industry was unable to tune up in time to meet this increased foreign demand. There was a slight rise in domestic shipments of iron ore which, combined with imports and drawdown of inventory stocks at the mills, helped meet Canadian industrial requirements. The pattern of iron ore production remained basically the same in 1972 as in earlier years. Seventeen companies produced ore at 18 locations. Of these, 10 operations were in Ontario, three in British Columbia, two in Quebec, two in Newfoundland (Labrador) and one in Quebec-Labrador. During 1972 two of the byproduct producers closed their operations. Cominco Ltd. shutdown it's pyrrhotite flotation plant at Kimberly, British Columbia and Falconbridge Nickel Mines Ltd. closed down its iron-nickel operation at Falconbridge, Ontario. Both of these plants were closed for economic reasons. With the exception of Ontario, all of the producing Provinces experienced decreases in shipments of iron ore during 1972. Newfoundland registered the largest loss with shipments of 15.4 million tons, a drop of 2.9 million from the 1971 total. British Columbia and Quebec also showed deficits of 0.8 million and 0.5 million tons, respectively, compared with 1971. Ontario recorded a fractional increase of 0.45 million tons for the comparable period.

Construction of three large iron ore projects in Quebec-Labrador continued during 1972. Work at two of the sites was curtailed owing to labor difficulties, and completion dates have been moved forward. A 10-million-ton-per-year expansion at the Carol Lake concentrator and the new 6-million-ton-per-year pellet plant at Sept Isles, both Iron Ore Company of Canada projects, were rescheduled for 1973 startup. Quebec Cartier Mining Co. continued work on the 16-million-ton-per-year Mount Wright concentrator. Developments include an 88-mile extension of the rail line from Gagnor to Mount Wright, construction of the new concentrator, establishing the new town of Fermont, building power transmission lines, and preproduction stripping at the minesite.

Exports of iron ore for 1972 totaled 29.1 million tons compared with 33.1 million tons in 1971. This represents a drop of

about 12% which can be attributed primarily to labor problems in the Quebec-Labrador sector, and an overall reduction of shipments to Japan. The United States continued as the prime market, accounting for about 63% of the total with the balance going to the Economic Commission (UN) Steel Committee (ECSC) countries, the United Kingdom, Japan, and others.

Pig iron production recovered from the slump experienced in 1971 with a total of 8.5 million tons, a net gain of 9% during 1972. The bulk of the pig iron was used in Canada as charge material for steel furnaces; however, about 586,000 tons was exported to 10 countries, primarily the United States, the Netherlands, Italy, West Germany, and the United Kingdom.

Crude steel production in 1972 was a record 11.9 million tons, a 7% increase over the 1971 total. This increase roughly parallels domestic consumption which was up about 7.5% from 1971. The increase in production was shared by all major steel companies, with the exception of the Sydney Steel Corp., which was hampered by a 4-week strike at its works. Imports of steel in all forms continued to exceed exports by approximately 1.3 million tons for the year. During the latter part of the year, imports were curtailed considerably. This decline in imports was attributed to competition from domestic steel producers since foreign producers were increasingly affected by rising costs and currency revaluation.

Capital and repair expenditures continued strong through 1972 with some $431 million invested in the industry. The Algoma Steel Corp. Ltd. completed the relining of an existing blast furnace and began work on a new furnace scheduled for completion in 1974. Construction of a basic oxygen steel plant continued on schedule and will come onstream in April 1973. Dominion Foundries and Steel, Ltd. (Dofasco), started up its third electrolytic tinning line in March 1972 thus doubling its tinplate capacity. Dofasco continued work on its 6-year environmental control program with current efforts being directed to mill water treatment. Lake Ontario Steel Co. Ltd. (Losco) commenced expansion of capacity from 300,000 to 350,000 tons per year at its Whitby, Ontario plant.

Lead.—Canada maintained its position as the third largest producer of lead in the world, recording a mine production of 380,000 tons during 1972. This was a reduction of some 3% from 1971 when approximately 393,000 tons were reported. The drop in production was attributed mainly to labor difficulties at Cominco, Ltd., and the Heath Steel Mines Ltd.

Lead was produced in six Provinces and two Territories with the Yukon accounting for 30% of the total. British Columbia followed with 25% and the Northwest Territories contributed 22%. New Brunswick provided an additional 14% and the balance was divided among Newfoundland, Ontario, Quebec, and Manitoba.

Exports of lead in ores and concentrates decreased during the first 9 months of 1972 by 9.5% compared with the same period in 1971. Shipments to Japan increased 13.5% while shipments to all other countries declined.

Exports of lead metal during 1972 totaled 126,000 tons, an increase of 2,000 tons over the 1971 shipments. The principal markets were the United States, the United Kingdom, and the Netherlands.

The output of primary refined lead during 1972 amounted to 189,000 tons, 21,000 tons more than that of 1971.

The lead refiniery of Cominco, Ltd., at Trail, British Columbia, and that of Brunswick Mining and Smelting Corp. Ltd. at Belledune, New Brunswick, continue as the only producers of primary lead metal in Canada. At Belledune, the company has not quite completed conversion of the smelter from the Imperial Smelting Process (ISP) (lead-zinc) to a conventional lead smelting unit. When changes have been completed, the facility will have a productive capacity of approximately 55,000 tons of lead per year as compared with the current capacity of 30,000 tons.

Mine production of lead was increased with the opening of the Mattabi Mines Ltd. at Sturgeon Lake, Ontario, and the resumption of production at Manitou-Barvue Mines Ltd. at Val d'Or, Quebec. Cominco also announced the reopening of the H.B. mine to be operated at the rate of 1,000 tons of ore per day.

Lead operations closed during 1972 included the Nigadoo River Ltd. mine and the permanent suspension of operations at Walton, Nova Scotia, by Dresser Minerals, a division of Dresser Industries Inc.

Molybdenum.—Production of molybdenum in Canada during 1972 was 24.8 mil-

lion pounds valued at $34 million. These figures compare to 22.7 million pounds valued at $38.4 million in 1971 and represent an increase of some 2.1 million pounds, but a decline of $4.4 million in value. The apparent imbalance in the quantity-value ratio for molybdenum reflects the change from a comparatively controlled commodity to one of a competitive nature. The development of open pit copper-molybdenum mining is expected to contribute more to this competitive pricing situation in the future.

In spite of several mine closures and curtailments, necessitated by excessive inventory buildup and retarded demand, operating Canadian producers maintained output and Canada retained its position as the No. 2 world producer, supplying 14% of the world total. Canada was surpassed only by the United States, which accounted for approximately 64% of the world total.

Since Canadian consumption utilizes only 6% of the total domestic production of molybdenum, the industry depends on exports for sale of the balance. The principal markets are Western Europe and Japan.

In 1972 approximately one-half of Canada's molybdenum production was recovered as a byproduct or coproduct of copper from porphyry-type operations. The increase in proportion of byproduct molybdenum output in 1972 was the result of cutbacks in primary molybdenum production at the Placer Development Ltd. Endako mine, closure of the British Columbia Molybdenum Ltd. mine near Alice Arm, British Columbia, and the cessation of other operations. This trend is expected to increase as more porphyry deposits are brought onstream.

Canadian molybdenum in 1972 was produced at eight mines in two Provinces, six in British Columbia, and two in Quebec.

Placer Development Ltd., Endako Mine Division, Canada's largest molybdenum producer, reduced output to about 50% of its 18-million-pound-per-year capacity in March 1972. Production in 1972 was expected to be about 10 million pounds.

Brenda Mines Ltd. production of molybdenum concentrate ran higher in 1972 than in 1971. By September 30, 1972, it had accumulated an inventory in excess of 11 million pounds.

Utah Mines Ltd. completed its first full production year. The molybdenite concentrate contains significant amounts of rhenium and a feasibility study for its recovery was in progress during 1972.

The Lornex Mining Corp. Ltd. concentrator came onstream during 1972 and molybdenite recovery began in August. Estimated annual recovery is 2,300 tons of molybdenite concentrate, assaying 54% molybdenum when its mine is in full operation.

Gibraltar Mines Ltd. reached full mill capacity in April, however, the molybdenum circuit was only operational on a trial basis for about 1 month because mill feed was below average molybdenum grade and variable in content. Molybdenum will be recovered when there is an economic quantity in the feed.

British Columbia Molybdenum ceased operations on April 28.

In Quebec, Gaspé Copper Mines Ltd. continued to recover molybdenite as a byproduct of its copper mining operations near Murdochville on the Gaspé Peninsula.

Molybdenite Corporation of Canada Ltd. closed the Lacorne mine and mill in September.

Nickel.—For the second successive year the nickel industry continued a series of production adjustments in an effort to more closely match supply with consumer demand. Several producers reduced mine output below already established 1971 cutbacks and by mid-1972 additions to already large inventories had ceased. As economic activity improved toward the latter part of the year throughout the world, demand for nickel increased accordingly and inventories began to decline.

During 1972 there was one price change. Falconbridge Nickel Mines Ltd. announced a 15% increase during the month of September, which raised the price from US$1.33 to US$1.53 for electrolytic nickel. Other producers were quick to follow and the new price became firmly established. The prices of other primary nickel products, including ferronickel and nickel oxide sinter, also were increased.

Production of nickel during 1972 was 233,000 tons valued at $698 million. This figure represents a decrease of 34,000 tons from 1971 and a loss to the industry of some $103 million.

In spite of major cutbacks, three new nickel-copper mines were brought into

production during 1972. Société Minière d'Exploration Somex Ltée. started up its nickel-copper mine and concentrator at Lac Edouard, Quebec, during September. The operation is currently producing at the rate of 240 tons of ore per day and concentrates will be processed at the Sherritt Gordon Mines Ltd. refinery in Alberta. The Shebandowan deposit of International Nickel Company of Canada Ltd. (Inco) began mining at midyear. The third new producer, the Wellgreen nickel-copper mine at Kluane Lake, Yukon Territory, was placed in production by Hudson Yukon Mining Co. Ltd. However, it has since been announced that this mine will be closed early in 1973 owing to major mining difficulties.

Inco announced an additional 10% cutback during 1972 in addition to the 22% reduction established in 1971 to bring production in line with sales and to prevent further inventory accumulation. To accomplish this, the Crean Hill mine, the Totten mine, and the Coniston smelter, all in the Sudbury area, were closed. Additional reductions were announced at the Stobie mine at Sudbury and the Birchtree mine at Thompson.

Further announcements by Inco included completion of the Copper Cliff pressure carbonyl refinery. The plant will go into production during 1973 with an annual capacity of 50,000 tons of nickel pellets and 12,500 tons of nickel powder. Inco also is developing one new mine in the Sudbury area, the Levack West, which is scheduled for production in 1975.

Falconbridge also moved to reduce production in an effort to offset rising costs and mounting inventories. Effective April 1972, it announced a 5% cutback in ore production. Operations at the Longvack South mine were temporarily terminated and production at the Hardy concentrator was reduced. All of the Ontario plants were closed for a 2-week vacation period. Falconbridge has also deferred work on four new mines that were being developed in the Sudbury area.

Sherritt Gordon continued to process ore from its Lynn Lake mine in Manitoba. The company also treats ore and concentrate from the Giant Mascot Mines Ltd., and from foreign sources, at its Fort Saskatchewan refinery. Other developments in nickel during 1972 included the closing of Renzy Mines Ltd. located in Hainault Township, Quebec. Consolidated Canadian Faraday Ltd. closed the Werner Lake mine in August when ore reserves were exhausted. The Werner Lake concentrator continued to treat ore from Dumbarton Mines Ltd., where production has been increased from 700 to 1,100 tons of ore per day.

Silver.—Mine production of silver in Canada during 1972 established a new record with a reported output of 48.5 million ounces, an increase of 2.5 million ounces over the 1971 output. Preliminary figures indicate that Canada will again be the world's largest mine producer of silver.

Refinery output of silver during the first 9 months of 1972 was 16.2 million ounces compared with 14.5 million ounces refined during the similar period in 1971.

Silver was produced in seven Provinces and the two Territories with respective output and percentage as given below for the year 1972:

Province	Thousand ounces	%
Ontario	20,234	41.7
British Columbia	7,238	14.9
Yukon Territory	5,620	11.6
New Brunswick	5,430	11.2
Northwest Territories	4,399	9.1
Quebec	3,542	7.3
Manitoba	814	1.7
Newfoundland	810	1.7
Saskatchewan	401	.8
Total	48,488	100.0

The bulk of primary silver mined in Canada is derived as a byproduct or coproduct of base metal mining operations, particularly those of lead, zinc, and copper. In 1972, approximately 95% of the primary silver was recovered from these base metal ores with some 4% coming from silver ores and the balance from lode and placer gold mines.

Exports of silver in ores and concentrates and as refined metal totaled 41.3 million ounces, some 2.1 million ounces less than exports in 1971. The principal market continued to be the United States, which accounted for approximately 77% of the exports, while the remainder went mainly to Japan, West Germany, and Belgium.

The largest silver producer in Canada continue to be Ecstall Mining Ltd. from the Kidd Creek property near Timmins,

Ontario. Its reported production for the year 1972 was 12.8 million ounces of silver or approximately 26% of the entire Canadian production.

New developments in silver included the agreement between Texas Gulf Inc. and Minerals Resources International Ltd. under which the latter will develop a lead-zinc-silver deposit on Baffin Island in the Northwest Territories. Indicated reserves total about 7 million tons assaying 2% lead, 14% zinc, and 2 ounces of silver per ton. Under the terms of an agreement with Dolly Varden Mines Ltd., New Jersey Zinc Exploration Co. Ltd. will conduct a production feasibility study of the Dolly Varden mine. In a preliminary report reserves were estimated at 1.7 million tons assaying 9.51 ounces of silver, 0.80% zinc, and 0.51% lead.

Uranium.—Production of uranium in Canada increased approximately 19% during 1972 to 4,400 tons compared with 3,700 tons recorded during 1971. The bulk of this output came from mines in the Elliot Lake area of Ontario operated by Denison Mines, Ltd., and Rio Algom Mines, Ltd. The ore occurs in quartz pebble conglomerates of Precambrian origin. The Elliot Lake mines account for about 85% of the Canadian production with the balance coming from Eldorado Nuclear Ltd. operations near Uranium City, Saskatchewan, where the ore occurs in pitchblende vein-type deposits.

In the Elliot Lake area, Denison operated its mill at about 70% of the rated 6,000-ton-per-day capacity. Rio Algom operated the New Quirke mine and mill at a rate near 6,500 tons per day, well in excess of design capacity. The Eldorado mill in Saskatchewan, rated at 1,800 tons per day, operated at about half capacity throughout the year. Approximately two-thirds of the mill feed was generated at the company's new Hab mine, with the balance coming from the main Fay mine.

In November 1972, Denison and Uranium Canada Ltd. (UCAN) announced a sales agreement involving 8.9 million pounds of U_3O_8 valued at close to Can$60 million. The material is to be delivered to a group of Spanish utilities beginning in 1974 and continuing through 1977. This sale will completely dispose of the 3,200-ton joint venture industrial stockpile and also consume part of the Federal Government's general stockpile. The total commitment of Canadian uranium is now approximately 64,000 tons of which some 8,600 tons has already been delivered.

Exploration for uranium in Canada during 1972 was minimal with only three new permits issued by the Atomic Energy Control Board. This reduction in activity reflects the continuing soft market and the uncertainty of government policy with respect to foreign ownership of uranium properties.

Gulf Minerals Canada, Ltd. continued work at the Rabbit Lake property near Wollaston Lake in northern Saskatchewan. Production is scheduled for 1975 and it is expected that about 4.5 million pounds of U_3O_8 will be recovered on an annual basis. One significant development during 1972 was the announcement by Mokta (Canada) Ltd. that it outlined a small but rich uranium ore body at Cluff Lake in northern Saskatchewan. The Saskatchewan Government is building a 146-mile road from Turnor Lake to Cluff Lake, expected to be completed early in 1973 at which time development of the ore body will commence.

Zinc.—Canada maintained its position as the world's largest producer of zinc with an output of 1.2 million tons during 1972, an increase of 6% over 1971. The value of this production was some $503 million compared with $416 million in 1971. Zinc production originated in seven Provinces and the two Territories as indicated in the following:

	Quantity (tons)	Value (thousands)
Ontario	371,921	155,682
Northwest Territories	190,511	79,742
New Brunswick	188,032	78,708
Quebec	142,930	59,826
British Columbia	121,344	50,791
Yukon Territory	104,327	43,668
Manitoba	41,672	17,439
Newfoundland	25,039	10,481
Saskatchewan	15,037	6,294
Total	1,200,813	502,631

Exports of zinc in concentrates declined by 21% during the first 9 months of 1972 compared with the similar period in 1971. This decline was due primarily to a higher utilization of zinc concentrates for domestic processing, and a reduction in shipments to the United States where considerable smelting capacity had been eliminated. Shipments of zinc in concentrates to Belgium, the United Kingdom, India, and

Norway also declined, but shipments to Japan, West Germany, and France increased moderately.

Zinc smelter production in Canada increased from 372,000 tons in 1971 to approximately 472,000 tons in 1972. The new facility of Ecstall Mining Ltd., a wholly owned subsidiary of Texas Gulf Inc. came onstream and was operating at full capacity by the end of 1972. Cominco operated at near capacity for most of the year, however, it lost approximately 1 month of production during July owing to labor problems. Canadian Electrolytic Zinc Ltd., and Hudson Bay Mining and Smelting Co. Ltd. also operated at close to capacity levels throughout the year. Brunswick Mining and Smelting ceased production of zinc during 1972 and was converting its works to the smelting of lead exclusively. At the close of 1972 there were four producing smelters in Canada with a rated capacity of some 576,000 tons, as follows:

Company	Location	Annual capacity (tons)
Canadian Electrolytic Zinc Ltd.	Valleyfield, Quebec [1]	127,000
Cominco, Ltd.	Trail, British Columbia	268,000
Hudson Bay Mining and Smelting Co. Ltd.	Flin Flon, Manitoba	72,000
Ecstall Mining Ltd.	Timmins, Ontario	109,000

[1] Expansion planned 204,000 tons (1973–75).

Domestic consumption of primary zinc increased to 114,000 tons in 1972 compared with approximately 101,000 tons in 1971. Galvanizing and diecasting accounted for most of the increase.

New mines which opened during 1972 included the Mattabi copper-zinc mine of Mattagami Lake Mines Ltd., at Sturgeon Lake, Ontario; the Garon Lake mine (Orchan) in Northwestern Quebec; the Ghost Lake zinc-copper mine of Hudson Bay Mining and Smelting Co. in the Snow Lake area, Manitoba; and the Nadina copper-zinc-silver mine operated by Bralorne Resources Ltd. in British Columbia. These mines added about 64,000 tons of contained zinc annually to the total Canadian production. Opening of these properties will help offset losses effected by the closure of the Quemont mine and several other small producers.

NONMETALS

Asbestos.—The production value of chrysotile asbestos in Canada during 1972 reached a level of $218.7 million. This compares with an output of 1.48 million tons valued at $205.9 million during 1971. Mine production in 1972 increased approximately 3.5% over that of 1971. The pattern of production during 1972 continued basically the same as that experienced in 1971. Nine mines in Quebec produced 81% of the total production; one mine in Newfoundland and one mine in the Yukon Territory produced 6% each, while two mines in Ontario combined accounted for 4%, with the balance coming from one mine in British Columbia.

Exports of asbestos from Canada exceeded 90% of the total production. Shipments were made to more than 70 countries. Major consumers, accounting for about 70% of exports, include the United States, Japan, and the United Kingdom, followed by West Germany and France, representing an aggregate market of almost 1 million tons. The balance of approximately 400,000 tons was spread throughout the world.

Canadian Johns-Manville Co. Ltd. continued the expansion of mining and milling facilities at Asbestos, Quebec. When this program is complete, the Jeffrey mine will be the largest single asbestos mine in the world with a rated annual capacity of some 544,000 tons of fiber per year.

Other important developments in Canada included the startup and shipment of concentrates by Asbestos Corp. Ltd. from the Asbestos Hill mine at Asbestos Hill, Quebec. It now has an annual rated capacity of 300,000 tons of concentrate per year which will be shipped to its refining facility at Nordenham, West Germany, for final processing to about 100,000 tons of fiber per year. Abitibi Asbestos Mining Co. Ltd. has commenced work on a pilot plant at their property north of Amos, Quebec. Proven ore reserves are estimated to be about 100 million tons of 4% fiber. Preliminary plans are to mine by open pit methods recovering approximately 140,000 tons of fiber per year. Rio Tinto Canadian Exploration Ltd. is in the process of evaluating the McAdam Mining Corp. Ltd. prop-

erty located 20 miles east of Chibougamau, Quebec. Geological indications show a reserve of some 105 million tons of material grading about 3.92% fiber. Pan Ocean Oil Corp. and Pathfinder Resources Ltd. are negotiating an agreement which may result in the development of Pathfinder's asbestos property 80 miles east of Montreal. Recent drilling has indicated over 45 million tons of fiber-bearing rock which graded between 3.87% and 4.68% asbestos fiber.

Potash.—Production of Canadian potash (K_2O equivalent) increased 3% during 1972 to 3.7 million tons, compared with 3.6 million tons produced in 1971. Consumer demand in the first half of 1972 was very strong with buying stimulated by shortages existing in some areas and anticipation of an increase in the floor price. On July 1, 1972, the Saskatchewan Government executed the first major revision of production licenses, issued under the Potash Conservation Regulation, 1969. The revised technique of issuing production licenses restricted all producers to an operating level of 49% regardless of their marketing possibilities. Any potential sales in excess of capacity (49%) of a given producer could be made only through reduction of other producer inventories. Inventory allowables are granted at the discretion of the Saskatchewan Government. Administration of the regulations is through a three member Potash Conservation Board.

Canpotex Limited, formed in 1970, was expanded in mid-1972 and now includes all producers as participating members. Canpotex has the responsibility of marketing and distributing all foreign sales of Saskatchewan potash. In August 1972, a significant sale of 65,000 tons of potassium chloride (38,600 tons K_2O equivalent) was made to the People's Republic of China. This represents the first substantial importation of potash by the Chinese and indicates a potential outlet for additional Canadian potash.

A total of 10 mines operated during 1972. Cominco Ltd.'s Vade mine at Vanscoy was rehabilitated and went back on-stream in October 1972.

In New Brunswick, plans and negotiations continued with respect to development of a potash deposit in the Sussex area of Kings County.

Sulfur.—Sulfur production in Canada during 1972 was approximately 7.4 million tons. Of this amount, about 6.5 million tons was elemental sulfur produced from the refining of sour gas and petroleum; the balance was recovered from smelter gases and pyrite in the manufacture of sulfuric acid.

Canada's sales of sulfur in 1972 recovered from the low level of 1971 and established a record in shipments of 3.1 million tons. Shipments to the United States which had dropped by 15% during 1971 did not recover, but offshore sales increased by more than 30%. The Asian market, already established as a substantial outlet for Canadian sulfur continued strong, and was expanded significantly by a sale of 132,000 tons to the People's Republic of China. The balance of international trade continued along traditional patterns with the principal markets being the United States, India, Australia, Taiwan, the United Kingdom, New Zealand, and South Korea in descending order of tonnage shipped.

Forty-five plants produced elemental sulfur in 1972 with a combined annual capacity of 9.1 million tons (actual production 6.5 million tons). Two plants are located in British Columbia, one in Saskatchewan, and the remainder in Alberta.

No significant discoveries of sour gas have been developed in recent years and it is not expected that production of elemental sulfur will continue at the high rate experienced in the recent past. However, production will continue to exceed demand and it has been estimated that stocks will exceed 12 million tons by the end of 1973.

Prices leveled off at about $6 per long ton for Alberta sulfur during 1972, after an uninterrupted decline from a high of $37 per long ton in mid-1968.

MINERAL FUELS

Coal.—Production of coal in Canada, including bituminous, subbituminous, and lignite, achieved a record level during 1972 reaching a total of 19 million tons. This represents an increase of 14% over that of 1971 when 16.7 million tons were produced. The value of production in 1972 was $153.4 million an increase of approximately $31 million over 1971. This increase in dollar value reflects both increased production and higher prices which prevailed throughout the period.

The two principal markets for Canadian coal are coking and thermal uses. Virtually all of the coking coal is for export, competing with other producing countries in the world market. The largest customer is Japan who purchased approximately 7.3 million tons during 1972. Other export markets include Belgium, Luxembourg, Chile, and the United States.

Domestically about 15 million tons of thermal coal were delivered to power stations for the generation of electricity. Consumption of coal was forecast to grow from 15.5 million tons in 1971 to about 22 million tons in 1975. During 1972, 6.6 million tons of coal were consumed in the manufacture of 4.7 million tons of coke for steel production.

During 1972 coal was produced in five Provinces at a total of 35 mines. The largest contributor was Alberta with 24 mines producing a total of 7.3 million tons of bituminous and subbituminous grade coals, which was both used domestically and exported. British Columbia ranked second with 6 million tons of low volatile bituminous coal, most of which was shipped to Japan. Saskatchewan was third with 2.9 million tons of lignite, all of which was used for generation of thermal power. Nova Scotia produced 1.2 million tons of high volatile bituminous coal which was utilized for power generation and coke production. New Brunswick produced 400,000 tons from three mines, all of which was consumed by the New Brunswick Electric Power Commission.

During 1972, Canada imported about 14.5 million tons of coal from the United States. Of this total approximately 300,000 tons was anthracite, virtually all of which went to Quebec and Ontario for industrial purposes. The balance of 14 million tons was bituminous, which was delivered to Ontario for coke manufacture.

Exploration for coking coal in Canada slowed down in 1972 compared with the high levels of previous years. This is attributed partially to decreased demand by Japan and financial and operating difficulties experienced by the operating mines. In the southern section of British Columbia, Crows Nest Industries Ltd. and Emkay Canada Natural Resources, Ltd., have done substantive development work and initiated market investigation on several potential coal properties. Brameda Resources Ltd. and Denison Mines each have properties in the advanced stages of exploration in the coking coal belt northeast of Prince George, British Columbia. Current activity in Alberta is directed toward the development of subbituminous fields to meet increasing energy requirements of the Province. Production at the Highvale mine is being doubled from 1 million to 2 million tons per year by 1974. Two other subbituminous mines in the Forestburg area are also expanding to meet the future requirements of the Alberta Power Ltd. Battle River generating station. Saskatchewan, also experiencing the same accelerating energy requirements as Alberta, has taken steps to expand lignite production as a means of increasing power capacity. Manitoba and Saskatchewan Coal Company Ltd., a wholly owned subsidiary of Luscar Ltd., has announced the opening of a new lignite mine at Estevan. The mine is scheduled to come onstream in 1974 at the rate of 1.6 million tons per year. All of the coal produced from the mine will be sold to the Saskatchewan Power Corporation. Activity in Nova Scotia has picked up and several announcements were made during 1972. The Cape Breton Development Corporation (Devco) began preproduction mining at the new Lingan mine near New Waterford. It is expected that the mine will be fully operative by 1974 and will produce from 1.5 to 2 million tons of coking coal annually. Efforts are also being made to revitalize coal mining in the Sydney area. The Federal Government has approved spending $40 million over a 5-year period to rehabilitate three established mines on Cape Breton Island. A new preparation plant is included in the program and Devco officials believe that these efforts will restore the district to a position of viability.

Petroleum and Natural Gas.—Canadian production of crude oil, natural gas, and natural gas liquids continued at record breaking levels, registering substantial gains during 1972. Production of crude oil and natural gas liquids averaged more than 1.8 million barrels per day, a gain in output of over 232,000 barrels per day or 14.5% compared with the 1971 figures. Net withdrawals of natural gas increased by 14.1% to 7,812 million cubic feet daily during 1972 representing a gain of 932 million cubic feet per day compared with 1971. The combined value of oil and gas production established a new record of

$2.16 billion. This reflects an increase of some 14.3% over the corresponding revenue in 1971. The combined production of Alberta, Saskatchewan, and British Columbia accounted for 98% of the total revenue. Of this total the Province of Alberta accounted for 81%. The remaining 2% came from Manitoba, Ontario, the Northwest Territories, and New Brunswick.

Export demand for Canadian crude oil and equivalent increased to 940,000 barrels per day, all of which was shipped to the United States. Of the total, 72% or 680,000 barrels per day were shipped to refineries east of the Rocky Mountains, while 28% or 260,000 barrels per day were delivered to refineries in the Puget Sound area. Export quotas for Canadian crude oil were adjusted upward twice during 1972 to compensate for strong demand in the United States. Exports of natural gas climbed steadily to 2,807 million cubic feet, close to the authorized annual volume of 2,930 million cubic feet. The value of exports of natural gas reached $308.6 million compared with $253 million in 1971. In addition to the above, there were additional batch shipments of condensate, pentanes, and special crude oil allowances which raised the formal allocations by approximately 125,000 barrels per day.

Deliveries of crude oil to domestic refineries averaged 1.55 million barrels per day, an increase of 11.9% over the 1971 production levels. Canadian producers provided 740,000 barrels per day, representing 47.6% of total refinery production. Use of imported crude oil by Canadian refineries was up strongly during 1972, reaching 810,000 barrels per day, an increase of 21.8% over 1971. Full-scale production at two new eastern refineries was the main reason for this increase in the use of offshore crude oil. Production from the Golden Eagle Canada, Ltd. refinery at St.-Romuald, Quebec, and the Gulf Oil Canada, Ltd., plant at Point Tupper, Nova Scotia, are replacing imported refined petroleum products in eastern Canadian markets, and at the same time proving to be an important source of refined petroleum products to markets on the east coast of the United States. The high rate of petroleum refinery expansion has enabled eastern Canada (Maritime Provinces, Quebec, and Newfoundland) to move from the position of a net product importer to becoming a net product exporter, as follows in thousand barrels per day:

Year	Crude refined	Product demand	Net product	
			Exports	Imports
1968	485	569	--	163
1969	520	604	--	156
1970	564	635	--	159
1971	664	668	--	100
1972	785	708	--	26
1973 e	848	747	104	--

e Estimate.

Canada had 40 operating refineries in nine Provinces during 1972. The distribution and percentage of crude oil refining capacity by Province was as follows:

Province	1971	1972
Quebec	35	34
Ontario	23	24
Nova Scotia	10	10
Alberta	10	10
British Columbia	7	7
New Brunswick	7	7
Saskatchewan	4	4
Manitoba	3	3
Newfoundland	1	1

Several of the refineries increased capacity during 1972 and others are in the process of expanding their facilities. Imperial Oil, Ltd., announced a $200 million program which will revamp its petroleum supply system in the Prairie Provinces. The undertaking will involve construction of a new 140,000-barrel-per-day refinery at Edmonton and the closing of smaller, less efficient units at Calgary, Regina, Winnepeg, and Edmonton. New product terminals will be built at major Prairie centers and supplied from the new Edmonton refinery through existing pipeline systems.

Exploration and development continued strong in the frontier regions during 1972. In the Mackenzie Delta, Imperial Oil, announced a significant gas discovery at their Mallik L-38 location on Richards Island. Later in the year Imperial Oil made a further announcement that both oil and gas had been discovered at the Ivik J-26 well also on Richards Island. Other discoveries were announced and by the end of 1972 the Mackenzie Delta had yielded seven gas-condensate and oil wells, perhaps establishing a reserve base large enough to justify construction of a major pipeline to

southern markets. On Melville Island in the Arctic Archipelago, Panarctic Oils, Ltd. completed a gas well 12 miles southeast of the 1970 discovery on Drake Point. This well confirms the structure of the Drake Point reservoir, which probably continues under the Arctic Ocean, and is estimated to contain in excess of 5 trillion cubic feet of gas. This discovery, along with earlier developments at King Christan Island and Kristoffer Bay, have outlined almost half of the 30 trillion cubic feet necessary to support construction of a pipeline from the Arctic.

Drilling continued on Sable Island, 175 miles east of Halifax, Nova Scotia, and announcement of a new wet-gas discovery was made by the team of Mobil Oil Canada Ltd. and Texas Eastern Transmission Corp. Although no major oil discoveries were made in the Provinces during 1972, two important gas discoveries were announced in the southern Foothills Boot area of Alberta.

The Mineral Industry of Chile

By Lyman Moore [1]

Problems resulting from the nationalization of most mineral properties in 1971 continued to hamper production and trade during 1972. Massive resignations of supervisory and technical personnel occurred during nationalization, and qualified replacements were not found for many important positions. Litigation in foreign countries by former owners, to obtain compensation for nationalized properties, disrupted existing supply channels. Foreign copper sales were threatened by legal attachments of metal from nationalized mines in some consuming countries, and by concern that markets in some other countries might be closed to manufactured goods made with nationalized copper. The Chilean copper industry began replacing former supply sources and export markets with suppliers and customers in Communist countries.

Chilean purchases of mining equipment, and expenditures for new plants were severely limited by lack of foreign exchange. This resulted from an unfavorable trade balance due to continuing low copper prices, the increasing need for imported food and liquid fuels, and the unwillingness of North American and Western European financial institutions to continue commercial credit after the nationalization measures and accompanying monetary difficulties. The exchange deficit was partially met by the rescheduling of 1972 payments on the public debt, various commercial borrowings, and large long-term Communist credits.

During 1972 the gross national product (GNP) increased an estimated 2%. Reductions of 8% to 10% occurred in agriculture and fishing; there were small changes in mining, industry, and construction; and increases of 4% to 7% occurred in utilities, transportation, commerce, and services.

PRODUCTION

The value of mineral production in 1972 was slightly less than that in 1971 as was the quantity of minerals produced. Average overall prices received in 1972 were about the same as those in 1971. Mine output of copper, the most important commodity, increased 1%. Small to moderate production increases were made in gold, silver, salt, and natural gas. Moderate decreases occurred in iron ore, molybdenum, nitrates, iodine, sulfur, coal, and petroleum. Production of petroleum refinery products and of natural gas liquids increased about 6% because of plant expansions.

[1] Mining engineer, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Chile: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Copper:				
Mine output, metal content [2]		710,681	717,332	724,768
Metal, copper content:				
Smelter [3]		658,206	639,078	668,570
Refined: [4]				
Fire		93,232	74,711	95,933
Electrolytic		[r] 373,998	376,909	349,343
Gold, mine output, metal content	troy ounces	52,177	64,179	75,946
Iron and steel:				
Iron ore and concentrate	thousand tons	11,265	11,228	8,631
Pig iron	do	481	458	486
Ferroalloys	do	12	[r e] 13	14
Crude steel [5]	do	592	[r e] 654	631
Semimanufactures (hot rolled)	do	436	506	491

See footnotes at end of table.

Table 1.—Chile: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS—Continued				
Lead, mine output, metal content		892	881	626
Manganese ore and concentrate		26,723	23,838	16,085
Mercury	76-pound flasks	388	502	640
Molybdenum, mine output, metal content		5,701	6,321	5,917
Silver, mine output, metal content	thousand troy ounces	2,450	2,729	2,859
Zinc, mine output, metal content		1,537	1,982	1,814
NONMETALS				
Barite		1,542	1,282	2,598
Cement, hydraulic	thousand tons	1,372	1,368	1,404
Clays:				
Kaolin		47,265	57,434	54,844
Other (unspecified)		116,568	93,473	95,546
Feldspar		3,525	900	1,607
Fertilizer materials, crude:				
Nitrates:				
Sodium		515,615	642,097	565,049
Potassium, enriched		158,235	186,828	142,341
Phosphates, guano		14,894	13,075	15,263
Gem stones, lapis lazuli	kilograms	7,800	6,090	15,450
Gypsum:				
Crude		153,263	116,410	113,134
Calcined		63,132	46,332	61,071
Iodine, elemental		r 2,822	2,212	2,097
Pigments, natural mineral, iron oxide		19,035	14,900	19,512
Pozzolan		161,944	145,840	158,967
Quartz:				
Common quartz		87,229	161,253	159,868
Glass sand		31,197	17,271	10,530
Salt, all types	thousand tons	517	426	437
Stone, not further described:				
Limestone		2,409	2,433	2,258
Marble		1,923	2,250	2,544
Sulfates, sodium:				
Natural, mined		25,790	6,888	4,911
Anhydrous, coproduct of nitrate industry		41,210	40,338	37,138
Sulfur:				
Native other than Frasch:				
Refined, sulfur content		47,134	32,428	16,139
Unrefined, sulfur content		61,487	74,070	61,440
Sulfur content of acid derived from pyrite and industrial gases		9,821	2,699	17,045
Talc		r 3,045	1,758	1,833
MINERAL FUELS AND RELATED MATERIALS				
Coal, bituminous and lignite	thousand tons	1,510	1,623	1,459
Coke, coke oven	do	303	313	308
Gas, natural:				
Gross production	million cubic feet	269,405	282,034	285,094
Marketed	do	94,280	126,252	144,070
Natural gas liquids, gross production:				
Condensate	thousand 42-gallon barrels	1,087	1,220	1,031
Natural gasoline	do	395	681	1,128
Liquefied petroleum gases [6]	do	1,288	1,812	2,826
Petroleum:				
Crude	do	12,432	12,882	12,527
Refinery products: [7]				
Aviation gasoline	do	183	97	197
Motor gasoline	do	9,671	11,183	11,579
Jet fuel	do	481	573	880
Kerosine	do	2,727	3,562	3,829
Distillate fuel oil	do	4,461	5,649	5,127
Residual fuel oil	do	6,131	9,996	9,818
Liquefied petroleum gas	do	1,503		
Asphalt, refinery	do	45		
Solvents	do	24	5,468	6,287
Other	do	492		
Refinery fuel and losses	do	1,493		
Total	do	27,211	36,528	37,717

e Estimate. p Preliminary. r Revised.

[1] In addition to the commodities listed, borates, lime, pyrites, selenium, vanadiferous slag, and manufactured gas are produced but available information is inadequate to make reliable estimates of output levels.

[2] Data given are the nonduplicative copper content of ores, concentrates, precipitates, metal, and other copper-bearing products measured at the least stage of processing reported in available sources.

[3] Figures presented are total blister and equivalent copper output including that blister subsequently refined in Chile and copper which is produced by electrowinning. Material produced for refining at Ventanas smelter is included.

[4] Figures presented are total refined output, distributed into two classes according to method of refining; output of Ventanas refinery is included.

[5] Excluding castings.

[6] Data apparently represent net plant output for consumption, presumably excluding quantities reinjected, as follows in thousand 42-gallon barrels: 1970—60; 1971—15; 1972—not available.

[7] Includes a relatively small quantity of products derived from natural gas.

TRADE

Despite a 3% drop in exports of blister and refined copper in 1971 from 1970, copper continued as Chile's leading mineral export commodity. Blister shipments declined 14% but refined copper exports were 2% greater than in 1970. Sodium and salt ranked second and third in exports of mineral commodities.

Mineral fuels continued to account for most of Chile's imports. Details of imports are not available for 1971; latest data available are published in prior issues of this chapter.

During 1972, merchandise export returns reported by the Chilean Central Bank decreased 11% from that of 1971 to $854.2 million, and import registrations increased 44% to $1,411 million. Much of the increase in the value of imports was due to higher prices rather than greater volume.

A larger proportion of Chile's imports were obtained from Communist countries in 1972 than previously because of more liberal credit terms offered by Communist countries. Reported credits extended by Bulgaria, the People's Republic of China (PRC), North Korea, Poland, and the U.S.S.R., at low interest rates, totaled $383.5 million. Trade agreements were signed with the PRC, Czechoslovakia, East Germany, Hungary, North Korea, Romania, and the U.S.S.R. providing for sales during 1973-75 of about 260,000 tons of refined copper, 40,000 tons of copper concentrates, 1,000 tons of molybdenum trioxide, and $87 million worth of copper manufactures. Sales contracts for large quantities of nitrate, iodine, and other products were also signed with Communist countries. Credits of about $38 million were extended to Chile by France, the Netherlands, Sweden, and the United Kingdom.

Table 2.—Chile: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
METALS			
Aluminum metal including alloys, all forms	26	NA	
Copper:			
Ore and concentrate	24,997	(3)	(3).
Precipitate	174	NA	
Slag, ash and residues	105	NA	
Copper sulfate	1,700	[4] 1,530	NA.
Metal, including alloys:			
Scrap	161	6,702	United Kingdom 6,651; West Germany 50.
Unwrought:			
Unrefined:			
Precipitates including cement	17,653	NA	
Blister	197,550	[4] 170,300	United Kingdom 39,500; West Germany 37,800; United States 35,200; Japan 31,900.
Refined	426,030	[5] 434,800	West Germany 116,000; Italy 63,600; United Kingdom 61,900.
Semimanufactures	38,827	1,256	Norway 489; Switzerland 325; United States 290.
Gold ore and concentrate [6]	41,322	(3)	(3).
Iron and steel:			
Ore and concentrate, thousand tons	9,908	9,928	Japan 9,036; United States 892.
Slag	25,858	NA	
Metal:			
Pig iron, including cast iron	9,752	NA	
Ferroalloys	1,802	NA	
Steel, primary forms	7,863	NA	
Semimanufactures	3,276	NA	
Lead ore and concentrate	[2] 3,640	3,413	Belgium-Luxembourg 2,606; West Germany 807.
Manganese ore and concentrate	3,307	NA	
Mercury, 76-pound flasks	3	NA	
Molybdenum:			
Concentrate	5,623	6,719	West Germany 2,218; Japan 2,097; Sweden 1,097.
Oxide, all grades	2,089	NA	
Silver ore and concentrate [7]	67,509	(3)	(3).
Tin:			
Ore and concentrate, long tons	[2] 3,878	4,213	All to United Kingdom.
Metal, including alloys, all forms do.	NA	412	United States 269; United Kingdom 99; Netherlands 44.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
METALS—Continued			
Zinc:			
Ores and concentrate	[2] 2,822	13,294	Japan 9,972; Belgium-Luxembourg 2,146; Netherlands 1,176.
Metal, scrap, ash, residues	176	NA	
Other:			
Ore and concentrate	714	880	All to Austria.
Metal-bearing slag, n.e.s	12	NA	
NONMETALS			
Boron materials, crude natural borate	65	NA	
Cement	31,924	NA	
Fertilizer materials:			
Crude nitrates:			
Sodium	374,418	344,204	United States 184,284; Spain 78,387; Netherlands 27,706.
Potassium enriched	[r] 25,791	4,591	All to United States.
Manufactured:			
Nitrogenous, value, thousands	NA	$682	Canada $439; United States $243.
Other including mixed	51,771	52,244	United States 46,969; United Kingdom 5,275.
Iodine	2,245	1,759	United States 1,338; France 170; United Kingdom 120.
Precious and semiprecious stones, kilograms	16,341	NA	
Salt	293,549	[8] 254,012	All to United States.
Stone, sand and gravel, dimension stone, calcareous	16	NA	
Sulfur, elemental	1	NA	
Other nonmetals, n.e.s., value	$50	---	
MINERAL FUELS AND RELATED MATERIALS			
Coal	1,320	NA	
Natural gas liquids, thousand 42-gallon barrels	150	NA	
Other mineral fuels and related materials, n.e.s., value	$5,181	NA	

[r] Revised. NA Not available.

[1] Source: Unless otherwise noted, Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile. V. 2, 1970.

[2] Source: Statistical Office of the United Nations. World Trade Annual, 1971, v. I, II, III, New York, 1973.

[3] Trading partner countries report the receipt of 268,910 metric tons of copper ores and concentrates in 1971; this figure includes 169,682 metric tons to Japan; 62,443 metric tons to West Germany; 16,380 metric tons to Belgium-Luxembourg; and apparently corresponds to 1970 officially reported Chilean exports of copper ores and concentrates, silver-copper ores and concentrates, and gold-silver-copper ores and concentrates.

[4] Source: Metallgesellschaft A.G. Metal Statistics, 1962–72, 60th Edition, Frankfurt-am-Main, 1973; 328 pp.

[5] Source: Corporación del Cobre, Chile. Indicadores Del Cobre y Sub-productos. Boletin Estadistico Anual, 1971, Santiago, 1972, 20 pp.

[6] Reported as gold-silver and copper ores and concentrates.

[7] Reported as silver and copper ores and concentrates.

[8] Official trade returns of the United States.

COMMODITY REVIEW

METALS

Copper.—Copper production remained near the 1970 and 1971 levels despite large expansions in plant capacity that were approaching completion in 1971 when nationalization of the large mines took effect. Nationalization caused extensive changes in supervisory and technical personnel and closed traditional foreign sources of equipment and supplies. This resulted in inefficient operations and in equipment and supply shortages.

Litigation concerning the amount of compensation to be paid former owners of nationalized mines occupied the Chilean Government, the nationalized companies, and various Chilean and foreign courts throughout the year. Other legal actions against Chile were pressed by the former mine owners, to obtain payment on defaulted promissory notes that had been issued by Chile prior to nationalization. Claims for reimbursement of defaulted notes were also filed with the Overseas Private Investment Corp. (OPIC), a U.S. Government agency that guarantees payment of certain foreign investments. Some of the claims were settled during 1972, and others await arbitration.

The nationalization amendment adopted

in July 1971 denied any payment for ore reserves. Compensation for nationalized property was limited to the depreciated value of facilities and machinery, as determined by the Comptroller General. Compensation was also reduced by the amount of any profits earned since 1955 that the President determined to have been in excess of a reasonable return. The excess profits, as determined by the President, that were paid from the Chuquicamata and El Salvador mines to The Anaconda Company and from the El Teniente mine to Kennecott Copper Corp. were greater than the depreciated value of the respective operations. Therefore, no compensation was allowed to Anaconda and Kennecott for these properties. The Andina mine in which Cerro Corp. had an interest and the Exótica mine in which Anaconda had an interest were also expropriated, but since they were new mines, compensation payments for them were not subject to excess profit deductions.

Anaconda and Kennecott appealed the judgment of the Comptroller General on the Chuquicamata, El Salvador, and El Teniente mine valuations to a Special Copper Tribunal provided for in the nationalization amendment. Their appeal was rejected on August 11 by a vote of four to one. The majority opinion was that the nationalization amendment did not give the Tribunal authority to review political acts of the President such as the excess profit determination but only the independent valuations made by the Comptroller General. A dissenting opinion was filed by Justice Urrutia, President of the Tribunal and former Chief Justice of the Chilean Supreme Court. Separate appeals for rehearings were filed by the companies but were denied on September 7. This action exhausted judicial recourse in Chile relative to the valuation set on the nationalized mines of Anaconda and Kennecott.

Cerro Corp. appealed the Comptroller General's valuation of the Compañía Minera Andina, S.A., plant, and the Copper Tribunal accepted review because no Presidential determination was involved. Cerro disputed some deductions and contended that the valuation of $18.3 million set on the Andina equity should be increased to $20.9 million. The settlement announced December 3 by the Tribunal was $18.9 million, of which Cerro's 70% share was $13.3 million. Cerro also owns $24.8 million of Andina notes and interest. Negotiations were continuing in 1973 between Chilean and Cerro representatives regarding payment schedules and terms.

The Compañía Minera Exótica, S.A., was included in the nationalization of the large copper mines. The property had been 75% financed by a subsidiary of The Anaconda Company and 25% by Chilean Government corporations, with provision for eventual ownership by Chile after repayment of Anaconda's investment under a specified schedule.

On December 30 and 31, 1971, Corporación del Cobre (CODELCO), an agency of Chile, suspended payment on the promissory notes issued to The Anaconda Company in 1970, and to Kennecott in 1967. The companies had received the notes as payment, along with other considerations, in exchange for a 51% ownership by Chile in several mining properties, as an initial nationalization action.

CODELCO and Anaconda agreed in 1969 that the Chuquicamata and El Salvador properties, then owned by Anaconda subsidiaries, would be reconstituted into Compañía de Cobre Chuquicamata, S.A., and Compañía de Cobre Salvador, S.A., with capitalizations of $275.5 million and $66.6 million, respectively. The Anaconda subsidiaries agreed to exchange 51% ownership of each property for promissory notes having a face value equal to 51% of the capitalization. The remaining 49% interest was also to be sold to CODELCO between 1972 and 1981 for notes having a value from six to eight times annual after-tax earnings, depending on the time of purchase. The promissory notes were payable in 24 equal semiannual installments commencing June 30, 1970. The agreement specified tax rates during the purchase period and provided for obtaining the funds required for completing expansion programs then in progress.

Following suspension of payment on the promissory notes, Anaconda filed suit in New York for $11,857,352 against CODELCO and Corporación de Fomento de la Producción (CORFO), and the court attached certain assets of CODELCO in New York. Notes and interest payable June 30 and December 31, 1972, were also defaulted. The Government of Chile is con-

testing before the Copper Tribunal the collectibility of the promissory notes issued to Anaconda in 1969, holding that the constitutional amendment of 1971 prohibits further payment on the notes. The litigants disagree as to whether Chilean or New York courts have jurisdiction over the notes.

The promissory notes owned by Kennecott represented a loan by Braden Copper Co., a Kennecott subsidiary, to a Chilean Government agency for expansion of production. An agreement was reached in 1967 under which Braden assigned the El Teniente property to a new corporation, Sociedad Minera El Teniente, S.A., and the Chilean Government purchased a 51% interest in the new company for $80 million. The agreement also provided that production capacity would be increased from the existing 180,000 tons of copper per year to 280,000 tons per year with $27 million of the cost being financed by the Chilean Government, $93 million by a loan from Braden that was guaranteed by the Chilean Government, and $110 million by an Export-Import Bank loan. An additional $55 million provided by bank, commercial, and Chilean Government loans was eventually used in the expansion. The loan to Braden was payable in 30 semiannual installments bearing 5¾% interest. The first payment was due December 30, 1971, and was for $3.1 million of the principal and $2.7 million in interest.

The President of Chile suspended payment of the first installment maintaining that the 1971 nationalization amendment forbids loan payments until it is determined that the loan had been usefully employed. Kennecott filed suit in New York on February 3, 1972, and attached the bank accounts of CODELCO and of Minera El Teniente. Chile elected to make the initial payment on March 31 and made the second payment on July 3.

Kennecott on December 20 sold the promissory notes of the Chilean Government, whose payment was guaranteed by OPIC, to OPIC for $64.9 million plus $2 million accrued interest. This amount was the value of future payments discounted to reflect the difference between current interest rates and the rate provided for in the notes. OPIC reissued the loan to institutional investors on the original repayment schedule and with an OPIC guarantee of payment.

The sale to OPIC reduced Kennecott's Chilean loan credit to $12.6 million. It received a semiannual payment of $780,000 on the remainder of the loan on January 3, 1973.

Anaconda submitted claims of $159 million to OPIC in February 1972 for recovery of losses resulting from the nationalization of the Chuquicamata and El Salvador properties and the suspension of payment on the promissory notes. These claims were disallowed by OPIC on the grounds that the losses occurred when the 51% interest was sold to Chilean Government corporations on December 31, 1969, at which time only standby insurance was in effect. Anaconda is appealing this ruling to formal arbitration, as provided by the insurance contract. Anaconda's position is that the loss occurred when the nationalization amendment took effect on July 16, 1971, and at that time the insurance had been activated and was in force.

Anaconda also filed a claim on February 29 with OPIC for loss of their investment in the Exótica mine following the Chilean Government's deferral of a December 31, 1971, payment on notes Anaconda had received for their investment in Exótica. Chile held that the notes could not be paid until the Copper Tribunal ruled on their enforcibility under provisions of the nationalization amendment. OPIC on September 20 paid Anaconda $11.9 million and received the notes.

Cerro Corp. has insured $14.2 million of its investment in the Andina property with OPIC.

Lawsuits in foreign courts to obtain payment for expropriated equities were instituted by former owners of nationalized copper mines following denial of final appeals by the Copper Tribunal.

Kennecott advised the Tribunal that they had withdrawn from legal proceedings in Chile and had dismissed their Chilean legal representatives. Notices were sent to customers of El Teniente Copper Co. by Kennecott stating that Kennecott retained ownership rights to the copper produced from the El Teniente mine, that they considered any aquisition or disposal of this copper illegal, and that they would take all necessary action to protect their rights. In response to this notice the Chi-

lean Government transferred all export copper marketing functions from CODELCO to the State itself.

Kennecott challenged sales of El Teniente copper in countries that do not recognize unindemnified nationalization of foreign property. On October 2, 1972, French courts granted Kennecott an attachment on 1,250 tons of El Teniente copper scheduled to be landed at Le Havre. When French dockworkers refused to unload the copper, the ship was diverted to Rotterdam where Kennecott obtained an attachment from the Netherlands courts. Longshoremen supporting the Chilean position also refused to unload the copper in Rotterdam; however, an agreement was reached allowing the ship to leave and unload the copper at Le Havre where its ownership would be adjudicated by French courts. The French court in a November 29 ruling allowed purchasers to receive the copper but enjoined CODELCO from disposing of the proceeds until the case had been settled. The court rejected the Chilean plea that being a sovereign State its actions were immune from jurisdiction of other nations, and ordered further hearings in 1973. During the preliminary hearings Kennecott offered to submit the dispute to arbitration, but this solution was unsatisfactory to Chile.

Kennecott asked Swedish courts to sequester a monthly 1,500-ton shipment of El Teniente copper arriving in Sweden November 8. The Chilean shipper and the customer elected to test the legal status of the copper before shipping a large order; therefore, delivery was reduced to 140 tons, and the remaining copper was diverted to another country. The customer deposited payment with the court for the 140 tons of metal and set the copper aside until the suit was settled and it was certain that manufactured articles containing the copper could be exported without complications. The Swedish Government rejected an earlier suggestion by Chile that Sweden create a state organization to buy copper directly from Chile thus circumventing legal action on metal imports.

Early in 1973 Kennecott began legal proceedings in West Germany to obtain payment for copper produced from El Teniente.

The legal actions against Chile by Kennecott and Anaconda in France, Sweden, and the United States somewhat limited the market for Chilean copper; however, buyers were found for all copper produced. Some customers were apprehensive of possible future law suits and insisted that Chile assume the associated financial risk. The Intergovernmental Council of Copper Exporting Countries (CIPEC), meeting at Chile's request, announced general support for Chile's position and agreed to refrain from replacing Chilean copper in traditional markets that were disrupted by Kennecott's lawsuits.

In February 1972, a 51% interest in the Disputada mine was sold by Peñarroya of France to Empresa Nacional de Minera (ENAMI), the Chilean Government corporation having responsibility for small- and medium-sized copper mines. The announced purchase price was $13 million to be paid over an 8-year period with equivalent quantities of copper; Peñarroya retained a 35% interest, and the remaining 14% is held by private Chilean investors. Future dividends are guaranteed the minority shareholders, and Peñarroya will provide technical assistance to the operation.

In 1972 Chuquicamata produced 158,902 tons of electrolytic copper and 75,750 tons of blister copper (fine copper content), a decline of 6% from the 192,298 tons of electrolytic and 56,297 tons of blister produced in 1971. The 1972 production was 11% below the 1970 output. Shipments of converter cleanings to foreign smelters were begun in October at a reported rate of about 600 tons per day. About 200,000 tons of cleanings accumulated during past operations were said to be on hand.

The production rate decline at Chuquicamata was reportedly due to several operational factors. Waste stripping during the past several years was stated to have been at too low a rate, and the area of uncovered ore inadequate to supply the needed production despite the present practice of increasing bank heights and steepening pit slopes. Considerable waste must be removed to restore production capacity. The pit rim must be moved back, which will require relocating some mine facilities. Mine production has also been slowed by equipment shortages and lack of spare parts. In June orders were placed for 20 trucks of 120-ton size, and these should provide the needed increase in haulage ca-

pacity. Smelter operations have been slowed by a shortage of repair parts and supplies, particularly refractories that are made from imported materials. Shortages of skilled supervisory and technical personnel have also reduced efficiency, and it is reported that foreign experts are being retained to alleviate this problem. Several short strikes occurred, the longest being of 5 days duration in October. This was settled by an agreement increasing wages by 99.9% that was to continue in force until September 1973.

El Salvador produced 60,809 tons of electrolytic copper and 23,815 tons of blister copper in 1972, about 1% more than the 1971 output of 59,805 tons of electrolytic and 24,067 tons of blister. Workers voted to accept contracts on October 31 that increased wages 135% and provided that future disputes would be settled without strikes.

Production at Exótica declined about 12% to 31,199 tons of electrolytic copper from the 35,260 tons produced in 1971. However, during the last few months of the year output was restored to the 1971 rate of about 3,000 tons per month. Production continued to be limited by unexpectedly large quantities of iron, aluminum, manganese, and magnesium in the leach solution. This problem was studied during the year, and in early 1973 an agreement was signed with the Power Gas Corp. of England to install a solvent extraction circuit at an estimated cost of $15 million. The circuit is expected to provide clean solution for electrowinning and allow the original 100,000-ton-per-year design capacity of the plant to be attained.

El Teniente production increased about 29% to 71,978 tons of fire-refined copper, 107,953 tons of blister, and a small quantity of concentrate, which was shipped to other smelters. The 1971 output was 48,124 tons of fire-refined copper and 92,256 tons of blister. Mine production was interrupted for 10 days in May by a strike. During December a gross output of 19,163 tons was attained, the highest achieved during the last 10 years despite increasing production difficulties. El Teniente ore from the lower levels now being mined is less fractured than that from the higher levels and therefore does not cave as readily and requires more secondary breaking. Deeper ore also contains larger quantities of arsenic and antimony and requires more thorough fire refining to meet quality standards. A new reverberatory furnace was under construction in 1972. When completed in 1973, the furnace will increase annual smelter output to 280,000 tons of copper. Projects being planned include a 14-mile aqueduct having 25-cubic-feet-per-second capacity, and a new electric power distribution network.

The Andina mine completed its first full year of production, but its output of 53,900 tons of copper in concentrate was only 2% above that of 1971, when some units did not reach full capacity until midyear. Production rates were maintained at near design capacity of 5,000 tons per month until late September 1972, when a short strike and technical problems caused a reduction in output during the remainder of the year. Feasibility studies are being made for a molybdenum plant.

Production from the Mantos Blancos mine and plant was 23,955 tons of fire-refined copper and an additional 6,000 tons of copper in concentrate, an overall decrease of 3% from that of the previous year.

Mine production at Disputada decreased 12% to 30,000 tons of copper in concentrate. Blister production at the Chagres smelter decreased 11% to 15,943 tons.

Production began from the Sagasca property during 1972, and 5,000 tons of copper in precipitates were shipped. Opening of the plant was delayed by a flash flood on February 8, 1972, that washed out about 6 miles of road, the waterline, and the electric powerline.

Production at the Las Ventanas and Paipote smelters of ENAMI was 57,180 tons and 41,086 tons of blister copper, respectively, compared with 45,689 tons, and 40,436 tons produced in 1971, an overall increase of 14%. Smelter feed was supplied by medium and small mines except for relatively small quantities from Andina and El Teniente. The Las Ventanas electrolytic refinery produced 98,433 tons of copper, 2% less than that in 1971. The metal refined was supplied by Chuquicamata, El Teniente, Andina, and small and medium mines. Construction was initiated on a subsmelter in Vallenar with completion scheduled in 1973. The matte produced will be shipped to other smelters for conversion into blister copper. Plans were

announced in December to purchase a copper deposit north of Santiago and the eventual construction of a 20,000-ton-per-day open pit mine and concentrator. Also being planned by ENAMI are several new regional concentrating plants to serve small mines.

Feasibility studies are being made of the large Las Pelambres copper-molybdenum deposit by the United Nations Development Program and the Chilean Government.[2]

Iron Ore.—Iron ore production in 1972 was 8,631,000 tons, a decrease of 23% from that of the preceding year. The average grade of ore and concentrate produced was 61.61% Fe. Ore consumed domestically had an average grade of 63%. Shipments of natural iron ore and concentrates by Compañía de Acero del Pacífico, S.A. (CAP), were 8,040,860 tons, about 21% less than in 1971. Domestic shipments of 935,000 tons were only 1% less than the previous year, but exports were reduced considerably, particularly those to the United States following the sale of Bethlehem-Chile Iron Mines Co. to CAP. Domestic and foreign shipments from individual CAP mines were as follows, in metric tons:

Santa Barbara—Sante Fe Division:	
Run-of-mine ore to Japan	2,648,042
Blast furnace ore to United States	230,391
Open-hearth furnace ore to United States	61,243
Total	2,939,676
Algarrobo Division:	
Blast furnace ore to Japan	1,685,575
Fines to Japan	1,233,486
Total	2,919,061
Romeral Division:	
Run-of-mine ore to Japan	1,007,874
Blast furnace ore to Japan	24,837
Fines to Japan	161,631
Fines to United States	27,663
Blast furnace ore to Argentina	25,085
Run-of-mine ore to CAP steel mill	935,033
Total	2,182,123

Source: Skillings' Mining Review. V. 62, No. 11, Mar. 17, 1973, p. 6. (Original data in long tons converted at factor of 1 long ton equals 1.01633 metric tons.)

Cía. Minera de Atacama shipped 258,000 tons of natural ore, a sharp decrease from 1971 when 432,000 tons were shipped. The El Laco deposit in northeastern Chile, 20 miles from the Argentine border, was prepared for production, and shipments to Argentine steel plants were begun in early 1973. Due to decreased export demand, other new deposit developments and plant enlargements have been slowed. Current expansion projects are at Algarrobo where capacity is being increased by 600,000 tons per year, at Boqueron Chanar where a 3.0-million-ton-per-year plant is being constructed with Polish aid, and at Cerro Negro where a 6.0-million-ton-per-year pellet plant is scheduled for 1978. The iron ore port of Guacolda, 30 miles from Algarrobo, is being modernized. New berths will accommodate ore carriers of up to 250,000-ton capacity, and a dual reclaiming and shiploading system will be installed.

Iron and Steel.—Ingot steel production was 631,000 tons, a 4% decrease from the 1971 total. Of this production 94% was poured by CAP at its Huachipato plant, and the remaining 6% was poured by three small government-owned plants that produce mainly speciality and short-run items. Finished steel mill products manufactured by CAP totaled 461,500 tons, nearly as much as the 467,200 tons produced in 1971. Semifinished steel production was 19,500 tons compared with the 33,500 tons produced the previous year when an unusually large quantity was exported. Total steel shipments by CAP were 482,200 tons, of which 5,200 tons were exported, compared with 1971 when total shipments were 506,700 tons, of which 61,900 tons were exported. Domestic shipments by CAP increased substantially for all items except galvanized sheets and grinding bars and balls. Expansion of the Huachipato plant is continuing, and the planned increase in capacity to 1 million tons per year is now scheduled for completion by the end of 1974 with further expansion scheduled during 1975 and 1976. Two basic oxygen steel furnaces of French manufacture, are to be installed in 1974, and a third is to be installed in 1976. Negotiations continued between CAP and Dresser Industries, Inc. concerning aquisition by CAP of Dresser's majority interest in Refractarios Chilenos, S.A., the leading manufacturer of refractory brick in Chile.

Other Metals.—Molybdenum production was 5,917 tons of metal contained in 10,486 tons of concentrate, compared with the 1971 output of 6,321 tons of metal contained in 11,349 tons of concentrate. All

[2] The Anaconda Company. 1969 Annual Report. 36 pp.; 1970 Annual Report. 32 pp.; 1971 Annual Report. 32 pp.; 1972 Annual Report. 32 pp.
Continental Copper & Steel Industries, Inc. 1972 Annual Report. 11 pp.
Kennecott Copper Corp. 1972 Annual Report. 32 pp.

recovery was made as a byproduct of copper production at the Chuquicamata, El Salvador, and El Teniente plants, which produced 57%, 18%, and 25% of the total, respectively. A molybdenum and rhenium recovery circuit is planned for the Andina copper concentrator. Shipments of molybdenum concentrate were 60% exported and 40% processed domestically to ferromolybdenum and molybdenum trioxide, of which in turn about 90% was exported and the remainder consumed by the local steel industry. A plant to produce high-grade molybdenum chemicals and byproduct rhenium chemicals is planned by CAP.

Rhenium production in both 1971 and 1972 was about 1,900 pounds of metal in ammonium perrhenate, all of which was exported. Current production is by Carburo y Metalurgia, S.A., who plan to increase output to 2,700 pounds per year in 1973. The total recoverable rhenium content of ores now being produced at the large Chilean copper mines is reported to be about 7,700 pounds per year.

Gold production increased 18% to 75,946 troy ounces. Of the total 44% came from gold ores and 56% as a byproduct of copper production. Production from gold ores increased 74% over that of 1971, and byproduct production from copper ores decreased 5%.

Silver production increased 5% to 2,859,437 troy ounces from a revised 1971 production total of 2,729,000 troy ounces. Nearly 98% of the output was a byproduct of copper production. The remainder was about equally divided between byproduct recovery from lead and zinc production, and recovery from gold ores.

NONMETALS

Iodine.—Iodine production decreased 5% from the 1971 output of 2,097 tons. A fire in late 1971 damaged the largest iodine plant, that of Sociedad Química y Minera de Chile, S.A., a state-owned company, which controls nearly all of Chile's nitrate and iodine production. Partial operation was resumed in early 1972, but production had been restored to only 70% of the prefire rate at the end of the year. Sales of Chilean iodine were reduced about 50% from 1971 deliveries because of strong price competition from producers in other countries.

Nitrates.—Nitrate production was 565,049 tons of sodium nitrate and 142,341 tons of potassium nitrate, decreases of 12% and 24%, respectively, from 1971.

MINERAL FUELS

Coal.—Production of coal during 1972 decreased 10% below that of the previous year to 1,459,000 tons. This continued a long-term trend caused by gradual replacement of coal and coal gas by petroleum products, natural gas, and hydroelectric power. Receipts of metallurgical coal by CAP, which produces about 94% of Chile's steel, were 257,000 tons of domestic and 205,000 tons of imported coking coal. Receipts in 1971 were 265,000 tons of domestic and 198,000 tons of imported coal. Chilean coals will not form blast-furnace-grade coke unless blended with imported coking coal.

Petroleum and Natural Gas.—Empresa Nacional del Petróleo (ENAP) continued seismic exploration in 1972 and completed 333 kilometers of reflectivity and 64 kilometers of refractivity profile compared with 220 kilometers of refractivity profile logged in the previous year. Drilling activity decreased. Sixty-seven holes having a total length of 144,880 meters were drilled, compared with 78 holes having a total length of 168,477 meters in 1971. Sixty-one of the holes and 139,254 meters footage were drilled in Magallanes Province. The remainder was done in the south-central zone. The type of holes drilled and drilling results are tabulated as follows:

Type of well	Number of completions			
	Petroleum	Gas	Dry	Total
1971:				
Exploration	2	--	15	17
Extension	1	1	11	13
Development	31	1	16	48
Total	34	2	42	78
1972:				
Exploration	4	2	22	28
Extension	1	--	--	1
Development	19	2	17	38
Total	24	4	39	67

Offshore oil exploration continued in the Straits of Magellan area and between Concepción and Chiloe under a cooperative financing agreement between ENAP and the United Nations Development Program. A promising discovery of natural gas was made offshore from Puerto Saavedra at a depth of 260 meters. The discovery hole

was estimated by ENAP to have a production capacity of 240,000 cubic meters per day through a 5/8-inch choke.

ENAP reported gross withdrawals of natural gas of 285,093 million cubic feet, about 1.1% more than in 1971. Mainland fields supplied 58%, and Tierra del Fuego fields, the remainder. Posesión field (mainland) remained the largest producer yielding 31.5% of the total followed by Daniel (mainland) with 11.3%, and Cullen (Tierra del Fuego) with 10.1%. About 64% of the total volume of gas withdrawn at Posesión was reinjected, and 51% was reinjected at Daniel and 72% at Cullen. Approximately 50% of gas withdrawn from all fields was reinjected. A total of 144 million cubic feet of natural gas was marketed or consumed by oil and gas production facilities.

The total production of natural gas liquids increased 34.3% from the 1971 total to 4,985,000 barrels reflecting the first full year's production of a new natural gas treatment plant in the Posesión field. Exports of natural gas liquids increased 152% to 1,117,700 barrels, and imports decreased 93% to 70,700 barrels.

Crude petroleum production decreased 3% to 12,527,000 barrels. All production was from Magallanes Province. Fields on the island of Tierra del Fuego yielded 43% of the production, and mainland fields across the Straits of Magellan, the remainder. The largest production increases were made at Posesión and Cañadón fields, 481,000 and 221,000 barrels, respectively. The following table shows production for 1971 and 1972, by field:

Location and field	Production (thousand 42-gallon barrels)	
	1971	1972
Mainland:		
Daniel	2,265	2,272
Daniel Este	1,815	1,738
Cañadón	764	985
Posesión	1,124	1,605
Others	769	524
Total	6,737	7,124
Tierra del Fuego:		
Calafate	2,274	1,766
Cullen	1,199	1,107
Catalina Sur	426	298
Tres Lagos	710	685
Others	1,535	1,547
Total	6,144	5,403
Grand total	12,881	12,527

Imports of crude petroleum received at refineries were 25,495,000 barrels, an increase of 8% above 1971 receipts. Imports supplied 67.6% of the total petroleum refined (87.6% at the Concón refinery, 51.3% at Concepción, and none at Manantiales). Imports were from the Middle East, Colombia, Venezuela, and Bolivia.

Total petroleum refined during the year was 37,717,000 barrels, an increase of 3% over 1971. The Concón refinery processed 17,638,000 barrels, Concepción 19,570,000 barrels, and Manantiales 509,000 barrels. Total product recoveries for all refineries are shown in table 1, and following is a summary of products recovered at the Concón and Concepción refineries:

Production	Net production (thousand 42-gallon barrels)	
	Concón	Concepción
Aviation gasoline	197	--
Other gasoline and naphtha	5,811	6,387
Jet fuel	473	407
Kerosine	1,862	1,967
Distillate fuel oil	2,651	2,476
Residual fuel oil	4,561	5,256
Liquefied petroleum gas	727	1,962
Ethylene	--	383
Other	329	13
Total	16,611	18,851

Distillation capacity at the Concepción refinery was increased from 60,000 to 72,000 barrels per day. Construction now in progress at the Concón refinery will increase distillation capacity from 50,000 to 61,000 barrels per day and cracking capacity from 12,000 to 20,000 barrels per day. Bids for the design and engineering of a 2-million-ton-per-year natural gas liquefaction plant were asked for in December by ENAP. Completion is planned by 1977.

In October the Chilean Ministry of Economy, Industry and Commerce requisitioned the Concepción petrochemical plant of Petroquimica-Dow, S.A., in which the Dow Co. subsidiary owns 70% interest and the state-owned Petroquimica Chilena the remainder. The ministry charged that the plant had failed to supply customers during a strike of supervisory and technical employees and during a transportation workers strike. Dow appealed the seizure, and in early January 1973, the Comptroller General ordered the Ministry of Economy

to reconsider the requisition. Future ownership of the plant is undecided. Petrochemical production was reported in January to have been curtailed since mid-December because of equipment failures and a lack of repair parts.[3]

[3] Chemical Week. Chile's Seizure Illegal? V. 112, No. 2, Jan. 10, 1973, p. 45.

The Mineral Industry of the People's Republic of China

By Charles L. Klingman [1] and John E. Shelton [2]

Entry of the People's Republic of China (PRC) into the United Nations in October 1971 was followed by visits of President Nixon during February 21–28, 1972, and by Premier Tanaka of Japan subsequently on September 29. These visits portend closer economic relationships and increased trade with the United States and Japan. The PRC also began to negotiate trade agreements and to initiate exchange visits with many other countries as well, particularly Canada.

Much international activity occurred in mineral-oriented fields, basically to acquire shortage materials for a program of industrialization; equipment, and plants too sophisticated for the PRC to build; and industrial know-how in general to fill a long-standing technical void.

With the termination of the Cultural Revolution, the economy settled down to an annual growth of about 10% in both 1971 and 1972, with gross national product (GNP) clearly surpassing $100 billion [3] and perhaps reaching as high as $120 billion. This progress was achieved, despite 2 mediocre years in agriculture when much grain had to be imported to supplement domestic production. The fourth 5-year plan initiated in 1971 has been on schedule, with industrial operations "returning to discipline."

Consolidation and moderate buildup in selected areas were hallmarks of Chinese economic policy during 1972. Agriculture still received the highest priority in effort and funds, particularly agricultural machinery and chemical fertilizers. However, basic industry to support agriculture was also a fundamental part of the policy. To prepare the ground work for industrial expansion, great stress was placed on making the tools of production, especially mining, beneficiation, metallurgical, chemical, and refining equipment and plants. Conventional integrated operations and local industries were pushed simultaneously.

Within the mineral industries,[4] high priority was given to steel. The concerted effort to build up the iron ore base to supply steel plants was continued. Capital construction at major steel complexes did not receive as much attention as consolidation of projects and improvements in technology, although many small plants were built. Development policy in coal was somewhat similar to steel, with special emphasis in the "coal-short" south. The petroleum program did not involve any small operations, and the PRC's major field—Taching—did very well in 1972. The principal effort in the cement and fertilizer industries during 1971–72 has clearly been in terms of building hundreds of small plants around the country in areas of difficult access and which large plants cannot serve.

Despite eagerness to deal more with foreigners, the PRC apparently wants no part of any industrial and mineral joint ventures with advanced countries at this juncture. However, there is need to acquire international technical know-how and sophisticated foreign equipment to accelerate industrial growth. Accordingly, many exchange visits and purchase missions have been dispatched abroad. The most meaningful visits have been with the Japanese, involving steel, fertilizers, power, metallurgy, basic chemicals, and petrochemicals. The PRC and

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[3] Valuations given in this chapter were generally obtained by applying average world prices in U.S. dollars to known tonnages. In 1972 approximately 2.2 PRC yuans were equivalent to US$1.00.

[4] Wang, K. P. Mineral Situation in China. Article in Mining Annual Review 1973. Mining Journal (London), July 1973, pp. 408–413.

Canada have arranged two exchange visits (both ways) pertaining to minerals and petroleum.[5]

PRODUCTION

The PRC has not yet made public its latest (fourth) 5-year plan targets, although many announcements have been made on extent of fulfillment. Two figures have been officially reported for the national output of steel, specifically 21 million tons in 1971 and 23 million tons in 1972. Crude oil production (excluding shale oil) was said to be more than 20 million tons in 1970. Most other data have been given in percentages and indices. The following claims in 1971 percentage increases compared with 1970 figures were made: coal, 8% plus; washed coal, 27.6%; electric power, 18%; crude oil, 27.2%; crude oil processing capacity, 16%; iron ore, 26%; pig iron, 23%; crude steel, 18%; chemical fertilizers, 20%; cement, 16.5%; salt, 10%; mining equipment, 68.8%; and metallurgical equipment, 24.7%.[6]

Few overall claims were made for 1972. Coal figures were not presented, although there were many reports on target fulfillments by Provinces and coal combines. Steel gains in 1972 compared with 1971 figures were as follows: iron one tunneling footage, 20%; pig iron, 12%; steel, 9.5%; and rolled steel, 10%.[7] Reported gains in oil compared with 1971 figures were as follows: crude oil, 16%; refined oil products, 5%; and crude oil from Taching, 14.6%. Increases in fertilizer output were variously reported at between 25% and 33%. The 1972 cement target was said to have been achieved 25 days ahead of schedule.

[5] Canadian Mining Journal (Gardenvale). Canadian Minerals and Metals Mission to China. V. 94, Nos. 1 and 3, January 1973, pp. 19-31, and March 1973, pp. 28-34.

[6] New China News Agency (Peking). Dec. 31, 1971, p. 1.

[7] New China News Agency (Peking). Jan. 3, 1973, p. 1.

Table 1.—People's Republic of China: Estimated production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972
METALS			
Aluminum:			
Bauxite, gross weight [2]	500,000	550,000	550,000
Alumina, gross weight	250,000	270,004	270,000
Metal, primary, refined	130,000	140,000	140,000
Antimony, mine output, metal content	12,000	12,000	12,000
Bismuth, mine output, metal content	250	250	250
Cadmium, smelter production	100	100	100
Copper:			
Mine output, metal content	100,000	100,000	100,000
Metal, refined	100,000	100,000	100,000
Gold, mine output, metal content—troy ounces	50,000	50,000	50,000
Iron and steel:			
Iron ore, gross weight [3]—thousand tons	44,000	r 55,000	60,000
Pig iron and ferroalloys—do	22,000	27,000	30,000
Crude steel—do	18,000	[4] 21,000	[4] 23,000
Rolled steel—do	14,000	16,000	18,000
Lead:			
Mine output, metal content	100,000	100,000	100,000
Metal, refined	100,000	100,000	100,000
Magnesium metal, primary	1,000	1,000	1,000
Manganese ore, gross weight—thousand tons	1,000	1,000	1,000
Mecury, mine output, metal content—76-pound flasks	20,000	26,000	26,000
Molybdenum, mine output, metal content	1,500	1,500	1,500
Silver, mine output, metal content—thousand troy ounces	800	800	800
Tin:			
Mine output, metal content—long tons	20,000	20,000	20,000
Smelter—do	20,000 r	20,000	20,000
Tungsten, mine output, metal content	r 7,000	r 7,000	7,000
Zinc:			
Mine output, metal content	100,000	100,000	100,000
Refined	100,000	100,000	100,000
NONMETALS			
Asbestos	170,000	160,000	160,000
Barite	150,000	140,000	155,000
Cement, hydraulic—thousand tons	10,000	11,500	14,000
Fertilizer materials:			
Natural, crude phosphate rock—do	1,200	r 1,700	2,000
Manufactured, nitrogenous, N content [5]—do	[6] 1,040	[7] 1,230	[8] 1,650

See footnotes at end of table.

Table 1.—People's Republic of China: Estimated production of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972
NONMETALS—Continued			
Fluorspar	270,000	250,000	250,000
Graphite	30,000	30,000	30,000
Gypsum	550,000	550,000	600,000
Magnesite ---thousand tons--	1,000	1,000	1,000
Pyrite:			
Gross weight ---do---	2,000	2,000	2,000
Sulfur content ---do---	900	900	900
Salt ---do---	16,000	16,500	18,000
Sulfur, elemental:			
From sulfur ore	130,000	130,000	130,000
Byproduct elemental	120,000	120,000	120,000
Total	250,000	250,000	250,000
Talc	150,000	150,000	150,000
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite ---thousand tons--	20,000	20,000	20,000
Bituminous and lignite ---do---	340,000	370,000	380,000
Total ---do---	360,000	390,000	400,000
Coke, all types ---do---	18,000	22,000	24,000
Gas, natural:			
Gross production ---million cubic feet--	120,000	150,000	175,000
Marketed production ---do---	60,000	80,000	90,000
Petroleum:			
Crude:			
From oil wells---thousand 42-gallon barrels--	[4] 146,000	[r] 188,000	218,000
From oil shale ---do---	29,000	35,000	40,000
Total ---do---	175,000	223,000	258,000
Refinery products ---do---	168,000	[r] 190,000	200,000

[r] Revised.

[1] In addition to the commodities listed for which quantitative estimates of output have been made, the People's Republic of China is known or is believed to have produced the following commodities for which no estimates, even of order of magnitude, have been prepared, owing to a paucity of general information upon which to base an estimate: arsenic, chromite, nickel, titanium minerals, uranium, boron minerals, various clays (including koalin), feldspar, lime, mica, various industrial and dimension stones, sand, gravel and carbon black. Other unlisted commodities also may be produced.

[2] Mostly diasporic bauxite. Data shown include only the bauxite for aluminum manufacture; in addition 100,000 to 200,000 tons was produced each year for making refractories.

[3] In terms of equivalent 50% Fe ore.

[4] Officially reported. (In the case of oil, the reported figure was "over 21 million metric tons.")

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

[6] Source: Statistical Office of the United Nations. United Nations Statistical Yearbook, 1971. New York, 1972, pp. 263-264.

[7] U.S. Bureau of Mines estimate based on United Nations combined estimate for the People's Republic of China and Taiwan minus British Sulphur Corp. reported figure for Taiwan alone.

[8] Source: British Sulphur Corp. Ltd. Statistical Supplement No. 6, November-December 1972, London 1973, pp. 10-11.

TRADE

The PRC's total foreign trade (imports plus exports) in 1972, although showing signs of a breakthrough, was still only on the order of $5 billion. Minerals, metals, fuels, chemicals, mineral-related products, and mineral processing equipment and plants were, however, very important, particularly in imports. In 1972, total imports may have been on the order of $2.5 billion, including 14% to 18% steel, 6% to 7% nonferrous metals (mainly copper), and 7% to 8% chemical fertilizers (mainly urea). In addition, many other mineral industry-oriented products and equipment were imported, including special items like platinum and industrial diamond.

Japan has been by far the most important source of imports, particularly of steel, fertilizers, and industrial plants. In iron and steel, shipments of ordinary steel products were 1.93 million tons valued at $281 million (converted from rate of 360 yens to US$1.00) in 1971 and 1.69 million tons valued at $244 million (converted from rate of 308 yens to US$1.00) in 1972. West Germany ranked a distant second as a steel supplier to the PRC. In 1972, Japan exported about 1.1 million tons of nitrogenous

fertilizers (measured in N content) valued at $120 million to the PRC, about the same as 1971 in dollar value. Japan has recently contracted to sell the PRC about half a dozen large industrial plants worth perhaps two-thirds of $1 billion.

Nonferrous metals have come mainly from Chile, Peru, Zambia, and Canada. Chile and Peru committed to export annually to the PRC about 105,000 tons of copper and 10,000 tons each of lead and zinc. The PRC has a long-term contract with Zambia to import large tonnages of copper. Improved relations between Canada and the PRC probably will mean more mineral trade.

The PRC's traditional export metals, such as tin, tungsten, and antimony, totaled less than $50 million in 1972, about half the potential. Actually, the PRC could conceivably sell annually about 10,000 tons each of tin, tungsten concentrate, and antimony. Approximately 200,000 tons of fluorspar have been exported annually in recent years, roughly half to Japan. During 1972, the PRC also exported about 1 million tons of salt, almost all to Japan. A deal to export crude petroleum to Japan was discussed at yearend, which may become fairly important in the next few years.

Table 2.—People's Republic of China: Apparent exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	26,153	29,004	West Germany 16,322; Italy 3,855; United Kingdom 3,299.
Oxide and hyroxide	1,200	5,318	All to Finland.
Antimony metal, unwrought	--	450	All to U.S.S.R.
Arsenic oxide and acids	515	1,039	Japan 495; Australia 349; Italy 195.
Copper metal, unwrought	150	475	Belgium-Luxembourg 325; Netherlands 100; Italy 50.
Iron and steel metal:			
Pig iron	1,390	--	
Semimanufactures:			
Universals, plates and sheets	131	--	
Tubes, pipes, and fittings	258	580	United Kingdom 306; Australia 148; Italy 66.
Total	389	580	
Manganese ore and concentrate	37,485	45,948	Japan 39,428; Australia 3,320; Denmark 2,200.
Mercury ----76-pound flasks--	348	3,509	U.S.S.R. 2,900; United Kingdom 261.
Molybdenum concentrate	r 200	--	
Platinum-group metals and silver waste and sweepings ----value, thousands--	--	$35	All to United Kingdom.
Tin metal, including alloys, all forms:			
Scrap ----long tons--	--	15	All to France.
Unwrought ----do----	r 3,804	5,486	France 1,848; Netherlands 1,362; West Germany 980; Poland 98.
Titanium oxides	661	242	Japan 130; Italy 112.
Tungsten:			
Ore and concentrate	r 8,423	7,748	U.S.S.R. 5,249; Austria 1,798; Sweden 269.
Metal, including alloys, all forms value, thousands--	--	$53	All to Canada.
Zinc metal, including alloys, unwrought and semimanufactures	--	137	All to Japan.
Other:			
Ore and concentrate, n.e.s. [2]	1,252	4,002	Japan 3,083; Belgium-Luxembourg 519; Australia 400.
Nonferrous metal scrap, n.e.s	--	22	All to France.
Oxide, hydroxides and peroxides of metals, n.e.s	66	243	Sweden 84; West Germany 51; Italy 45.
Nonferrous metals, including alloys, all forms, n.e.s.[2]	221	993	West Germany 453; France 295; Sweden 84.

See footnotes at end of table.

Table 2.—People's Republic of China: Apparent exports of selected mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS			
Abrasives, natural, n.e.s	786	713	All to Japan.
Barite and witherite	53,971	45,612	West Germany 25,931; Italy 6,500; France 5,899.
Boron materials, oxide and acid	940	1,048	Japan 813; Australia 235.
Cement	(3)	--	
Clays and clay products:			
Crude clays, n.e.s	84,984	60,507	Japan 54,811; Italy 3,950; West Germany 1,746.
Nonrefractory products	--	171	All to Yugoslavia.
Diamond:			
Gem, not set or strung--value, thousands	$70	$36	All to Japan.
Industrial--do	r $85	$577	All to Belgium-Luxembourg.
Feldspar and fluorspar:			
Fluorspar	7,100	23,786	U.S.S.R. 16,279; Poland 7,507.
Undifferentiated	[4] 136,450	108,158	Japan 97,128; Sweden 3,653; Australia 3,473.
Fertilizer materials:			
Crude--value, thousands	--	$33	NA.
Manufactured--do	$26	--	
Graphite, natural	8,240	5,657	West Germany 4,100; United Kingdom 862; Japan 390.
Magnesite	21,612	18,471	United Kingdom 7,701; West Germany 3,464; Japan 3,101.
Mica, crude	1,285	1,196	All to United Kingdom.
Precious and semiprecious stones, except diamond--value, thousands	$603	$1,121	Japan $887; West Germany $108; United States $91.
Salt--thousand tons	r 1,069	1,108	Japan 1,001; U.S.S.R. 107.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	2,705	3,983	All to Japan.
Worked	1,765	1,401	Japan 1,152; Netherlands 249.
Gravel and crushed rock	5,268	4,191	All to Japan.
Quartz and quartzite	3,408	3,184	Do.
Unspecified	307	230	Do.
Talc, steatite, soapstone, pyrophyllite	82,432	115,998	Japan 90,256; United Kingdom 9,802; West Germany 6,615.
Other nonmetals, n.e.s.:			
Crude	1,591	2,066	Italy 1,321; Japan 745.
Slag, dross and similar waste, not metal bearing, from iron and steel manufacture	10,909	9,500	All to Japan.
Oxides and hydroxides of magnesium, strontium, and barium	1,539	1,005	All to Finland.
MINERAL FUELS AND RELATED MATERIALS			
Coal	226,945	344,353	All to Japan.
Petroleum refinery products:			
Mineral waxes, thousand 42-gallon barrels	54	75	Italy 30; Australia 26; Finland 6.
Nonlubricating oils, n.e.s--do	--	2	All to Australia.
Petroleum coke--do	406	308	All to Japan.
Total--do	460	385	

r Revised. NA Not available.

[1] Compiled from import data of Australia, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, the U.S.S.R., the United Kingdom, and Yugoslavia.

[2] Sources do not give details on metals included in this category, but presumably the figure consists chiefly of antimony, bismuth, and molybdenum.

[3] Revised to none.

[4] Revised to exclude material identified as fluorspar only in Soviet import statistics, which is reported separately in this table.

Source: For Poland and the U.S.S.R.: Official import statistics of the respective country; for all other countries: Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York, 1972, pp. 107-120; 1971 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York, 1974, pp. 109-124.

Table 3.—People's Republic of China: Apparent imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	--	147	All from Japan.
Metal, including alloys:			
Unwrought	9,029	32,339	Japan 15,030; Canada 5,000; France 3,995; U.S.S.R. 1,300.
Semimanufactures	6,486	2,176	Japan 959; Italy 745; Yugosalavia 305.
Chromium, oxide and hydroxide	310	470	All from Japan.
Columbium and tantalum metal, including alloys, tantalum	--	1	Do.
Copper:			
Ore and concentrate	--	4,121	All from Ireland.
Metal, including alloys, all forms	r 74,314	57,535	Zambia 44,346; United Kingdom 7,407; West Germany 2,680.
Iron and steel metal:			
Scrap—thousand tons	61	273	Canada 107; Australia 75; United Kingdom 54.
Pig iron, ferroalloys, and similar materials—do	6	487	Japan 298; Australia 188.
Steel, primary forms—do	15	76	Japan 38; Poland 36; West Germany 2.
Semimanufactures:			
Bars, rods, angles, shapes, sections—do	r 771	472	Japan 395; United Kingdom 18; Italy 17; U.S.S.R. 10.
Universals, plates and sheets—do	r 1,048	1,015	Japan 759; West Germany 98; Italy 42; U.S.S.R. 23.
Hoop and strip—do	r 23	25	Japan 18; West Germany 3; Italy 1.
Rails and accessories—do	r 34	47	Sweden 18; West Germany 11; Australia 11.
Wire—do	22	25	Japan 18; West Germany 3; United Kingdom 1.
Tubes, pipes, and fittings—do	r 417	471	Japan 392; West Germany 71; U.S.S.R. 4.
Castings and forgings, rough—do	1	4	Japan 3.
Unspecified—do	9	8	All from U.S.S.R.
Total—do	r 2,325	2,067	
Lead metal, including alloys, unwrought	r 26,736	6,196	United Kingdom 4,595; France 1,501; Japan 100.
Magnesium metal, including alloys, unwrought	30	NA	
Molybdenum metal, including alloys, all forms	--	6	All from Japan.
Nickel metal, including alloys, all forms	4,156	3,077	Netherlands 1,261; France 1,104; Canada 250.
Platinum-group metals, including alloys, all forms—value, thousands	$14,240	$1,748	United Kingdom $1,047; West Germany $554; France $95.
Silver metal, including alloys—do	$11	--	
Titanium oxides	317	--	
Tungsten metal, including alloys, all forms	2	11	All from Japan.
Zinc metal, including alloys, all forms	r 23,631	673	Do.
Other metals, including alloys, all forms:			
Metalloids, n.e.s—value, thousands	--	$26	United Kingdom $25.
Base metals	43	67	United Kingdom 39; Japan 17; Belgium-Luxembourg 10.
NONMETALS			
Abrasives, natural, n.e.s., grinding and polishing wheels and stones—value, thousands	$34	$34	NA.
Clay products, refractory	337	161	All from West Germany.
Diamond:			
Gem, not set or strung—value, thousands	$20,195	$14,357	United Kingdom $14,272; Belgium-Luxembourg $84.

See footnotes at end of table.

Table 3.—People's Republic of China: Apparent imports of selected mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Diamond—Continued			
Industrial ——value, thousands	$2,426	$1,119	Belgium-Luxembourg $1,091; West Germany $28.
Fertilizer materials, manufactured:			
Nitrogenous ——thousand tons	2,625	2,557	Japan 2,193; Italy 119; Belgium-Luxembourg 105.
Potassic ——do	11	5	All from Belgium-Luxembourg.
Other, including mixed ——do	10	29	All from West Germany.
Unspecified ——do	54	42	All from Norway.
Potassium compounds, n.e.s., caustic potash, sodic and potassic peroxides	--	1,880	Japan 1,380; Italy 500.
Stone, dimension, crude and partly worked	--	177	All from Italy.
Other nonmetals, n.e.s., halogens (excluding chlorine)	159	359	United Kingdom 285; Japan 74.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	2,700	2,574	All from Japan.
Petroleum refinery products:			
Mineral jelly and wax thousand 42-gallon barrels	5	1	All from West Germany.
Undifferentiated ——do	--	21	All from Poland.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	8,710	7,561	West Germany 7,361; Netherlands 200.

r Revised. NA Not available.
[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Bulgaria, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, the U.S.S.R., the United Kingdom, Yugoslavia, and Zambia.

Source: For Bulgaria, Poland, the U.S.S.R., and Zambia: Official export statistics of the respective country; for all other countries: Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York, 1972, pp. 121-130; 1971 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York, 1974, pp. 125-134.

COMMODITY REVIEW

METALS

Aluminum.—Increasing demand for aluminum for the PRC's industrial development program resulted in efforts to purchase alumina or aluminum throughout the world. Requirements by electrical, transportation. machinery, and other industries were greater than can be supplied by the PRC's aluminum productive capacity.

Imports in 1972 of aluminum by the PRC totaled about 100,000 tons. Imports were from Australia, Canada, France, and Japan. The PRC also purchased 30,000 tons of bauxite from Guyana. This bauxite may have been sent to some other country for refining.

The PRC's aluminum resources in aluminous shale and bauxite are sizable although much of the ore is offgrade diasporic material. Reserves have been reported in Chekiang, Fukien, Honan, Hopeh, Kwangsi, Kweichow, Liaoning, Shantung, and Yunnan Provinces. In 1972, aluminum metal production was about 140,000 tons—about 100,000 tons from Fushun in Liaoning, 20,000 to 30,000 tons from Sanmen Gorge in Kansu, and some tonnage from smaller facilities at Changling in Kirin, Wuhan in Hupeh, Hofei in Anhwei, and Nanning in Kwangsi. The low-grade nature of the reserves and shortage of electrical power may inhibit significant increases in aluminum reduction capacity.

Antimony.—The PRC continued to be a major world producer of antimony. Exports appeared to be higher in 1972 than during the last few years. Hibino Metal Industries of Japan imported 2,182 tons of antimony concentrate in 1972 and contracted to purchase 1,860 tons over a 6-month period starting November 1972. The United States imported 1,017 short tons of unwrought metal during the year, the first imports

from the PRC in several decades. The major world resource for antimony was the Hsikwangshan mine near Hsin Hua in Hunan Province. Reserves also were found in Kwangsi, Wwangtung, Kweichow, and Yunnan Provinces.

Bismuth.—Production in 1972 was about the same as that of the past several years. Although the PRC is a significant world producer, little was exported. Bismuth was recovered as a byproduct of tungsten and nonferrous metals refining.

Copper.—The PRC's requirements for copper have exceeded production capability and apparently will continue to exceed production for some time in the future. The PRC has been actively engaged in purchasing copper throughout the world. A long-term contract was made with Zambia to supply 50,000 tons of copper annually. During the first year of a 4-year contract, Chile was to supply the PRC with 65,000 tons of copper (38,000 tons of blister, 18,000 tons of electrolytic copper, and 9,000 tons of large diameter copper wire). It is possible that Chile might not completely fulfill the contract for 1972. Peru was to deliver 40,000 tons of copper and 10,000 tons each of lead and zinc by the end of 1972. The contract for about $45 million negotiated in June 1972 was part of an agreement in which the PRC loaned $40 million, interest free, for the development of Tintoya copper deposit in Peru. In addition the PRC purchased copper from other sources at the Canton Fair.

Mine production in the PRC apparently is from many mines, small by Western standards. The reported porphyry copper deposits in Northern China have not been developed. Hunan Province, produced 10% of the PRC's nonferrous metal production.[8] The Tunghua mine in Kirin can produce 2,500 tons of mine copper annually as can the Hungtoushan mine near Fushun, Liaoning. Prospecting teams are reported to have discovered new copper reserves. Increased reserves have been reported at the Huatung mine at Chingyüan, Liaoning, and the Tungkuanshan mine in Tungling, Anhwei. The No. 3 mine in Yunnan Province, a large mechanized mine, probably produces copper as a byproduct with tin. Other mines are reported in Tayeh, Hupeh, and Lanchow, Kansu.

The PRC's refined copper output was from both primary and secondary sources. It has been reported that increased efforts have been made to recover copper from scrap and secondary sources. The largest copper processing facilities were the smelter and refinery at Shenyang in Liaoning and a refinery at Shanghai. Smaller refineries treating mostly scrap were at Kunming, Hochiochum, and Wuwei in Kansu; Chuchow in Hunan; Chungtiaoshan in Anhwei; Wuhan in Hupeh and Taiyuan in Shansi. The first copper smelter in Fukien Province was put into trial production.[9]

Iron and Steel.—There are adequate resources of iron ore and fuel to meet the PRC's needs for producing iron and steel. However, there is a deficit in steelmaking capacity. The Chinese reported that total steel output had risen from about 21 million tons in 1971 to 23 million tons in 1972. Apparently about 17 million tons of steel was produced by the major steel facilities and little more than 6 million tons by the smaller and medium-sized plants. Official claims stated that pig iron increased 12%, steel 9.5%, and rolled steel 10% in 1972.[10] For small and medium facilities increases of 19% for pig iron and 16% for steel were claimed.

The PRC continues to exploit ore resources by developing new mines and constructing beneficiation plants to supply needed raw materials according to requirements. Equal emphasis was placed on expanding existing operations and opening new mines both large and small. With the increased raw material availability many steel plants had a higher output and better quality performance. Efforts also were made to produce more finished products at the steel plants. A concerted effort was made to increase recovery of scrap steel throughout the country. Approximately 9.3 million tons reportedly was collected in 1971 and apparently an increased quantity was collected for 1972.

Capacities of major Chinese steel plants are as follows:

[8] New China Mines Agency (International Service in Chinese, Peking). Nov. 21, 1972, D.2.

[9] British Broadcasting Corporation, Monitoring Service (Reading, England) SWB-Summary of World Broadcasts. Pt. 3, The Far East, Second Series, FE/W696, Oct. 25, 1972, p. A/6.

[10] Page 1 of work cited in footnote 7.

Plant	Province	Blast furnace unit	Steel furnace [1]	Capacity (metric tons per year)
Anshan	Liaoning	10	25 OH	7,000,000
Wuhan	Hupeh	4	6 OH	2,500,000
Shanghai	Shanghai	8	Various	2,000,000
Taiyuan	Shansi	5	BOF and electric	1,500,000
Peiping	Peiping	3	Oxygen converter	1,500,000
Maanshan	Anhwei	13	OH and oxygen	1,000,000
Canton	Canton	3	OH and BOF	1,000,000
Penhsi	Liaoning	2	OH and electric	1,000,000
Paotou	Suiyüan	1	2 OH and oxygen	800,000
Chungking	Szechwan	3	2 OH	800,000

[1] OH — Open-hearth furnace; BOF — Basic-oxygen furnace.

In order to rapidly raise steelmaking capacity, the Chinese have carried out negotiations with major Japanese steel companies to build a large steelmaking and processing facility. The PRC also imported a large oxygen generator from Japan probably for use at a steel plant which is being expanded under the 5-year development plan. A 15-man Chinese metallurgical study team visited Japanese steelmakers from December 1972 to February 1973 to discuss purchase of a 3-million-ton hot steel strip mill, a 2-million-ton cold strip mill, a 40,000-ton Sendzimir mill, a galvanized sheet and a tinplate plant, and other sheet plants. Negotiations covered complete plants plus technical know-how to run the plants.[11]

Imports of steel and steel products from Japan averaged just under 2 million tons annually during 1971–72. Approximately 40,000 tons of scrap steel was imported from the United States by way of Japan in 1972.

Most of the major and medium steel enterprises fulfilled their 1972 plans including Anshan, Shanghai, Capital (Peking), Penhsi, Maanshan, Taiyuan, Tientsin, Tangshan, Talien, Tayeh, Tsitsihar, Kwangchou, Fushun, Chengtu (seamless tube mill), Kunming, Hsining, Tsinan, Kirin (ferroalloy plant) and Liaoyang (ferroalloy plant).[12]

During 1972 Anshan produced between 6 and 7 million tons of steel from 10 blast furnaces, 25 open-hearth furnaces, and various basic oxygen furnaces (BOF's). Improvements in the No. 1 blooming mill and the roofs of the open-hearth furnaces resulted in improved efficiency. The dust collection system of the sintering plants was renovated for greater dust removal. It was reported that the modern, mechanized Takushan mine produces a 31% ore, mainly magnetite, which is upgraded to 63% before smelting. The Anshan complex hosted a large industrial conference for its customers from around the country during the year.

The Penshi steelworkers reported that its Nanfen mine was expanded to 7 million tons and the Waitoushan mine was expanded to 3 million tons of principally lean, Mesabi-type iron ore. These expansions are adequate to meet the Penshi's iron ore requirements.

At the Wuhan steelworks in Hupeh completion of the fourth large blast furnace increased Wuhan's capacity to possibly 2-½ million tons per year. The Tayeh mine part of the Wuhan combine reportedly was enlarged to a 3.4-million-ton-of-ore (60% iron plus) annual capacity. The Tahungshan mine and the Chengchao underground mine, also part of Wuhan, stabilized production during the year. The Capital steelworks improved coke consumption, product quality and achieved self-sufficiency in iron ore by successfully improving recovery from the lean ores of Chienan. Included in the mines of Chienan are Tashihho (1-million-ton capacity), Suichang, and Chungkuany, Yangshan, and Tayangchuang. The Taiyuan steelworks with Austrian BOF's increased output over that of last year. Innovations at the Maanshan steel complex enabled them to surpass 1972 targets in iron ore and in iron and steel production. The Nanshan mine was mechanized during the year. A pumping program to lower the water table enabled the Kushan mine to be reopened.[13] Nanshan and Kushan are parts of the Maanshan complex.

[11] Japan Metal Bulletin (Tokyo). Feb. 24, 1973, p. 3.
[12] Jenmin, Jihpao (Peking). Jan. 3, 1973, p. 1.
[13] China Reconstructs. April 1973, pp. 38–44.

Lead and Zinc.—The Imperial Smelting Process plant at Shaokuan, Kwangtung Province, was in operation during 1972. Although rated capacity was 18,000 tons of lead and 35,000 tons of zinc per year, production may be lower because of a shortage of raw materials.

The PRC's production of lead and zinc continued at approximately 100,000 tons per year for each metal. The largest mine was the Shin-kou-shan in Hunan, started initially as an open pit mine. In Liaoning, the Hsiuyen mine produced lead and the Ching-ching mine produced lead and zinc. Other mines were in Anhwei, Fukien, Hunan, Kiangsi, Kwangtung, Kweichow, and Yunnan Provinces. In addition to the Shaokuan smelter, intermediate smelters were at Chu-chou in Hunan and K'un-ming in Yunnan. There also are eight small smelters.[14]

Manganese.—Production of manganese continued at about 1.0 million tons. Some of the richest manganese reserves in the world are in the provinces south of the Yangtze River. The sedimentary deposits range from 20% to 40% manganese. Major manganese mines are in Fukien, Hunan, Kiagsi, Kwangsi, Kwangtung, and Kweichow Provinces with some from southwest are in Kansu and Liaoning Provinces.[15]

Mercury.—The PRC continued to rank among the world's major producers of mercury. Production of about 26,000 flasks was primarily from Kweichow and Hunan Provinces with some from Southwest Kwangtung Province. Once a major exporter, the PRC has curtailed exports in recent years.

Tin.—Production of tin was estimated at about 20,000 tons in 1972. Of the total output most was used or stockpiled in the PRC. Most of the production and reserves were in southern Yunnan Province near Kuchiu. The lode deposits of cassiterite are associated with small amounts of arsenic, copper, lead, and zinc in limestone. Ranging second in production was high-grade placer tin in Kwangsi. Tin was also produced in Hunan, Kiangsi, and Kwangtung Provinces, partly as a byproduct of tungsten mining. Reportedly the PRC's reserves of tin were 1.5 to 2.0 million tons, much at an average grade of 2.5% to 5.0%. The PRC's tinplate industry apparently is not adequate to meet its needs, and large quantities of tinplate were imported from Japan.

The PRC may become associated with the International Tin Council, possibly in a capacity different from that of a full member. The PRC considered accession to the International Tin Agreement, but the regulations for full membership could present major obstacles for the PRC.

Imports of tin metal from the PRC by other countries was more than 6,500 tons in 1972, up from about 6,450 tons in 1971. Imports of 160 tons by the United States were the first in more than 20 years.

Titanium.—The PRC has adequate reserves of titanium ore to meet current needs. Although there is no evidence of facilities to produce titanium metal, the PRC produced about 3,000 tons of titanium dioxide which probably was used as a white pigment for paint.

Tungsten.—Production of tungsten was estimated at 7,000 tons tungsten content. Little is known about the current status of tungsten mines in the PRC. Efforts were being made to modernize and further mechanize the mining and concentration facilities. Wolframite is produced at the Hsihuashan, Kweimeishan, Pankushan, and Tachisan mines in Kiangsi and other mines in Kwangtung. Production from scheelite deposits in Hunan is becoming an important source of tungsten. Extensive reserves at depth at Tachishan and scheelite reserves in Hunan are a significant part of the about 135 million tons of ore reserves.

Consumption of tungsten in pace with steel production in the PRC has been increasing and is estimated to be at least 5.0 million pounds of tungsten metal.

Exports of tungsten concentrate were estimated at 1,250 tons, down from 2,320 tons in 1971.[16] Factors contributing to the decline of exports may be increasing Chinese consumption and withholding of exports due to low market prices.

Uranium.—Production of uranium ore was from Chushan in Kiangsi and Weiyüan in Kwangtung. Uranium-235 was separated from uranium concentrate at a gaseous diffusion plant near Lanchou in Kansu Province for use in nuclear testing.

By the end of 1972 the PRC is known to have exploded 12 nuclear devices near

[14] Canadian Mining Journal. The Canadian Mining and Metals Mission to China. V. 94, No. 1, January 1973, pp. 19–31.
[15] Work cited in footnote 14.
[16] United Nations UNCTAD Committee on Tungsten. Tungsten Statistics, v. 7, No. 2, April 1973, pp. 1–61.

Lap Nor, Sinkiang Province. Seven were air-dropped, two were detonated on a tower, two were underground, and one was delivered by a 600-mile missile. Since two earth-orbiting satellites were launched by the PRC it appears that the PRC could have long-range delivery capability.

A PRC survey team mostly of power and nuclear specialists visited Japan in October 1972 to investigate Japanese technology and possibly the PRC-Japan cooperation.

NONMETALS

Asbestos.—The PRC produced about the same quantity of asbestos in 1972 thus ranking among the top five world producers. Production of both short- and long-fiber chrysotile-type asbestos was principally from the high-grade deposit at Shihmien in Szechwan Province. The Chinese also have shown interest in Canadian processing of asbestos.

Barite.—Production of barite was estimated at 155,000 tons in 1972. The largest use of barite in the PRC is in oil-drilling mud and production of barite is mainly dependent upon the level of oil-drilling activity. Japan imported 12,500 tons and the United Kingdom imported 1,600 tons from the PRC in 1972.

Boron Minerals.—Extensive deposits of boron-bearing materials are known to occur in the Iksaydam area of Tsinghai Province. Little is known about production but it is believed that output exceeds demand.

Cement.—Production of cement increased significantly in 1972. This is an industry that is particularly well suited to small and medium-sized plants. It was reported that there were small plants in 70% of the counties in the PRC. The number of plants increased from 1,800 to 2,400 in 1971.[17] Raw materials were available for production of cement throughout the PRC. Some of the materials used to produce cement included shales, lime, coral, slag, and calcium carbonate residues. Finished cement was needed in all areas of the PRC primarily for agricultural and transportation purposes. Cement was used for irrigation and water conservation projects as well as manufacturing railroad ties, poles, pipes, and other articles. The small plants, while not always efficient, were particularly advantageous for producing cement in widespread parts of the PRC.

The bulk of the cement production was from about 60 plants whose annual capacity was between 100,000 and 1,000,000 tons. Some of the larger, known cement plants in the PRC are as follows:

Plant name	Province	Annual capacity (metric tons)
Hantan	Hopeh	1,000,000
Yao Hsien	Shensi	1,000,000
Huahsin	Hupeh	1,000,000
Kwangchow	Kwangtung	700,000
Yungteng	Kansu	600,000
Fushun	Liaoning	550,000
Chungking	Szechwan	550,000
Tangshan	Hopeh	550,000
Tatung	Shansi	500,000
Ch'ihsin	Liaoning	400,000
Mutanchiang	Kirin	400,000
Tungfanghung	Kiangsu	400,000
Kunming	Yunnan	330,000
Kweiyang	Kweichow	300,000

Diamond.—The only known producing diamond mine in the PRC is the Changte mine in western Hunan Province. Deposits have also been reported in Kweichow and Shantung Provinces. Synthetic diamonds are possibly being produced in Tsingtao in Shantung Province. There has been some international trade in diamonds of both gem industrial and quality.

Fertilizer and Chemical Materials.—The PRC is the third largest world consumer of nitrogenous fertilizer. Demand has been rising at an annual rate of about 10% to 15%. It is estimated that 1972 fertilizer output exceeded 10 million tons of equivalent ammonium sulfate or more than 2 million tons of contained nitrogen. During the period between January and September 1972, it was reported that output increased by 33%. For the first 9 months of the year about 100 small, medium-sized, and large nitrogenous and phosphatic fertilizer plants were put into operation throughout the country.[18] There are now more than 2,000 small chemical fertilizer plants scattered all over the 29 provinces in the PRC. Approximately half of the production of fertilizer came from fairly large and modern plants. Large fertilizer plants are located at Nanking and Yangchow in Kiangsu, at Taiyüann in Shansi, at Chuchow and Liling in Hunan, at Kunming in Yunnan, at Hofei in Anhwei, at Tsinan in Shantung, and at Lanchou in Kansu. Completion of new large fertilizer plants was reported at Lunan

[17] U.S. Department of Commerce, National Technical Information Service. Foreign Broadcast Information Service (FBIS). PRC. V. 1, No. 230, Dec. 1, 1972, p. B 1.

[18] U.S. Department of Commerce, National Technical Information Service. Foreign Broadcast Information Service (FBIS). PRC. V. 1, No. 206, Oct. 24, 1972, p. B 6.

in Shantung, at Anyang in Honan at Changsha in Hunan. and at Hsüanwei in Yunnan. Fertilizer plants also were being built at various petroleum refineries.

The other half of the PRC's fertilizer production came from many small and medium-sized plants. Although such plants are wasteful and inefficient, they were built near the localities which would use the fertilizer to reduce the transportation cost. Such plants also are easier to build and require less capital investment. Many of these small plants utilized ammonia recovered from coking operations at small iron and steel plants. In 1972 more than 300 small enterprises were modified to use local coal and charcoal as raw material resources for production of nitrogen fertilizer.[19]

The PRC imports sizable quantities of nitrogenous fertilizer. By far the largest supplier was Japan which furnished 1.76 million tons of urea (45%), 650,000 tons of ammonium sulfate (21%), and 670,000 tons of ammonium chloride (26%), or a combined total of 1.1 million tons of nitrogen content. Other imports came from Kuwait and two large consortiums called NITREX and ANIC. Near the end of 1972, China signed a 3-year agreement to buy from Venezolana de Nitrogen (NITROVEN) approximately $23 million worth of urea during the second half of 1973. The PRC purchased from Greece 16,000 tons of fertilizer in May 1972 and later purchased 20,000 tons of fertilizer for delivery in the first 3 months of 1973.

Production of pyrite continued at about 2 million tons during 1972. Sulfur recovered was utilized primarily in the manufacture of sulfuric acid which was consumed to a great extent in manufacturing fertilizers. In July 1972, Canada exported 27,500 tons of sulfur to the PRC.

Production of phosphate was estimated to be about 2 million tons in 1972 primarily for use by the fertilizer industry. Important phosphate mines are located at Kaiyang in Kweichow, Paotou in Inner Mongolia, Tunghaihsien and Haichow in Kiangsu Province, and at Chinghsiang in Hupeh Province with a capacity of about 600,000 tons per year. Extensive bedded phosphate rock deposits were discovered at Kunyang near Kunming in Central Yunnan Province. Lesser phosphate production came from Kansu, Kwangsi, and Szechwan Provinces. Phosphate rock imports have been more than 1 million tons per year; about two-thirds of these imports came from Morocco and some came from North Vietnam.

There is little information available on potash reserves in the PRC. However, considering the size and geographical diversity of the PRC, it is reasonable to assume that sizable potash deposits may exist at the Tarim and Tsaidam Basins in the interior which are similar to other major world potash reserves. The PRC purchased $2.5 million worth of potash from Canada late in 1972.

Fluorspar.—Production of fluorspar amounted to about 6% of the world's supply. Major sources of fluorspar production were Chekiang, Hopeh, and Kwangsi Provinces. A new fluorspar mine has been developed in Taolin in Hunan Province. There was an ample supply of fluorspar for the Chinese steel and aluminum industries and more than half the production was exported. Japan imported 107,000 tons of fluorspar from the PRC in 1972. The balance of the exports may have gone to West Germany, the U.S.S.R., and Poland. During the year sodium fluosilicate was recovered as a byproduct of the phosphate rock industry.

Quartz Crystal.—There apparently is a production of natural and synthetic quartz crystal for use in the electronics industry, but few verifiable facts are available about the industry.

Salt.—The PRC was the second largest world producer of salt. A record production of possibly 18 million tons was reached in 1972. The major use of salt was for food. Industrial consumption increased resulting in a rising need for refined salt and soda. Plants were operated in Tientsin, Tangku, Tsingtao, and Tzukung. Japan imported almost 1 million tons of salt from the PRC in 1972.

The major output of salt was from solar evaporation of sea water in Kiangsu, Shantung, Hopeh, and Liaoning Provinces and on Hainan Island. Additional supplies of salt were produced inland from brines in Szechwan, salt beds in Hunan, Kiangsi, and Yunnan and lakes in Tsinghai. Potassium salts, bromine, iodine, and boron compounds also were recovered from the inland lake salts.

[19] British Broadcasting Corporation, Monitoring Service (Reading, England). SWB—Summary of World Broadcasts. Pt. 3, The Far East Series. FE/W725, May 23, 1973, p. A/9.

Steatite and Talc.—Steatite and talc were produced during 1972 at Taling in Liaoning Province. Since supply has always been greater than demand, a large portion of the production was, as usual, exported. Japan imported 75,000 tons of talc and 58,000 tons of steatite during the year.

Vermiculite.—Vermiculite has been found and is reportedly being quarried at more than 20 places in Linshu County of Shantung Province. A factory has been established and put into operation for making heat insulating boards, bricks, and pipes by using vermiculite with cement as a binder.[20]

MINERAL FUELS [21]

Coal.—PRC's coal production in 1972 is estimated at 400 million tons of raw coal which is equivalent to 300 to 350 million tons of dressed coal. This is only a small increase over the quantity produced in 1971.

The PRC has seven very large coal combines (or administrations), each with many mines. Fushun and Fuhsin in Liaoning produced more than 20 million tons of mine-run coal each in 1972, and Kailan was close to this level. Tatung in Shansi, Huainan in Anhwei, and Hokang and Chihsi in Heilungkiang were in the 13 to 16-million-ton-per-year range. In addition there are about five coal combines of 5 to 10 million tons, namely Pingtingshan (Honan), Fengfeng (Hopeh), Peking, Tzupo (Shantung), and Yangchuan (Shansi). Roughly 50 additional combines produced 1 to 5 million tons yearly each; they are headed by Chiaotso (Honan), Shuangyashan (Heilungkiang), Huaipei (Anhwei), Penhsi and Peopiao (Liaoning), Tsaochuang (Shantung), Hopi (Honan), Chinghsing (Hopeh), Tun Tungchuan (Shensi), Tunghua (Kirin), Luan (Shansi), Shihchuaishan (Ningsia), Meitien (Kwangtung), Pinghsiang (Kiangsi), Hsuchou (Kiangsu), and Hsishan (Shansi). Together these 60-odd combines contributed possibly two-thirds of the national coal output, with the rest coming from many small and medium-sized mines scattered around the country. These smaller mines, generally 100 to 1,000 tons per day in size, are important for "local" agriculture and industry.

The Fushun combine has bituminous coal strata totaling 40 to 130 meters in thickness, overlain by 80 to 150 meters of oil shale (8% to 9% oil), and dipping 25 to 30 degrees. Mining is by opencut (Hungwei pit) and underground (Hungchi mine) methods. The pit is 6.5 kilometers long, 1.5 to 2.5 kilometers wide, and 250 meters deep with an additional depth of another 200 meters anticipated. Bags of ammonium nitrate-fuel oil are used in blasting. There are 79 electric shovels and 450 kilometers of electrified railways. The coal is upgraded in heavy-media plants near the pit to clean coal of 6% and 10% ash, with 75% recovery of the coal. Shale oil is retorted, coal middlings and shale coal are burned for steam and power, and spent shale is used for making cement.

The Fushin operations reportedly surpassed its 1970 target by 3 million tons and produced a record of 93,000 tons during 1 day—May 26, 1970. Recent detailed drilling uncovered extensive new reserves. The combine's Hsinchiu opencut mine did particularly well in 1971 and in 1972. The Pingan underground mine was said to have made production gains for 55 consecutive months, thus increasing output by one-third during that period.

Kailan coalfield established an alltime high in output, in overfulfilling 1972 targets in beneficiated coal, in tunneling footage, in production costs, and in labor efficiency.[22] A program in Kailan was nearing completion to develop new reserves, build shafts, slopes, and tunnels and to strengthen the haulage system, particularly for the deeper seams. The Tangchiachuang and Linhsi collieries were singled out for superior performance.

The Huainan combine probably produced at the 1971 level, and Tatung produced at a little higher level. Chihsi with nine coal mines and 25 shafts fulfilled its 1972 target while rehabilitating the old Titao mine. Hokang's Suli mine has a pair of new shafts rated at 1.4 million tons per year. Pingtingshan, which already has 11 collieries, continued to expand. Peking and Yangchuan, the two largest Chinese anthracite combines, had productive years. Fengfeng opened up a 600,000-ton mine called Shunchuang in October. Huaipei with 10 pairs of shafts and the largest coal-washing plant in East China has been raising output by about 20% annually. Tzupo with 10 mines and 23 pairs of shafts was being further mechanized. Shihchuaishan has

[20] British Broadcasting Corporation, Monitoring Service (Reading, England). SWB—Summary of World Broadcasts. Pt. 3, The Far East, Second Series. FE/W 702, Dec. 6, 1972, p. A/12.

[21] Work cited in footnote 4.

[22] New China News Agency (Peking). Jan. 8, 1973, p. 1.

been built up into a medium-sized coal base. Hsuchou completed a 600,000-ton washing plant. Hsinmi in Honan started up the 600,000-ton Lukou mine. Talung, a large coal mine in Liaoning, was placed in operation at yearend. Tsaochuang, Chiaotso, Feicheng, Fengcheng, Luan, Pinghsiang, Chinghsing, Hsishan, and Meitien were among mines mentioned as having done well in 1972.

The PRC continued to expand the small and medium sector, closing down the nonproductive coal mines and building up the productive ones. Lesser mines in Hopeh Province now produce well over 5 million tons of coal annually. Kirin turned out more than 10 million tons in 1972, with probably only one combine larger than 1 million tons. Most coal mines in Kansu are small to medium size. In Shansi, Shantung, Anhwei, Peking, Shensi, and Ningsia, tributary coal mines are clustered around the larger ones. Small mines have been developed even in isolated places like Sinkiang and Tibet. According to the PRC, South China is no longer short of coal. Kwangtung and Szechwan Provinces have raised production sharply in recent years, and each produces 3 to 5 million tons of coal with one combine producing more than 1 million tons per year. Yearly coal output in Yunnan and Kwangsi are well over 2 million tons, but there is one mine in Kwangsi which produces close to 1 million tons. Small coal mines abound in Kiangsi, Hupeh, Chekiang, and Fukien Provinces. Hunan now has quite a number of coal mines of 100,000- to 600,000-ton yearly capacity. With such developments, many remote areas in the south are now self-sufficient in coal.

Petroleum and Natural Gas.—The PRC's crude oil output exceeded the 30-million-ton-per-year or 600,000-barrel-per-day level for the first time in 1972. A small part of this was shale oil. The gap between crude and refined oil widened slightly, although the country can refine the bulk of oil produced. Specifically, the Chinese claimed a 16% increase in crude oil and a 5% increase in refined products over 1971 figures.[23] The gain in natural gas was about 15%, but base output remained uncertain. Exploration and drilling in the abundant sedimentaries was encouraging.

The main thrust of expansion was at Taching, west of Harbin in Manchuria. Production of crude exceeded the 5-year plan and surpassed the 1971 level by a reported 14.6%. This means that output in 1972 was possibly 14 to 15 million tons. Much drilling was done to prove reserves and to establish new producing wells. Careful geological work coordinated with water injection, according to individual formations, have resulted in stable pressures and high production. Taching's refinery at Lunfeng has been enlarged to more than 5 million tons per year. Petrochemical facilities have also been expanded. Nonetheless, large surpluses of crude were sent to refineries like Fushun, Talien (Dairen), Shanghai, and Lanchow in 1972. Taching oils are found at medium depths and are high in wax content.

The recently expanded Karamai field in Sinkiang Province produced as much as 5 million tons of crude in 1972. The drilling program to delineate additional reserves apparently has been successful. Local refineries, however, are grossly inadequate, and most of the crude had to be shipped to Lanchow and elsewhere. The old Yumen oilfield rejuvenated a few years ago resorted to water injection of abandoned wells to maintain an annual output of possibly 3 million tons. Again, refining capacity is limited and surplus oil went to Lanchow. Although the Tsaidam Basin in Tsinghai Province has excellent potential, production was at low levels, and the local refinery was indeed small.

Not much information is available about an oilfield by the Yellow River Delta near Liching, which may be the Shengli Field. Japanese experts say that this field has produced more than 20 million tons of crude since 1966 and that some offshore work is being done. It is known that the Chinese have a few rigs in the area and have bought a $8.6 million offshore drilling assemblage called Fuji from the Japan Drilling Co. which had been using it in Indonesia. The Japanese advanced a proposal to help the Chinese develop offshore oil in Pohai Bay when an economic mission went to the PRC in late August. The PRC has repeatedly asserted its claim to Senkaku Islands (Tiaoyutai).

At the Shanghai refinery, a large locally made catalytic cracking unit was installed in the spring of 1972. The Shanghai refinery, like the ones at Lanchow and Peking, is rated at about 2.5 to 3 million tons per year. Peking is the newest of the three refineries and was built with petrochemical facilities at the start. Lanchow also diversi-

[23] New China News Agency (Peking). Dec. 26, 1972, p. 1.

fied into petrochemicals and fertilizers lately. Reportedly, the Talien (Dairen) No. 7 oil refinery had been completely renovated and refined 3.5 million tons of crude in 1972 as against 1.2 million in 1971. The Chinhsi No. 5 oil refinery was said to have adopted new techniques and installed new equipment, which resulted in quadrupling its capacity. An inquiry about purchasing pipelines from the Japanese to bring Taching crude 1,200 kilometers to Hulutao may be aimed at Chinhsi and passing by Fushun. There seem to be at least three refineries in Fushun—one with a capacity of possibly 3 to 4 million tons processing Taching crude brought in by tank cars, and two small refineries working on local shales. There is keen interest in petrochemicals. In March 1973, two petrochemical plants were bought from the Japanese for 6.9 billion yens (possibly $26.5 million).

Early in January, the Chinese offered to sell 200,000 tons of Taching crude to Japan. The Japanese took this matter up immediately, hoping to open the door for large-scale purchases. Subsequent negotiations were stalled, however, because Chinese prices were much higher than similar-grade, low-sulfur crude from Minas, Indonesia. Moreover, the PRC has no facilities to accommodate large tankers.

It was reported [24] that the PRC had petroleum reserves of 19,500 million barrels or 2.9% of the world total.

[24] Fortune. The Greatest Monopoly in History. V. 87, No. 4, April 1973, p. 153.

The Mineral Industry of Colombia

By Larry S. Dewey [1]

The overall performance of Colombia's mineral industry during 1972 recorded mixed results. Various sectors of the mineral industry displayed moderate increases. Coal continued to be the most valuable nonpetroleum mineral product, followed by emerald. Colombia, the world's principal source of emerald, was also an active gold producer because world prices were at an alltime high. Although gold production in 1972 decreased 1%, the value realized from 1972 production increased approximately 9% over the 1971 value. Colombia continued to rank high among the gold producers in the world, and was one of the few producers of platinum.

The most serious decline in mineral production was that recorded by crude oil. Because of strict conservation measures and lack of new major discoveries the output of crude oil declined 8% compared with a 2% decrease the previous year.

In late 1971 and early 1972 the Ministerio de Minas y Petróleos took steps to enlarge the ore treatment plant in the Pasto mining area to a capacity of 10 tons per day in order that small miners in the southern part of the country could rely on adequate equipment for the treatment of their ores. Additionally, the Colombian Government under Decree No. 2358 set up a National Commission of Energy Resources as a consultative agency of the Government. The Commission is composed of different organizations from the public and private sector with the objective of promoting technical and economic studies for the formulation of a general policy in the field of energy.

PRODUCTION

Output of many metals and nonmetals were slightly ahead of production levels established in 1971. Production of crude steel, copper, lead, and cement increased; however, the output of gold, platinum, and zinc declined. Mineral fuels, especially crude oil, declined by 8%, but coal production was estimated to have increased 14% over last years pace.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Colombia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Chromite, gross weight	170	500	[e] 200
Copper, mine output, metal content [e]	50	56	67
Gold, troy ounces	[r] 201,518	189,618	186,816
Iron and steel:			
Iron ore and concentrate, thousand tons	[r] 453	370	416
Pig iron, do.	231	197	281
Crude steel, do.	[r] 239	248	275
Lead, mine output, metal content	293	205	294
Manganese ore, gross weight	464	450	492
Mercury, 76-pound flasks	215	213	152
Platinum-group metals, troy ounces	26,358	25,610	24,111
Silver, do.	75,581	68,307	69,678
Zinc, mine output, metal content	156	112	85
NONMETALS			
Barite	6,821	5,790	6,306
Cement, hydraulic, thousand tons	2,757	2,828	3,006
Clays:			
Kaolin	92,610	96,575	101,056
Other	616,050	670,000	738,675
Diatomite	280	300	357
Feldspar	23,152	24,836	26,358
Fertilizer materials:			
Crude, phosphate rock	12,000	10,000	6,206
Manufactured (gross weight):			
Nitrogenous	NA	NA	112,133
Phosphatic	NA	NA	42,159
Other, including mixed	NA	NA	286,706
Fluorspar	NA	NA	4,200
Gem stones, emerald, thousand carats	[2] 60	672	1,750
Gypsum, thousand tons	[r] 189	182	201
Lime [e], do.	1,000	1,000	1,000
Mica, all grades	26	32	38
Salt:			
Marine, thousand tons	532	300	674
Rock, do.	230	338	349
Total, do.	762	638	1,023
Sand (silica)	3,200	NA	4,512
Stone:			
Calcium carbonate	13,424	NA	NA
Dolomite, thousand tons	[r] 13	14	14
Limestone, do.	5,007	NA	4,900
Quartzite, thousand tons	2,850	14,380	2,000
Marble, cubic meters	165	172	181
Sulfur: [e]			
From ore	29,900	30,500	32,500
Petroleum refinery byproduct	3,600	3,500	3,500
Total	33,500	34,000	36,000
Talc, soapstone, pyrophyllite	1,723	1,975	2,247
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, thousand tons	[r] 3,317	2,800	3,200
Coke, all types, do.	498	490	524
Gas, natural:			
Gross production, million cubic feet	104,894	111,288	115,622
Marketed production, do.	46,736	51,186	60,988
Natural gas liquids, thousand 42-gallon barrels	4,510	3,629	2,962
Petroleum:			
Crude oil, do.	79,594	78,101	71,674
Refinery products: [3]			
Aviation gasoline, do.	558	503	466
Motor gasoline, do.	16,002	16,355	17,529
Jet fuel, do.	1,292	1,482	1,545
Kerosine, do.	3,552	3,360	2,997
Distillate fuel oil, do.	6,769	7,301	8,986
Residual fuel oil, do.	16,352	18,121	18,051
Lubricants, do.	499	356	32
Other:			
Liquefied petroleum gas, do.	1,651	1,499	1,983
Naphtha, do.	1,731	1,338	1,077
Asphalt and bitumen, do.	1,576	618	915
Petroleum coke, do.	870	[e] 900	3,075
Miscellaneous and unspecified, do.	2,378	[r e] 4,191	
Total, do.	53,230	56,024	56,656

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

[1] In addition to the commodities listed, carbon black, coal briquets, and magnesite are also produced, but output is not reported quantitatively and available information is inadequate to make reliable estimates of output levels.

[2] May include gem stones other than emeralds.

[3] Includes refinery fuel and unfinished oils destined for interrefinery transfer and further processing.

TRADE

Shipments of Colombia's principal mineral export items recorded mixed results. A majority of imported mineral items registered increases; the rise in raw material imports was the most significant. The detailed trade data which appeared in the 1971 chapter is the most recent official information available. Some information of petroleum trade can be found in table 2.

Table 2.—Colombia: Trade in crude and refined petroleum

(Thousand 42-gallon barrels)

Commodity	1970	1971	1972
Exports:			
Crude oil	31,246	25,396	14,926
Refinery products:			
Distillate fuel oil	1,513	979	2,002
Residual fuel oil	9,014	10,749	10,085
Other	r 31	--	340
Total	10,558	11,728	12,427
Bunker loadings:			
Distillate fuel oil [1]	2,287	NA	3,818
Residual fuel oil	1,380	NA	1,084
Total	3,667	NA	4,902
Imports:			
Refinery products:			
Gasoline	21	40	248
Jet fuel and kerosine	35	36	--
Distillate fuel oil	19	11,446	--
Residual fuel oil	172	--	--
Lubricants	97	40	9
Other	r 165	87	6
Total	509	11,649	263

r Revised. NA Not available.
[1] Includes aviation gasoline, jet fuel, and lubricants.

COMMODITY REVIEW

METALS

Copper.—An important development in 1972 was the discovery of a large porphyry copper deposit in the valley of the Strato River in the northwestern part of the country. Surface sampling and shallow diamond drilling have revealed estimated reserves of 625 million tons of 1% copper. The discovery was made by a cooperative prospecting team from the Colombian Geological Institute and the U.S. Geological Survey.

Gold.—The rapid increase in the price of gold provided the Colombian Government with the necessary incentive to reopen several small gold mines that had been closed for more than 20 years. In September, 1972 the Government issued a decree creating a Coordinating Council for the promotion of wider participation by the State in the prospecting for and production of gold. One of the first steps taken by the Coordinating Council was to create a new company, Colombian Golds. This new company was to begin operations in early 1973. Gold production has tended to decrease since 1965; however, the decrease in 1972 output was less than 1% compared with that of the previous year, due mainly to a 15% increase in production by Pato Consolidated Gold Dredging Ltd. Total gold mining operations in Colombia in 1972 recorded a volume of 186,816 ounces, compared with 189,618 ounces in 1971.

Iron and Steel.—Acerías Paz del Rio, S.A., (A.P.d.R.) continued to be Colombia's dominant iron and steel producer during 1972. It produced all of the country's pig iron from iron ore produced at its own mine and from sizable quantities of fines withdrawn from its large stockpile. A.P.d.R. reported making improvements at its iron and coal mines as well as in rail facilities linking the iron mine with its steel plant. The blast furnace was modified during 1972 to

permit injection of oil to reduce coke consumption by 30%.

Colombiana de Arrabios Ltd. was a new entry into Colombia's iron and steel industry in 1972. It began producing in December and was expected to produce 30,000 tons of pig iron for foundry use in 1973. The firm was also considering the addition of ore sinterization by 1975, which would raise production about 50%.

Nickel.—The Cerro Matoso ferronickel project, which will be Colombia's largest mining venture, is proceeding, but nothing significant was accomplished in 1972. This project will be carried out by Compañia de Niquel Colombiano, S.A., which is owned jointly by the Instituto de Fomento Industrial (IFI), Hanna Mining Co., and Chevron Oil Co. Each of the participating entities is to contribute one-third of the investment required for the project, but the Government-owned IFI has a 50% voting interest. The lateritic nickel deposit involved in this project is located in the Montelibano District of the Department of Córdoba.

NONMETALS

Asbestos.—In early 1972, the General Engineering Co. of Toronto, Canada, began design work for the Las Brisas asbestos project in the northern part of the Department of Antioquia. The Las Brisas asbestos mining and milling facilities upon completion are to be operated by Asbestos Colombianas, S.A. in which Nicolet Industries, Inc., of Ambler, Pa., holds a 70% interest. This project is being designed with an annual capacity of 63,000 tons of ore, which include both the mining and processing function.

Cement.—Work continued throughout 1972 in an attempt to increase daily output of the Cementos Diamante, S.A., plant at Ibaqué from 700 to 1,000 tons. Total Colombian cement production in 1972 was a little over 3 million tons.

Fertilizer Materials.—In recent years, discoveries of large volumes of phosphate rock have led to the initiation of a program by IFI to develop local production rather than rely on costly imports. The first step under this program was to develop a project for the exploitation of the Turmeque deposits near Ventaquemada in the Department of Boyacá by Compañia Colombiana de Minas, a dependency of IFI. A 60,000-ton-per-year superphosphate plant was being constructed under contract by Pan American Consulting, Ltd.; part of this project was expected to be completed by yearend 1972.

Similar exploitation projects were being considered in connection with phosphate rock deposits in the Sardinata and Azufrada Areas in the Department of Santander, the Sogamosa Area of the Department of Boyacá, and at several locations in the Department of Huila. However, in 1972 there were no reports of significant development activity.

Salt.—Development of a marine salt production and exporting complex at Bahía Hondo on the Guajira Peninsula was in progress during 1972. This complex was to have an annual output capacity of 1.5 million tons of salt and was scheduled for completion in 1973.

MINERAL FUELS

Coal and Coke.—Negotiations continued in 1972 between IFI and firms interested in developing the coal deposits at El Cerrejon in the Department of Guajira. Drilling conducted in 1971 indicated reserves of 50 to 100 million tons of low-sulfur, steam-grade, noncoking coal. Strip mining methods would reportedly be economical for 10 to 15 years, but part of the reserves would be recoverable only by underground mining.

Acerías Paz del Rio, S.A., continued to be Colombia's principal producer and consumer of metallurgical coke. It was also the operator of the country's only major coal washery.

Petroleum and Natural Gas.—Total output of crude oil declined 8% during 1972, reflecting the application of government conservation measures to the Caballos formation of the Orito Field. The decrease in crude production was expected and is forecast to continue because no new discoveries were made in 1972, and conservation measures as applied by the Ministerio de Minas y Petróleos were to remain in effect indefinitely. The Ministerio in 1971 maintained that ½-inch chokes should be installed at producing wells in the Orito Field, which is the area's principle field, to limit the rate of production for conservation purposes in order to guarantee maximum crude oil recovery from the field. Gulf Oil Co. and Texas Petroleum Co., owners of the field, insisted that this step was not necessary. Output from the Putumayo Field was held

to a compromise level of 65,000 barrels per day during 1971 pending resolution of this dispute. In 1972, the arbitration tribunal ruled in favor of the conservation measure and reduced the average daily production to 30,000 barrels per day.

Natural gas production, which rose 4% during 1972, was primarily from oilfields where, in a number of cases, gas-to-oil ratios have been rising steadily in conjunction with reservoir depletion.

Proved reserves of crude oil reportedly totaled 1,500 million barrels at yearend 1972. As of the same date, proved reserves of natural gas were reported at 2,400 billion cubic feet.

There were 27 exploratory wells drilled in 1972, of which all but 3 were dry holes. A total of 30 development wells were also drilled, but details were not available. New exploration in Colombia was reported practically at a standstill. Generally, only one or two rigs are active in the country at any given time.

Applications for concessions were at a high level in 1972. Among the largest applications was one by Empresa Colombiana de Petróleos (ECOPETROL) for 2.2 million hectares on and offshore of the Pacific coast, north and south from Buenaventura, and another application covered 1.8 million hectares in Putumayo. Weeks Natural Resources, a private firm, applied for 2.3 million hectares in the Caqueta and Vaupes jungles, and Texaco Inc. filed on large blocks in Caqueta and western Putumayo. Many other companies sought smaller acreage in many different parts of the national territory, as well as offshore.

There were two new companies, Aquataine Colombie, S.A. a French firm, and Cayman Corp. a United States firm that entered the Colombian petroleum industry in 1972 by signing association contracts with ECOPETROL. Under these contracts both Aquataine and Cayman are to absorb all exploration expenses. However, if a well suitable for development is brought in, ECOPETROL reimburses the firm one-half the expenses for the well and becomes a joint-venture partner. Both Aquataine and Cayman were conducting only seismic operations and will not do any drilling until 1973. Conservation measures, the lack of new discoveries, and inadequate refining capabilities resulted in shortages of gasoline and other petroleum products during 1972.

Consequently, several major projects are being planned to meet the shortage in domestic petroleum products until such time as new discoveries are brought onstream. The ECOPETROL refinery in Barrancabermeja was scheduled to install a turbo expander in 1975 and a balance unit in 1976 to obtain a higher gasoline yield instead of a heavy percentage of fuel oil, for which there is little demand. This project should increase gasoline capacity by 15,000 barrels per day.

A new refinery in Tumaco with a total capacity of 75,000 barrels per day was scheduled for completion in 1978.

The Mineral Industry of Cyprus

By E. Shekarchi [1]

The political tensions which have existed in Cyprus since 1963 continued in 1972. During the year, talks between the Turks and the Cypriots took place under the sponsorship of the United Nations, without concrete results. Due both to the political instability and depletion of high-grade ore, the production of chromite, copper, and cupreous concentrates decreased and some mining companies were phasing out their operations.

The text of the 5-year Development Plan (1972–76) was not published by year-end. Reportedly the aim of the Development Plan is a continuation of previous plans and includes full use of productive resources, development of a sound balance of payments, and expansion of light industry and manufacturing.

Negotiations between the European Economic Community (EEC) and Cyprus for an Association Agreement were completed in December 1972. Under the agreement virtually all trade barriers between Cyprus and the EEC will be removed in two phases spread over 9½ years. On industrial products the EEC will immediately reduce 70% of its tariffs, while Cyprus will reduce its tariffs by 75% in three steps spread over 4 years. Details of the second phase will be agreed upon in negotiations due to begin 18 months before the end of the first phase, or early in 1977.

Following the floating of the British pound sterling, the Government of Cyprus decided to divorce the Cyprus pound from sterling and maintain the par value of Cyprus pound to gold.

The Geological Survey Department (GSD), continued its comprehensive survey of the island's mineral resources with integrated geological, geophysical and geochemical exploration, and drilling. The mapping for mineral exploration amounted to a total of 17 square kilometers on a 1:5,000 scale. The main interest of the geological survey continued to be exploration work, not only for sulfide ores but also for other minerals such as chromite, asbestos, and nonmetallic ores. During the year 44 exploration holes were drilled amounting to a total of about 16,000 feet.

[1] Physical scientist, Division of Ferrous Metals.

PRODUCTION

Available data for mineral production are given in the following table.

Table 1.—Cyprus: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Chromite ore and concentrate (marketable)	33,335	40,597	[e] 26,000
Copper, mine output, metal content [2]	18,161	16,414	[e] 16,000
NONMETALS			
Asbestos	25,625	27,697	[e] 30,000
Cement, hydraulic	[r] 266,271	303,250	[e] 420,000
Clays, crude:			
Bentonite [3]	[r] 13,100	12,564	11,044
Other (unspecified) [e 4]	162,568	221,500	NA
Gypsum:			
Crude	44,694	17,266	27,941
Calcined [e 4]	8,800	8,159	NA
Lime, hydrated	[4] 78,795	[4] 107,100	[e] 110,000
Mineral pigments:			
Terra verte [3]	13	7	8
Umber	6,953	6,993	[3] 10,430
Yellow ocher [3]	451	482	876
Pyrites:			
Gross weight	[r] 939,504	830,094	[3] 460,170
Sulfur content	[r] 455,659	402,596	223,182
Salt, marine	7,000	6,592	[e] 7,000
Stone, sand and gravel:			
Dimension stone, marble [4]	43,802	33,205	NA
Crushed and broken building stone, thousand tons	878	1,302	NA
Sand and aggregate, do	1,576	2,775	NA
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products: [e]			
Gasoline, thousand 42-gallon barrels	--	--	700
Jet fuel and kerosine, do	--	--	350
Distillate fuel oil, do	--	--	900
Residual fuel oil, do	--	--	1,200
Asphalt, do	--	--	50
Refinery fuel and losses, do	--	--	300
Total, do	--	--	3,500

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

[1] In addition to the commodities listed, a variety of other crude construction materials may be produced, but information is inadequate to make reliable estimates of output levels.

[2] Includes copper content of copper concentrates, cupriferous pyrite ore, and cement copper produced; excludes content of iron pyrite.

[3] Exports.

[4] Estimates of Senior Mines Officer, Republic of Cyprus, for 1970 and 1971.

TRADE

According to the annual report of the Senior Mines Officer there was a sharp decline in mineral exports during 1972; their value amounted to only 20% of total exports compared with 23% in 1971. The quantity of mineral products exported during 1972 fell to 644,000 tons compared with 853,450 tons in 1971. The most important mining products exported, in order of value, were cupreous concentrates, asbestos, iron pyrites, and copper cement (precipitates).

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

(Metric tons)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, scrap	136	111	Italy 97; West Germany 13.
Chromium, ore and concentrate	31,246	42,951	Austria 13,998; France 11,101.
Copper:			
Concentrate	53,862	51,446	West Germany 38,727; Spain 8,467; Italy 4,252.
Cement	11,137	9,201	All to West Germany.
Cupreous pyrite	96,049	74,513	Do.
Metal, scrap	2,284	365	West Germany 173; Spain 84.
Iron and steel:			
Scrap	6,480	6,393	Greece 5,482; Italy 872.
Semimanufactures, tubes, pipes and fittings	340	652	Libya 422; Malta 56.
Lead, scrap	324	141	Italy 83; West Germany 58.
Zinc, scrap	62	235	Netherlands 173; Spain 62.
Other waste and scrap of base metals	3	22	All to Netherlands.
NONMETALS			
Asbestos, crude	24,133	22,612	United Kingdom 6,796; Denmark 4,093; Israel 2,268.
Cement	20	--	
Clays and clay products, refractory	13,101	12,564	Israel 12,552.
Gypsum	4,421	--	
Lime	5,352	11,483	Libya 4,876.
Pigments, mineral	7,404	7,475	United States 4,285; United Kingdom 2,011.
Pyrites, unroasted	818,106	611,842	Netherlands 181,186; France 153,521.
Stone, gravel and crushed stone	1,400	1,444	Libya 831; Israel 613.

[1] Includes reexports.

Table 3.—Cyprus: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum, including alloys, all forms	1,136	1,274
Copper:		
Copper sulfate (including alums) and persulfates	685	755
Metal, including alloys, all forms	178	259
Gold, including platinum plated, unwrought and semimanufactures, troy ounces	17,520	21,043
Iron and steel:		
Scrap	--	22
Pig iron (including cast iron) and ferroalloys	313	235
Primary forms	57	105
Semimanufactures	76,902	95,548
Lead:		
Oxides	196	160
Metal, including alloys, unwrought and semimanufactures	263	492
Nickel, including alloys, unwrought and semimanufactures	8	7
Platinum group and silver:		
Silver and platinum ores, troy ounces	3,279	--
Metal, including alloys:		
Platinum group, do	4	7
Silver, do	r 72,933	146,107
Tin, including alloys:		
Scrap, long tons	3,640	5,517
Unwrought and semimanufactures, do	282	397
Titanium oxides	63	122
Zinc:		
Oxide and peroxide	18	17
Metal, including alloys, unwrought and semimanufactures	470	364
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	26	14
Grinding and polishing wheels and stones, value	$70,140	$77,191
Barite and witherite	246	24
Cement	27,131	33,098
Chalk	373	369
Clays and clay products (including all refractory brick):		
Crude, n.e.s	640	97
Products:		
Refractory (including nonclay bricks), value	r $104,789	$211,591
Nonrefractory, do	$555,715	$798,350

See footnotes at end of table.

Table 3.—Cyprus: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Diamond, gem, not set or strung	value	$10,714	$15,869
Diatomite and other infusorial earths		72	55
Fertilizer materials:			
Crude		28	--
Manufactured:			
Nitrogenous		44,713	41,862
Phosphatic		12,667	14,724
Potassic		863	1,623
Other, including mixed		44,600	36,136
Ammonia		20	32
Graphite, natural		3	--
Gypsum and plasters		272	69
Pigments, mineral:			
Natural, crude		242	188
Iron oxides, processed		18	19
Precious and semiprecious stones, except diamond:			
Natural	value	$10,222	$19,226
Manufactured	do	$8,794	$26,717
Salt and brine		378	439
Sodium and potassium compounds, n.e.s		r 263	363
Stone, sand and gravel:			
Dimension stone		1,383	1,121
Gravel and crushed rock		78	647
Sand, excluding metal bearing		24	44
Sulfur:			
Elemental, other than colloidal and other		1,799	1,735
Sulfur dioxide		46	85
Sulfuric acid, oleum		318	211
Talc, steatite, natural		518	482
Other n.e.s., building materials of asphalt, asbestos and fiber, cement		7,151	4,544
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		3,211	8,847
Coal, including briquets, all grades		150	95
Coke and semicoke		218	487
Peat, including briquets and litter		12	--
Petroleum:			
Crude	thousand 42-gallon barrels	--	(1)
Partly refined	do	4,024	--
Refinery products:			
Gasoline (including natural)	do	869	921
Kerosine and jet fuel	do	412	472
Distillate fuel oil	do	962	974
Residual fuel oil	do	1,665	1,895
Liquefied petroleum gas	do	214	277
Lubricants	do	48	42
Mineral jelly and wax	do	(1)	4
Asphalt and bitumen	do	r 66	64
Other nonlubricants	do	(1)	4

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Chromite.—Hellenic Mining Co. Ltd. (HMC), the only chromite producer in Cyprus, produced about 26,000 tons of chromite in 1972, a decrease of 36% compared with 1971 production. The decline was due to depletion of high-grade ore.

Copper.—Cyprus Mines Corp. (CMC) was again the largest producer and exporter of sulfide minerals. The prospecting activities of CMC came practically to a standstill during the year except for limited geophysical surveys, geochemical analysis, and some reconnaissance drilling. Development drilling in the mine area at Skouriotissa continued in 1972.

Copper ore from two mines, Skouriotissa and Lefka, was transported by rail to the concentrator at Morphou Bay. Approximately 779,000 tons of ore with an average grade of 1.3% copper and 30% sulfur was processed at the Morphou plant. In addition, the pressure-leach plant at Morphou extracted copper and pyrites from tailings produced in earlier years. This plant

treated 428,000 tons of material averaging 0.6% copper and 25% sulfur.

The main products of these plants, concentrate consisting about 20% copper and precipitates of approximately 70% copper, were sold to West Germany.

HMC was the second largest producer and exporter of sulfides in 1972. HMC carried out some limited geophysical and geochemical surveys over the areas covered by its mining leases and prospecting permits. Most of the company's production was from the Mousoulos underground mine, and from the Mavri Sykia, Mathiati, Memi, and Alestos open-cast mines. Development work on the Kokkinoyia mine was completed during the year and limited production was initiated.

Total copper production of Cyprus decreased 2% in 1972 compared with that of 1971.

NONMETALS

Asbestos.—Cyprus Asbestos Mines, Ltd., the only asbestos producing company in the country, managed successfully to produce during the dry season as well as on a small scale during the winter months. Asbestos production increased 8% in volume and 15% in value in 1972 compared with that of 1971. The main recipients of Cyprus asbestos were the United Kingdom, Denmark, and Israel.

The Geological Survey of Cyprus, as consultant to Cyprus Asbestos Mines, carried out detailed mapping at the Amiandos mines, followed by drilling in 1972. The purpose of the investigation was to delineate the extent of economic asbestos mineralization in the concession.

Cement.—Production of cement registered another increase in 1972 compared with that of 1971 due to the demand of the construction industry.

The annual increase in cement consumption in Cyprus has averaged 9% over the past 20 years, and it is anticipated that the industry will continue to experience a high rate of growth in the future. The present installed production capacity will meet anticipated consumption requirements only until 1975. To help the country meet its growing demand, maintain its self-sufficiency, and pave the way for exports at competitive prices, the Cyprus Cement Company, Ltd., decided to increase its production capacity from 105,000 tons in 1972 to 345,000 tons by the end of 1974. The cost of the expansion plan, including net working capital and interest during construction, was estimated at $11.6 million. To amass this sum, Cyprus Cement acquired $2.3 million from the International Finance Corporation (IFC), a member of the World Bank Group; $4.7 million from the National Bank of Greece; and $4.6 million from the Bank of Cyprus. The completion date of the planned expansion was given as the end of 1974.

Pyrite.—Iron pyrite production decreased 45% in 1972 compared with that of 1971, due to depletion of high-grade ores. Development of a low-grade pyrite orebody near Skouriotissa, begun mid-1972, is expected to extend CMC's mining operation for another 5 years.

MINERAL FUELS

Exploration activities for petroleum were dormant during the year. However, oil exploration licenses covering a total of 3,260 square miles were still valid at the end of 1972.

The refinery of Cyprus Petroleum Refinery, Ltd., owned by Shell Oil Co., 25.5%, British Petroleum Co., Ltd., 25.5%; Mobil Oil Corp., 34%; and the Cyprus Government, 15%, was officially inaugurated in February 1972. The refinery is situated near Larnaca on the southern coast of the island and, at its full capacity of about 13,500 barrels per day, is expected to produce gasoline, diesel fuel, kerosine, and fuel oil to fill domestic requirements.

The Mineral Industry of Czechoslovakia

By Bernadette Michalski [1]

The Czechoslovakian economy, not yet fully recovered from the political economic crisis of 1968, did not attain most planned goals for 1972. Industrial production rose by 5%, falling short of the planned 7% increase. The mineral industry faired far better than the overall economy. Steel ouput reached peak levels as a result of modernization and installation of new facilities at major iron and steelworks. The chemical industry was revitalized with the expansion of the Zaluzi chemical works and the availability of additional raw materials via the pipeline transporting gas from the U.S.S.R. to Czechoslovakia and points west.

PRODUCTION

The nonferrous metal industry realized significant production gains in most commodities. Primary aluminum production derived from imported bauxite continued on an upward trend. Ziar Nad Hronom, the nation's sole primary aluminum plant operated at 65% capacity during 1972 while less than 50% of the plant's capacity was utilized in 1970. Copper mine and metal output continued to increase. Expansion and modernization activities in Slovakian copper mines more than offset production declines in the Bohemian mines.

While domestic iron ore production declined, the nation's iron and steel industry utilizing imported iron concentrate and imported pig iron continued to grow, maintaining its position as the third largest steel producer in East Europe.

Bituminous coal production declines were reported in the Ostrava Karvina, Kladen, Rosicka, and Plzenska Basins for an overall decrease in production of more than 3%. Inspite of expansion activity setbacks, brown coal output at the North Bohemian Basin increased by nearly 1 million tons, offsetting production declines at the Sokolov Basin.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Czechoslovakia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum ingot, primary only ---thousand tons--	31	37	43
Antimony: [e]			
Mine output, metal content	600	600	600
Metal	1,300	1,300	1,300
Copper:			
Mine output, metal content	[r] 4,800	5,300	6,000
Blister	4,000	4,500	6,000
Metal, including secondary	16,723	17,196	18,068
Iron and steel:			
Iron ore, gross weight ---thousand tons--	[r] 1,606	1,609	1,581
Pig iron (including blast furnace ferroalloys)--do---	7,548	7,961	8,360
Ferroalloys (electric furnace only) ---do---	104	112	116
Crude steel ---do---	11,480	12,064	12,727
Steel semimanufactures ---do---	[r] 9,072	9,525	9,974
Lead:			
Mine output, metal content	5,680	5,101	4,917
Metal, including secondary	17,615	17,609	18,163
Manganese ore, gross weight	86,000	48,000	--
Mercury ---76-pound flasks--	4,815	5,628	6,614
Nickel metal, primary [e]	800	800	800

See footnotes at end of table.

Table 1.—Czechoslovakia: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS—Continued			
Silver [e] ——thousand troy ounces	1,100	1,100	1,000
Tin:			
Mine output, metal content ——long tons	163	166	157
Metal, including secondary ——do	[r] 65	80	90
Zinc, mine output, metal content ——	10,250	8,560	9,250
NONMETALS			
Barite [e] ——	7,500	8,000	8,000
Cement, hydraulic ——thousand tons	[r] 7,402	7,956	8,045
Clays, kaolin ——do	367	404	422
Fertilizer materials, manufactured:			
Nitrogenous, nitrogen content ——do	[r] 296	317	344
Phosphatic:			
Thomas slag, P_2O_5 content ——	3,712	3,626	3,160
Other, P_2O_5 content ——	318,640	327,176	331,093
Fluorspar [e] ——	80,000	[r] 90,000	90,000
Gypsum and anhydrite:			
Crude ——thousand tons	487	479	501
Calcined [e] ——do	25	25	25
Lime (quicklime and hydrated lime) [2] ——do	2,148	2,254	2,420
Magnesite:			
Crude ——do	631	619	[e] 620
Clinker [e] ——do	1,100	1,200	1,200
Perlite [e] ——	10,000	10,000	10,000
Pyrite:			
Gross weight ——thousand tons	342	352	328
Sulfur content [e] ——do	144	[r] 150	138
Salt ——do	213	215	220
Stone, limestone and other calcareous ——do	18,184	19,444	19,849
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen ——	858,162	977,854	1,197,731
Coal:			
Bituminous ——thousand tons	[r] 28,064	28,702	27,822
Brown ——do	78,007	81,052	81,726
Lignite ——do	3,776	3,739	3,840
Total ——do	[r] 109,847	113,493	113,388
Coke:			
From bituminous coal:			
Metallurgical ——do	[r] 8,273	8,613	9,073
Gashouse ——do	25	12	--
Unspecified [3] ——do	1,968	1,837	1,606
Total ——do	[r] 10,266	10,462	10,679
From brown coal ——do	1,408	911	474
Fuel briquets (from brown coal) ——do	1,356	1,366	1,343
Gas:			
Manufactured, all types ——million cubic feet	250,486	262,565	274,007
Natural, marketed ——do	42,519	43,190	[e] 43,000
Petroleum:			
Crude:			
As reported ——thousand tons	203	194	191
Converted ——thousand 42-gallon barrels	1,377	1,316	1,285
Refinery products: [4]			
Kerosine ——do	[r] 1,852	2,139	2,170
Diesel oil ——do	21,910	23,917	26,006
Lubricants ——do	938	1,050	1,001

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

[1] In addition to the commodities listed, Czechoslovakia also produces arsenic, gold, feldspar, graphite, uranium, a number of additional crude construction materials (such as stone, sand, and gravel), and other petroleum products, such as gasoline and residual fuel oil, but information is inadequate to make reliable estimates of output levels.

[2] Excludes output by small producers.

[3] Derived by subtracting reported metallurgical and gashouse coke from reported total coke output.

[4] Data are presented only for those products reported in official sources; insofar as can be determined, Czechoslovakia produces a complete range of petroleum refinery products.

TRADE

The following mineral commodity trade tables for 1970 and 1971 were compiled chiefly from trade returns of other nations, listing each country's imports from Czechoslovakia as exports of Czechoslovakia, and each country's exports to Czechoslovakia as imports to Czechoslovakia. This policy has been adopted because of the incomplete nature of official Czechoslovak returns. It is believed that this method results in a reasonable approximation of Czechoslovakia's total mineral trade.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide and hydroxide	4,975	120	All to Austria.
Metal and alloys:			
Scrap	702	1,292	West Germany 737; Austria 491.
Unwrought and semimanufactures	5,816	8,047	West Germany 3,330; France 2,438; Austria 1,640.
Copper:			
Ore and concentrate	923	NA	
Metal and alloys:			
Scrap	996	599	West Germany 532; Austria 40.
Unwrought and semimanufactures	5,333	5,740	West Germany 5,404.
Iron and steel:			
Ore and concentrate	41,395	816	All to Austria.
Roasted pyrite	5,901	7,415	Do.
Scrap ---thousand tons	47	5	Italy 3.
Pig iron ---do	43	--	
Ferroalloys ---do	29	23	West Germany 14; Austria 4; Italy 3.
Steel ingots and other primary forms ---do	234	298	West Germany 103; Yugoslavia 102; Italy 78.
Semimanufactures:[2]			
Bars, rods, angles, etc ---do	1,215	1,248	East Germany 148; Canada 102; West Germany 93.
Plates and sheets ---do	523	663	West Germany 211; Italy 135.
Hoop and strip ---do	191	147	Yugoslavia 37; Arab Republic of Egypt 27; Switzerland 19.
Railway material ---do	16	15	West Germany 5; Romania 3.
Wire ---do	49	66	West Germany 22; Hungary 10; Poland 9.
Pipes and tubes ---do	387	433	Netherlands 23; West Germany 15; East Germany 14.
Castings ---do	2	2	Mainly to West Germany.
Total ---do	2,383	2,574	
Lead:			
Ore and concentrate	--	146	All to Belgium-Luxembourg.
Metal and alloys:			
Scrap	160	254	Denmark 203; West Germany 51.
Unwrought and semimanufactures	--	1,000	All to Poland.
Magnesium metal and alloys:			
Scrap	808	419	West Germany 309; Austria 110.
Unwrought and semimanufactures	1,136	795	All to West Germany.
Nickel:			
Matte and speiss	35	--	
Metal and alloys:			
Scrap	1,153	281	West Germany 142; Netherlands 102.
Unwrought	834	20	All to Netherlands.
Platinum-group metals, unworked and partly worked ---value, thousands	--	$282	All to West Germany.
Tin, metal and alloys, unwrought and semimanufactures ---long tons	14	112	All to Poland.
Titanium oxides	1,533	1,346	Sweden 595; France 275; Italy 261; Yugoslavia 210.
Tungsten, ore and concentrate	345	218	All to West Germany.
Zinc:			
Ore and concentrate	[3] 21,014	19,024	West Germany 9,098; Poland 7,917; Belgium-Luxembourg 1,932.
Metal, scrap only	223	206	All to West Germany
Metal, nonferrous, n.e.s.:			
Ore and concentrate	17,325	20,533	All to Austria.
Waste and sweepings of platinum-group metals ---value, thousands	$370	$367	All to West Germany.
Ash and other nonferrous base metal-bearing residues	10,451	12,977	West Germany 8,072; Netherlands 1,745.
Metal, unwrought and semimanufactures	533	28	France 25; Italy 3.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS			
Barite	6,226	9,660	West Germany 8,858; Austria 802.
Cement, hydraulic ---thousand tons--	241	248	Yugoslavia 198; West Germany 50.
Clays and clay products:			
Crude clays:			
Bleaching clay ---do---	[4] 6	NA	
Kaolin[5] ---do---	56	64	Poland 59; East Germany 5.
Type not specified[6] ---do---	388	282	West Germany 188; Italy 31; Austria 22.
Clay products:			
Nonrefractory ---do---	24	12	West Germany 5; Austria 5.
Refractory ---do---	25	24	West Germany 12; Sweden 7; Belgium-Luxembourg 3.
Diamond, gem and industrial value, thousands--	$122	$192	All to Belgium-Luxembourg.
Fertilizer materials:			
Manufactured, phosphatic	--	282	All to France.
Ammonia	[3] 1,006	1,449	All to West Germany.
Gem stones, precious and semiprecious, except diamond ---value, thousands--	$141	$22	Do.
Graphite	--	40	All to Yugoslavia.
Magnesite[7] ---thousand tons--	335	293	West Germany 77; Poland 67; Hungary 62.
Mica, worked	68	61	Italy 39; West Germany 22.
Stone, sand and gravel:			
Dimension stone, crude and worked	36,358	26,162	West Germany 21,389; Netherlands 4,773.
Gravel and crushed rock	60,004	30,692	All to West Germany.
Sand	12,420	15,402	All to Austria.
Talc	[4] 2,955	4,409	Mainly to Poland.
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous[7] ---thousand tons--	2,970	3,461	East Germany 1,006; Hungary 725; Austria 610; Romania 311.
Lignite[7] ---do---	1,250	1,232	Mainly to East Germany.
Coke and semicoke[7] ---do---	2,500	2,202	East Germany 796; Romania 497; Hungary 282.
Gas, natural and manufactured (including LPG) ---do---	33	16	West Germany 13; Austria 3.
Petroleum:			
Partly refined oil thousand 42-gallon barrels--	2,201	1,558	All to Austria.
Refinery products:			
Gasoline ---do---	373	863	West Germany 602; Austria 261.
Distillate fuel oil ---do---	1,647	114	All to Switzerland.
Residual fuel oil ---do---	358	1,304	All to Austria.
Lubricants ---do---	22	11	Do.
Other ---do---	761	584	Netherlands 250; Austria 177; West Germany 135.
Crude chemicals from coal, gas, or oil distillation	[3] 69,224	46,931	West Germany 32,302; Italy 11,957.

NA Not available.

[1] Because Czechoslovakia publishes only limited data on mineral commodity exports, this table has been compiled from a variety of sources. Except where otherwise indicated, information for 1970 is from the 1970 edition of Supplement to the World Trade Annual. V. 1 (East Europe), Statistical Office of the United Nations, Walker and Company, New York, and information for 1971 is from official trade returns of recipient countries, and Foreign Trade, Analytical Tables, Statistical Office of the European Community, 1971 edition.

[2] Data for 1970 and 1971 are from Statistics of World Trade in Steel, United Nations Publication, 1970 and 1971 editions.

[3] Supplement to the World Trade Annual (see footnote 1) and official Polish trade returns (see footnote 4).

[4] Główny Urzad Statystyczny (Central Statistical Council). Rocznik Statystyczny Handlu Zagranicznego 1971 (Foreign Trade Annual for 1971), Warsaw, 1971, 438 pp.

[5] Official Czechoslovakian sources report the export of kaolin alone as follows: 1970–192,000 tons; 1971–211,000 tons. These figures are not included in the body of the table because they duplicate input data presented under the caption "Type not specified" which were obtained from sources listed in footnote 1, but the latter figures do not include shipments to Poland and East Germany, which have been listed separately under kaolin.

[6] Includes kaolin (see footnote 5).

[7] Statisticka Rocenka Ceskoslovenske Socialistické Republiky, 1973 (Statistical Annual of the Czechoslovak Socialist Republic, 1973), Prague, 618 pp.

Table 3.—Czechoslovakia: Imports of selected mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	[2] 378	104	All from Yugoslavia.
Oxide and hydroxide	[2 3] 10,118	NA	
Metal and alloys:			
Scrap	860	2,254	Austria 2,135; West Germany 119.
Unwrought [4]	[2] 73,413	75,900	All from U.S.S.R.
Semimanufactures [4]	26,468	19,149	U.S.S.R. 14,700; Yugoslavia 3,966.
Chromium, chromite ore and concentrate [4] thousand tons	99	111	Mainly from U.S.S.R.
Copper:			
Metal and alloys:			
Unwrought [4]	39,472	50,035	U.S.S.R. 37,000; West Germany 6,724; Poland 5,070.
Semimanufactures [4]	5,700	[5] 6,688	Yugoslavia 3,292; West Germany 2,508; U.S.S.R. 888.
Iron and steel:			
Ore and concentrate [6]—thousand tons	12,724	12,592	U.S.S.R. 10,968; India 651.
Metal:			
Scrap [7] —do	19	NA	
Pig iron —do	[7] 790	726	All from U.S.S.R.
Ferroalloys —do	[7] 104	360	West Germany 257; U.S.S.R. 103.
Steel, primary forms [8] —do	14	NA	
Semimanufactures: [8]			
Bars, rods, angles, etc —do	89	102	U.S.S.R. 76; Poland 22.
Plates and sheets —do	432	427	U.S.S.R. 292; West Germany 86.
Hoop and strip —do	15	15	West Germany 5; United Kingdom 4; Austria 4.
Railway material —do	11	(9)	NA.
Wire —do	6	4	West Germany 2; Sweden 1.
Pipes, tubes, fittings —do	27	333	West Germany 164; U.S.S.R. 153.
Castings and forgings —do	1	(9)	NA.
Total —do	581	881	
Lead:			
Oxides	3,027	2,565	Austria 1,020; France 837; Netherlands 708.
Metal and alloys, all forms [4]	26,508	[5] 27,168	U.S.S.R. 22,300; Yugoslavia 4,518.
Magnesium metal and alloys, all forms [4]	1,702	852	All from U.S.S.R.
Manganese ore and concentrate [6] thousand tons	202	313	U.S.S.R. 216; India 52.
Mercury 76-pound flasks	1,479	[5] 840	All from Yugoslavia.
Molybdenum metal and alloys, all forms	1	3	All from Austria.
Nickel metal and alloys, all forms	64	97	All from West Germany.
Platinum-group metals and alloys, unwrought, and semimanufactures value, thousands	$208	NA	
Silver and alloys, unwrought and semimanufactures —do	$2,133	$1,618	Netherlands $1,365; Italy $184.
Tin:			
Oxides long tons	39	NA	
Metal and alloys, all forms —do	823	262	United Kingdom 162; Netherlands 100.
Titanium oxides	1,093	1,076	West Germany 544; Italy 532.
Tungsten:			
Ore and concentrate	955	26	West Germany 16; Netherlands 10.
Metal and alloys, all forms	2	2	All from Austria.
Zinc:			
Dust (blue powder)	2,936	[5] 4,050	Belgium-Luxembourg 2,242; Yugoslavia 1,808.
Metal and alloys, all forms [4 7]	41,435	[5] 53,170	U.S.S.R. 37,800; Yugoslavia 9,309; Poland 5,970.
Other:			
Ore and concentrate	25,716	11,117	Finland 10,500.
Metal and alloys, n.e.s	111	28	France 25.
NONMETALS			
Abrasives, natural, grinding stones	276	137	Belgium-Luxembourg 130.
Asbestos [4]	39,017	26,916	U.S.S.R. 21,100; Canada 5,777.
Barite	935	1,429	All from West Germany.

See footnotes at end of table.

Table 3.—Czechoslovakia: Imports of selected mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Cement [4 7] ——thousand tons	[2] 474	471	Mainly from U.S.S.R.
Clays and clay products:			
Crude clays	12,786	[5] 12,522	Yugoslavia 10,064; West Germany 2,326.
Products:			
Nonrefractory	3,780	2,804	All from Italy.
Refractory	4,089	5,897	West Germany 2,869; France 1,540.
Diamond:			
Gem ——value, thousands	$158	NA	
Industrial ——do	$1,017	$1,280	All from Belgium-Luxembourg.
Feldspar and fluorspar	15,449	[5] 9,673	France 6,600; Yugoslavia 2,461.
Fertilizer materials:			
Crude, phosphatic [6] ——thousand tons	473	454	All from U.S.S.R.
Manufactured:			
Nitrogenous, N content [6] ——do	97	79	U.S.S.R. 64; Austria 10.
Phosphatic, P_2O_5 content [6] ——do	361	377	U.S.S.R. 170; Morocco 103.
Potassic, K_2O equivalent [6] ——do	526	569	East Germany 454; U.S.S.R. 108.
Gem stones, precious and semiprecious, except diamond ——value, thousands	$45	$34	West Germany $19; France $15.
Graphite, natural	[4] 664	242	All from West Germany.
Gypsum [7]	3,903	NA	
Lime [7]	110,266	86,388	All from Poland.
Mica, worked	12	8	All from Switzerland.
Pigments, mineral, iron oxides	1,738	1,495	Mainly from West Germany.
Pyrite, sulfur content of [6] thousand tons	76	58	Mainly from U.S.S.R.
Salt:			
Rock	[6] 34,839	[7] 47,242	All from Poland.
Brine	[6] 121,558	[4 7] 134,460	U.S.S.R. 122,700; Poland 11,072.
Sodium and potassium compounds, n.e.s.:			
Caustic soda [7]	16,450	18,861	West Germany 12,806; Poland 4,776.
Soda ash [4]	[7] 45,670	26,774	Mainly from U.S.S.R.
Stone, sand and gravel:			
Quartz and quartzite	2,450	2,986	Mainly from West Germany.
Crushed stone and gravel	3,291	1,591	All from Austria.
Dimension stone, worked [5]	1,117	937	All from Yugoslavia.
Sulfur:			
Elemental, all forms [4] ——thousand tons	[7] 303	163	All from U.S.S.R.
Sulfuric acid [4] ——do	[7] 90	[5] 92	U.S.S.R. 79; Yugoslavia 13.
Other, unspecified, crude nonmetals	162	45	All from Austria.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black [4]	16,467	14,279	U.S.S.R. 11,100; France 1,914.
Coal, anthracite and bituminous [6] thousand tons	4,569	5,447	U.S.S.R. 2,916; Poland 2,531.
Coke and semicoke [4] ——do	NA	75	All from U.S.S.R.
Gas, natural [6] ——million cubic feet	47,371	57,891	Do.
Petroleum:			
Crude [6] ——thousand 42-gallon barrels	72,015	84,562	Mainly from U.S.S.R.
Refinery products:			
Gasoline ——do	66	[5] 5	All from Yugoslavia.
Kerosine and jet fuel ——do	14	[5] 2	Do.
Lubricants ——do	294	[5] 281	Austria 252; Yugoslavia 29.
Other ——do	--	73	All from Italy.
Undifferentiated [4 10] ——do	[r] 7,448	8,001	All from U.S.S.R.

[r] Revised. NA Not available.

[1] Because of limited Czechoslovakian trade data on imports of mineral commodities, this table has been compiled from export data of countries trading with Czechoslovakia. For 1970, all entries without a source footnote are from the 1970 edition of Supplement to the World Trade Annual. V. 1 (East Europe), Statistical Office of the United Nations, Walker and Company, New York, and 1971 entries not further described are from Foreign Trade, Analytical Tables, Statistical Office of the European Community, 1971 edition.

[2] Official trade returns of Hungary.

[3] Erroneously reported as thousand tons in 1971.

[4] Official trade returns of the U.S.S.R.

[5] Official trade returns of Yugoslavia.

[6] Statisticka Rocenka Ceskoslovenske Socialisticke Republiky, 1973 (Statistical Annual of the Czechoslovak Socialist Republic, 1973), Prague, 618 pp.

[7] Official trade returns of Poland.

[8] Statistics of World Trade in Steel, 1970 and 1971 editions, United Nations, New York.

[9] Less than ½ unit.

[10] Figure indicated is difference between official U.S.S.R. exports of crude petroleum to Czechoslovakia and official Czechoslovak imports of crude oil from the U.S.S.R.

COMMODITY REVIEW

METALS

Antimony.—Domestic production satisfies the nation's requirement for antimony metal; however, only minimal development or expansion activity in the industry is anticipated because of limited ore reserves. By 1980, Czechoslovak planners envisage a 56% increase in the consumption of antimony, relying on foreign sources to satisfy about 35% of the total requirement. Bolivia will in all probability figure prominently among Czechoslovakia's foreign suppliers.

Copper.—Domestic production accounts for about 8% of domestic requirements. Mining activities are concentrated in central Spis-Gemer, in the Dobsina-Rudnany-Smolnik Triangle, in Banska Hodrusa-Zlatihorsko, and in Karlovarsko-Tisova. Exploration in progress at Novovesha revealed impregnated-vein and vein-type copper deposits, at Vernar porphyritic ores were discovered, and at Helpar copper impregnation in amphibolites was noted. Czechoslovak geologists anticipate copper reserves to increase some 100,000 tons by close of the current 5-year plan.

Iron Ore.—Domestic proven, probable, and possible reserves of iron ore were reported at 73 million tons at the close of 1971. Production provides about 5% of domestic consumption. Czechoslovakia's principal mining operations are located at Nizna Slana where siderite ores are extracted and at Rudnany where siderite ores combined with copper, mercury, and barite are extracted.

Iron ore imported from the Soviet Union continues to be the principal raw material source for Czechoslovakia's growing iron and steel industry. During 1972 about 14 million tons of ore was imported, about 90% of which came from the U.S.S.R.

Iron and Steel.—The industry's growth pattern is sustained by replacement of obsolete furnaces; 1972 marked a full year's operation of a 1,095-cubic-meter-volume blast furnace of 500,000 tons annual capacity at the Klement Gottwald Foundry at Ostrava Kunice. Pig iron production at the plant totaled 2.4 million tons in 1972 as compared with 1.97 million tons in 1971. Projected steel output of 14 million tons by 1975 is based on increased oxygen converter capacity at the East Slovak Iron and Steel Works at Kosice which is Czechoslovakia's sole producer of basic oxygen furnace (BOF) steel. Present plant capacity is 2.5 million tons of steel. During 1972 two additional BOF furnaces having a combined capacity of 1.5 million tons were being constructed under Austrian license at the Vitkovice Steel and Machinery Works. Delivery to the Kosice works is planned for late 1973. By the close of 1975 more than a quarter of all steel output in Czechoslovakia will be produced from oxygen converters. Production of steel by furnace type is listed in table 4.

Table 4.—Salient statistics on iron and steel production

		1969	1970	1971
PIG IRON				
Number of blast furnaces		19	17	18
Production of pig iron and ferroalloys:				
Pig iron for steelmaking	thousand metric tons	6,537	7,128	7,507
Pig iron for foundry	do.	451	393	435
Blast furnace ferroalloys	do.	21	27	19
Electric furnace ferroalloys	do.	97	104	112
Total	do.	7,106	7,652	8,073
Materials consumed per ton of pig iron:				
Iron ore and manganese ore	kilograms	385	336	352
Sinter	do.	1,538	r 1,566	1,550
Scrap	do.	36	31	28
Coke	do.	638	613	601
Limestone	do.	164	150	144
INGOT STEEL				
Production of crude steel:				
Open hearth	thousand metric tons	7,536	7,841	8,149
Bessemer	do.	225	231	230
Electric furnace	do.	1,270	1,344	1,434
Oxygen converter	do.	1,771	2,064	2,251
Total	do.	10,802	11,480	12,064
Materials consumed per ton of crude steel:				
Pig iron	kilograms	701	718	713
Scrap	do.	392	421	418

r Revised.

Source: Statistická, Rocenka Ceskoslovenské Socialistické Republiky, 1972 (Statistical Annual of the Czechoslovak Socialist Republic, 1972). Prague, 1972, 622 pp.

Mercury.—Mercury is recovered as a by-product at the Rudnany complex ore mine. The refinery located near Spisska Nova processes the Rudnany mine concentrate at a rate of 40 tons per day. The concentrate averages the following: copper 21%, iron 28.4%, sulfur 28.3%, antimony 5.5%, arsenic 1.2%, and mercury 1.9%. The mercury is refined to 99.99% purity.

The sizable increase in mercury output was attributable to operation of the Del Monego S.p.A. designed plant at Rudnany. Apparently partial shipment of Rudnany mine concentrate to Japan for separation and smelting were discontinued by 1972.

NONMETALS

Cement.—At least three major cement plants were under construction during 1972. If completed on schedule, the new facilities will add 2.5 million tons annually to the industry's current rated capacity, bringing the nation to near self-sufficiency by 1975. A 600,000-ton-per-year capacity plant at Litomerice and a 750,000-ton-per-year capacity plant at Turna nad Bodvou should enter production by close of 1973. The third facility located in Western Slovakia, will upon completion have an annual capacity of 750,000 tons of Portland cement, 100,000 tons each of white cement, colored cement, and powdered lime, 60,000 tons of powdered hydrates, and 40,000 tons of synthetic plaster.

Feldspar.—The Czechoslovak Government has engaged Gibbons Brothers, Inc. of the United Kingdom to construct a feldspar beneficiation plant at Halamky.

Fluorspar.—Mining activity is centered at the barite-fluorspar-galena deposit at Harrachov. Czechoslovak sources report that domestic production satisfies 60% of consumption requirements for this commodity.

Perlite.—Mining and beneficiating operations are centered at Lehotka Pod Brehy near Ziar Nad Hronom and at Byst in Eastern Slovakia.

MINERAL FUELS

In 1972 Czechoslovakia's fuel consumption was estimated at 90 million tons of standard fuel equivalent (SFE). Averaging an annual increment of 3.5% to 4.0%, fuel consumption is estimated at 168 million tons of SFE by 1990. Indigenous sources, principally solid fuels, supply nearly three-quarters of Czechoslovakia's present fuel requirements. However, by 1990 indigenous fuels will supply less than half of the nation's requirements. Czechoslovakia's fuel import program is proposed as follows:

	1970	1980	1990
Coal (million tons)	4.5	6.0	4.8
Crude petroleum (billion barrels)	72.0	185.0	296.0
Natural gas (million cubic feet)	47.4	353.2	678.0

Carbon Black.—The bulk of Czechoslovak carbon black output is produced at Valasskè Mezirici. Heavy aromatic fractions from tar distillation are retorted before being subjected to low-speed cyclones and textile fabric filters. The plant products include fast-extrusion furnace carbon black, high-abrasion furnace carbon black, and general-purpose furnace carbon black. By the close of 1975 domestic output is planned at 30,000 tons annually, covering most of domestic requirements.

Coal.—While output levels reached planned goals for 1972, the Czechoslovak coal industry may experience greater difficulties in meeting its future quotas, since delays in mine development and ancillary facility construction were frequently reported in the Czechoslovak press. Mines primarily affected by delays were Maxim Gorky, Merkur, Brezno, Czechoslovak Army, Jan Sverna, and the Most area mines. The bulk of the mines mentioned are located in the North Bohemian Basin, the center of the industry's expansion activity. Future output, is planned as follows, in million tons.

	1980	1990
Bituminous coal	27.5	26.0
Lignite and brown coal	92.3	98.6
Total	119.8	124.6

Nuclear Energy.—By yearend, Czechoslovakia's first nuclear powerplant was operational. The Novovoronezh type nuclear power station is located in Western Slovakia at Jaslovske Bohunice. The station's planned capacity is 840 megawatts by 1978. Two light water reactors and four generators will be the power source for the station. On December 25, two of the planned four power generators were placed into the distribution network. A second nuclear plant should be onstream in 1979–80. Located at Dolesice, the second plant is also planned at 840 megawatts capacity bringing total capacity to nearly 1,700 megawatts at the close of this decade.

Between the period 1980–90 only 1,000 megawatt units are to be constructed. The construction of a nuclear powerplant with a reactor based on fast neutrons (BN 1,000) is also under consideration. By 1985, nuclear powerplant capacity is planned at 5,000 megawatts with a proposed increase of 10,000 to 12,000 megawatts by 1990.

Petroleum.—Since domestic production is limited to nearly 40,000 barrels per day, most of Czechoslovakia's crude petroleum supply, about 240,000 barrels per day, is imported from the Soviet Union. Middle East oil imports will, however, play an increasingly prominent role in the nation's crude petroleum supply. An economic and technical agreement was signed during the year between Czechoslovakia and Iraq. The agreement provides for a $50-million loan to finance the cost of equipment and services to be supplied to Iraq. About 80% of the loan is to be repaid by crude oil exports from the Iraq National Oil Co. The remaining 20% is to be used to purchase other Iraqi products. However, if no other suitable products are available, the remaining credits may be applied to the import of additional Iraqi crude petroleum.

During the year, two major refineries were in operation, the 170,000-barrel-per-day Slovnaft refinery near Bratislava and the 60,000-barrel-per-day Zaluzi refinery at Most. By the close of the current 5-year plan, refining capacities will be increased to 200,000 barrels per day and 100,000 barrels per day respectfully. In addition, two new refineries are scheduled for construction. In 1974 construction of a 60,000-barrel-per-day refinery at Kralupy-on-Vltava near Prague will be underway. The following year construction will begin on Czechoslovakia's fourth major refinery. Refining capacity will be 60,000 barrels per day when the first stage of construction is completed by 1978. The second stage is scheduled for completion by 1980, doubling the refinery capacity to 120,000 barrels per day.

The Mineral Industry of the Arab Republic of Egypt

By Richard F. Zaffarano [1]

The petroleum sector continued as the most important segment of Egypt's mineral industry in 1972. During the year, Egypt formally joined the Organization of Arab Petroleum exporting Countries (OAPEC). Egyptian authorities engaged in a long-range petroleum development program to support the economic and social development of the country. Planning included increased emphasis on the exploratory effort in the Western Desert that resulted in three discoveries which will be in production in 1973. Additional field development would help counter the 56% decline in production that occurred during the year. To encourage exploration, foreign operators were assured of Egyptian goodwill and favorable leasing terms in comparison to those of the Organization of Petroleum Exporting Countries (OPEC) and OAPEC. Yearend petroleum reserves were estimated at 5.2 billion barrels, and natural gas at 7.5 trillion cubic feet. These reserve estimates include fields in the Sinai Peninsula that were occupied by Israeli troops. Financial planning progressed regarding the projected Suez-Mediterranean pipeline (SUMED). Major emphasis within the nonfuel industries focused on the new 100,000-ton-per-year aluminum electrolytic plant in the Haj Hammadi region and completion of the first phase of the Helwan Iron and Steel complex that involved installation of a 1,950-ton-per-day blast furnace and new steel converter. Completion of the nitrogenous fertilizer plant at Talkha in the Nile Delta was rescheduled from the second half of 1974 to mid-1973.

PRODUCTION

Crude oil production fell by 56% to an annual average of 212,000 barrels per day. Production by Gulf of Suez Petroleum Co. (GUPCO), from the Morgan field, Egypt's largest producing oilfield, slumped from peak production of 341,000 barrels per day in 1971 to an average of 140,000 barrels per day in 1972. The El Morgan field experienced declining reservoir pressures and the operating company GUPCO, a joint enterprise of the state-owned Egyptian General Petroleum Corp. (EGPC) and Amoco, budgeted $40 million [2] in 1972 for what will be one of the world's largest waterflood pressure maintenance projects. The facilities will inject 300,000 barrels daily of treated seawater. The El Alamein-Yida complex in the Western Desert, presently Egypt's second ranking oil producer, was producing at a rate of 21,000 barrels per day. Egypt's declining oil production trend was partly offset when three small new Western Desert fields was put on production. The largest of these fields, Abu al-Gharadiq, has a production potential of 20,000 barrels per day. The other two, Al-Razzaq and Yidma were producing at the rate of 12,000 and 8,000 barrels per day, respectively, at yearend and were connected into the El Alamein field pipeline system.

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[1] Physical scientist, Division of Fossil Fuels.

[2] Where necessary, values have been converted from Arab Republic of Egypt pounds (E£) to U.S. dollars at rate of E£1.00=US$2.30.

Table 1.—Arab Republic of Egypt: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Iron and steel:			
Iron ore and concentrate—thousand tons	451	473	e 473
Pig iron e—do	454	e r 500	e 500
Crude steel e—do	227	e r 227	e 227
Manganese ore and concentrate	4,387	4,278	e 4,300
NONMETALS			
Asbestos	1 449	70	e 70
Barite	215	291	e 300
Cement, hydraulic—thousand tons	r 3,684	3,921	e 3,700
Clays:			
Fire—do	975	634	NA
Kaolin	22,441	44,727	e 50,000
Diatomite	2,326	2,250	e 2,200
Feldspar, crude	r 1,787	3,171	e 3,000
Fertilizer materials:			
Crude phosphate rock—thousand tons	716	713	e 710
Manufactured:			
Nitrogenous—do	387	385	NA
Phosphatic:			
Thomas slag—do	411	487	e 490
Superphosphate—do	22	34	NA
Fluorspar	267	644	e 700
Gypsum and anhydrite, crude 2—thousand tons	427	527	e 530
Pumice	200	225	e 230
Salt, marine—thousand tons	3 410	421	e 430
Sodium sulfate, natural	(4)	4,000	e 4,000
Stone, sand and gravel, n.e.s.			
Basalt—thousand cubic meters	350	406	NA
Dolomite—thousand tons	85	91	NA
Granite:			
Broken—do	14	21	NA
Dimension—cubic meters	300	350	NA
Gravel—do	1,600	1,455	NA
Limestone and other calcareous, n.e.s—do	r 5,565	5,349	NA
Marble:			
Marble blocks (including alabaster blocks)—do	NA	5,926	NA
Broken and gravel	8,500	7,018	NA
Quartz	14,668	13,593	NA
Sand, including glass sand—thousand cubic meters	2,902	3,035	NA
Sandstone—do	81	86	NA
Sulfur, elemental, byproduct e	650	650	1,000
Talc, soapstone, steatite and pyrophyllite	6,487	6,321	e 6,300
MINERAL FUELS AND RELATED MATERIALS			
Coke:			
Oven and beehive e—thousand tons	350	350	350
Gashouse and other low temperature e—do	30	30	30
Total e—do	380	380	380
Gas:			
Manufactured, all types e—do	30	30	30
Natural:			
Gross production e—million cubic feet	37,000	31,000	23,000
Marketed e—do	3,000	3,000	2,500
Petroleum:			
Crude—thousand 42-gallon barrels	119,165	106,993	77,592
Refinery products:			
Gasoline—do			
Jet fuel—do	4,207	5,908	
Kerosine—do	3,997	5,735	
Distillate fuel oil—do	4,122	5,588	NA
Residual fuel oil—do	10,814	17,130	
Other—do	563	670	
Refinery fuel and losses—do	e 1,422	e 3,078	
Total—do	25,125	38,109	NA

e Estimate. p Preliminary. r Revised. NA Not available.

1 Including vermiculite.

2 Includes some alabaster.

3 Includes a relatively small quantity of natural sodium sulfate.

4 Included with salt.

Table 2.—Arab Republic of Egypt: Exports of [1] of major mineral commodities [2]

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum, including alloys, semimanufactures	387	331
Copper, including alloys, semimanufactures	100	16
Iron and steel:		
Pig iron, sponge, iron and steel powder	4,391	--
Primary forms	7,737	--
Semimanufactures	40,830	57,172
Lead, including alloys, semimanufactures	--	3
Other: Ash and residue-bearing nonferrous metals, n.e.s	80	129
NONMETALS		
Abrasives, natural, grinding stones	--	NA
Asbestos, crude	9	10
Cement	346,128	1,361,622
Chalk	100	204,044
Clays and clay products: Products:		
Refractory (including nonclay bricks)	29	39
Nonrefractory	952	292
Diamond: Industrial carats	10,662	NA
Fertilizer materials:		
Crude, phosphatic	319,299	77,951
Manufactured:		
Nitrogenous	1,150	--
Phosphatic, Thomas slag	93,016	78,755
Gypsum and plasters	3	--
Lime	778	1,480
Salt	60,532	38,604
Stones, sand and gravel:		
Dimension stone, crude and worked	22	16
Quartz and quartzite	3,600	--
Gravel and crushed rock	--	145
Sulfur, sulfuric acid	46	40
Talc, steatite	412	90
Other nonmetals, n.e.s.:		
Crude: Other	2	70
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	626
Gas, hydrocarbon: Natural	130	--
Petroleum:		
Crude thousand 42-gallon barrels	r 24,799	3,665
Partly refined do	r 29	148
Refinery products:		
Kerosine and jet fuel do	177	--
Distillate fuel oil do	186	144
Other:		
Nonlubricating oils, n.e.s do	29	340
Petroleum coke do	7	--
Total do	r 399	484

r Revised.
[1] Includes reexports.
[2] From the Central Agency for Public Mobilization and Statistics, October 1971 and October 1972.

Table 3.—Arab Republic of Egypt: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	96	75
Metal:		
Scrap	r 4,662	11,294
Unwrought and semimanufactures	1,114	2,876
Arsenic, trioxide pentoxide and acid	22	(2)
Chromium, oxides and hydroxides	26	22
Cobalt, oxides and hydroxides	2	(2)
Copper:		
Matte	1,484	2,779
Metal including alloys, all forms	664	859
Gold troy ounces	r 205	173
Iron and steel:		
Roasted pyrite	4,582	3,779

See footnotes at end of table.

Table 3.—Arab Republic of Egypt: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Iron and steel—Continued		
Metal:		
Scrap	9,664	63,265
Sponge iron, powder, shot	87	5
Spiegeleisen	42,208	47,807
Ferromanganese	3,485	3,315
Steel, primary forms	11,148	12,500
Semimanufactures	204,158	232,059
Lead:		
Oxides	707	551
Metal including alloys, all forms	4,897	11,318
Magnesium metal, unwrought and semimanufactures	860	7
Manganese oxides	965	1,175
Mercury—76-pound flasks	123	478
Molybdenum, metal including alloys, all forms	4	3
Nickel:		
Matte, speiss, and similar materials	2	11
Metal including alloys, semimanufactures	38	31
Platinum-group metals and silver:		
Silver, unwrought and semimanufactures including alloys—thousand troy ounces	48	48
Rare-earth metals, compounds of thorium, uranium, and rare-earth metals	r 26	4
Tin:		
Oxide—long tons	10	2
Metal including alloys, all forms—do	621	578
Titanium oxides	591	820
Tungsten	1	1
Uranium and thorium and their alloys	24	66
Zinc:		
Oxides	384	167
Metal including alloys, all forms	3,527	2,548
Other:		
Ore and concentrate, n.e.s	2,304	1,576
Metal including alloys, all forms:		
Pyrophoric alloys (including ferrocerium)	(2)	--
Base metals, including alloys, all forms, n.e.s	2	1
NONMETALS		
Abrasives, natural, n.e.s	146	45
Asbestos	6,609	6,819
Boron materials, oxide and acid	3	76
Cement	717	67
Chalk	1	8
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	9,443	5,202
Products:		
Refractory (including nonclay bricks)	11,541	11,141
Nonrefractory	11	318
Diatomite	1,786	610
Feldspar and fluorspar	34	113
Fertilizer materials:		
Crude:		
Nitrogenous	22	--
Phosphatic	1	--
Potassic	(2)	7,445
Manufactured:		
Nitrogenous	198,769	429,831
Other including mixed	1	6
Ammonia	68	23
Graphite, natural	107	824
Gypsum and plasters	(2)	233
Lime	42	--
Magnesite	3,422	8,791
Mica including worked	36	41
Pigments, mineral, natural, crude	841	1,051
Pyrite, unroasted	47,514	37,677
Salt	23	27
Sodium and potassium compounds, n.e.s.:		
Caustic soda	20,056	25,244
Caustic potash, peroxides of potassium or sodium	302	311
Stone, sand and gravel:		
Dimension stone, crude and worked	43	618
Dolomite	48	301
Gravel and crushed rock	--	(2)
Quartz and quartzite	41	15
Sand (excluding metal bearing)	350	1,714
Sulfur:		
Elemental	55,343	58,065
Sulfur dioxide—kilograms	435	--
Sulfuric acid—do	6,351	5,923

See footnotes at end of table.

Table 3.—Arab Republic of Egypt: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
Talc, steatite, natural		11	20
Other nonmetals, n.e.s.:			
Crude, n.e.s.		68	273
Oxides, hydroxides, and peroxides of barium and strontium		30	10
Bromine, fluorine, and iodine		r 3	6
Metallurgical residues not containing metals		29,435	--
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		44,505	173,639
Coal and briquets:			
Anthracite and bituminous coal		466,052	433,112
Briquets of anthracite and bituminous coal		(2)	--
Lignite and lignite briquets		--	(2)
Coke and semicoke		33,905	--
Gas, natural		93,087	98,877
Hydrogen and rare gases		16	79
Peat, including peat briquets and litter		1,248	3,840
Petroleum:			
Crude	thousand 42-gallon barrels	8,075	11,288
Partly refined	do		
Refinery products:			
Gasoline	do	r (2)	(2)
Kerosine and jet fuel	do	3,255	2,520
Distillate fuel oil	do	r 2,060	5,456
Residual fuel oil	do	r 700	412
Lubricants	do	r 4	3
Other	do	r 34	52
Total	do	r 6,053	8,443
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		74	285

r Revised.
[1] From the Central Agency for Public Mobilisation and Statistics, October 1971 and October 1972.
[2] Less than ½ unit.

TRADE

A preferential trade agreement which allows 4,000 barrels daily of Egyptian refined oil products to be imported by the European Community (EC) at a 55% tariff reduction was signed in Brussels in December 1972. This quota applies only to the original Six Community Nations (France, West Germany, Italy, the Netherlands, Luxembourg, and Belgium). An additional amount was expected to be added for the three new member countries—the United Kingdom, Ireland, and Denmark—when they join the EC in 1973. Egypt and the Six Nations found a solution to the pending problem of the Israel boycott that had delayed the conclusion of their trade pact. For the Six Community Nations, nondiscrimination was a vital tenet of all agreements and they could not approve the contingency of companies in the Community being boycotted because of relations with Israel. Egypt, on the other hand, refused to dissociate itself from the Arab boycott. The solution adopted was that each party to the agreement make a declaration in writing to the other concerning nondiscrimination and rulings affecting individual country security.

In November 1972, the Egyptian Government announced a new foreign trade policy that was directed to increasing industrial exports in 1973 by 8% and agricultural exports by 5% with a minimum overall average of 6.5%.

An Egypt-Soviet trade protocol was signed in Moscow on December 27, 1972. According to the agreement, the 1973 volume of trade between the two countries should reach $575 million. Under the agreement, the U.S.S.R. was to import from Egypt in 1973, 2 million tons of crude oil, 18,000 tons of yarn, 50,000 tons of citrus products, and 21 million meters of cotton textiles.

The Egyptians will spend an estimated $81.2 million over the next 10 years for expansion and modernization of the Port of Alexandria. Included in the project is $22.4 million for building the necessary dock facilities for handling exports of phosphate rock and other minerals.

During 1971, the latest year for which complete data were available, Egypt's trade

pattern remained the same as in recent years. Petroleum and petroleum products, sulfur, and cement were the principal trading items. Imports of coal and metals continued. In addition to petroleum and petroleum products, cement and chalk were the leading nonmetallic exports. Communist countries were the largest trading partners. Trade details are shown in tables 2 and 3.

COMMODITY REVIEW

METALS

Aluminum.—Work continued on the new 100,000-ton-per-year aluminum electrolytic plant in the Haj Hammadi region. Expenditures reached $138 million. Approximately 30,000 tons of alumina were imported and stockpiled at the new plant. A consignment including 21,000 tons of iron for erection of the aluminum smelting plant in Haj Hammadi was received from the Soviet Union in November 1972. The first stage of the project will be operational in 1974. The plant will cost $138 million and provide 4,000 new jobs. Work progressed during the year on expanding the Haj Hammadi Transformer Station to meet the plant's power requirements.

Iron and Steel.—Work progressed at the Helwan iron and steel complex. The first phase of the project, involving the installation of a third blast furnace and new steel converters and the erection of complex workshops, was completed. The capacity of the third blast furnace is 1,950 tons of iron per day. This project is expected to increase Egypt's output of iron and steel to about 2 million tons annually by 1975 from 1.2 million in 1972. The project will use iron ores from the Bahareza Oasis deposit which is estimated to contain a 200-million-ton reserve. Egypt was negotiating with the U.S.S.R. for the supply of 23 electric locomotives to transport iron ore from Bahareza Oasis to the Helwan iron and steel complex.

NONMETALS

Cement.—The Egyptian Government is planning two cement factories, one in Assiut, Upper Egypt, and the other in Helwan, Cairo. In addition, a cement factory is planned at Torah and two are planned at Alexandria; one of the Alexandria plants will have an annual productive capacity of 600,000 tons. These plants will increase cement production from 32 to 55 million tons by the end of the 5-year plan (1973–77).

Fertilizer Materials.—The Egyptian-Soviet planned phosphorus complex to be built in Qena will have an output of approximately 120,000 tons of phosphorus annually for use in producing 360,000 tons of phosphate fertilizers. About 30,000 tons will be used for local demand, and the remainder is destined for export.

In June 1972, Egypt and Poland signed an agreement whereby Poland will participate in the development of the phosphate mines in the Red Sea Sabaiyya areas. Other projects to be jointly undertaken include the Gharbaneya gypsum quarries in Alexandria and the refractory earth deposits in Aswan.

Egypt's projected nitrogenous fertilizer plant at Talkha plans to use natural gas discovered by Ente Nazionale Idrocarburi (ENI) at Abu Madi in the Nile Delta. The first phase of the project originally scheduled for completion during the second half of 1974 has been rescheduled to commence production in July 1973. The feedstock for this facility will use 350 tons per day of natural gas for the manufacture of 291,000 tons per year of cal-nitro fertilizers (31% nitrogen).

MINERAL FUELS

Petroleum.—*Exploration.*—At yearend the Egyptian Government was concentrating on increasing exploratory efforts in the Western Desert to counter the plunge in the country's petroleum production. The intensified exploratory plans will require an investment of $1,150 million over the next 8 years, of which $345 million would be for exploration and the remaining $805 million for preparing new fields for production. Most of the investment will have to be in foreign exchange. Thus, attraction of foreign partners to provide risk and development capital will be essential. Egypt's foreign partners have borne about 75% of the petroleum development cost over the past 10 years and the state only 25%.

Table 4.—Concessions held in Arab Republic of Egypt at the end of 1972

Company	Ownership (%)	Area held (square kilometers)	Location
Compagnie Orientale des Petroles d'Egypte (COPE)	--	435	Suez Gulf and Sinai coast.
Agip	50.0		
Egyptian General Petroleum Co. (EGPC)	30.0		
Petroleum Corp	20.0		
Egyptian Petroleum Development Co. (EPEDCO)		100	Suez Gulf.
Japan Petroleum Drilling Co. (JPDC)	39.8		
North Sumatra Oil Development Corp. (NOSODECO)	27.8		
Others	32.4		
Faiyum Petroleum Co. (FAPCO)		11,180	Western Desert.
Amoco U.A.R. Oil Co. (AMOCO)	50.0		
EGPC	50.0		
General Petroleum Co. (GPC)	100.0	480	West coast of Suez Gulf.
EGPC	100.0	47,450	Western Desert.
Gulf of Suez Petroleum Co. (GUPCO)		3,500	Suez Gulf (only offshore).
AMOCO	50.0		
EGPC	50.0		
International Egyptian Oil (IEOC)		15,400	Nile Delta and Suez Gulf.
Agip	100.0		
Nile Valley Petroleum Co. (NIPCO)		29,900	Western Desert and Upper Nile Valley.
AMOCO	50.0		
EGPC	50.0		
Phillips Petroleum Oil Co. (Phillips)	70.0	13,940	Western Desert.
Hispanoil	30.0		
Transworld Petroleum	100.0	100	Suez Gulf.
Western Desert Petroleum Co. (WEPCO)		34,800	Western Desert.
EGPC	50.0		
Hispanoil	15.0		
Phillips	35.0		
Total		157,285	

Source: The American Association of Petroleum Geologists.

During 1972, the Government offered for leasing, 100 square kilometer parcels in an area extending from the Libyan border in the west to Rosetta in the east. Included was a large section of unexplored Continental Shelf and large tracts of the Western Desert and Nile Valley. The EGPC approved on March 4, 1972, a joint-venture agreement with a U.S. company, Trans-World Oil, for a 100-square-kilometer offshore block in the Suez Gulf. The term followed the pattern of other agreements and was for a 30-year period, renewable for another 10 years. Trans-World agreed to spend $23 million on exploration during the first 9 years and pay all expenses if no commercial oil is discovered. In the event of discovery of commercial production, Trans-World is entitled to recover one-half of these expenses and a 50–50 EGPC/Trans-World joint operating company will be formed.

Trans-World also offered to participate in a $25 million project for the recovery of associated gas from GUPCO's offshore El Morgan field in the Gulf of Suez and other state fields in the vicinity. As a guarantee for these commitments, Trans-World provided $4 million.

Offshore, the Egyptians have chosen the Indonesian- style production-sharing system to encourage foreign companies to finance exploration costs. Once commercial production is established, the foreign partner may be reimbursed with up to 40% of annual production over 10 years. The remaining 60% will be divided roughly 75% for Egypt and 25% for the company, with variations depending on the rate of production.[3]

Onshore, the Egyptians are maintaining the former formula for proposed contracts, calling for a 50–50 enterprise once a discovery is made, but with some refinements and incentives.

Brazil's PETROBRÁS concluded an agreement for oil rights under Egypt's 50–

Table 5.—Exploration activity in Arab Republic of Egypt, 1972 (crew-months)

	Seismic	Gravity
FAPCO (and NIPCO)	13.0	--
GPC	96.0	6.0
GUPCO	0.6	--
Total 1972	109.6	6.0
Total 1971	120.0	--

Source: The American Association of Petroleum Geologists.

[3] Petroleum and Petrochemical International. V. 13, No. 2, February 1973, pp. 24, 25, 62, 65.

Table 6.—Summary of extension and development drilling in Arab Republic of Egypt, 1972

Company	Field	Spudded	Producing	Dry	Total number of wells drilled	Footage
FAPCO	Abu al-Gharadiq	3	4	1	5	49,900
GPC	Ras-Gharib	4	3	1	4	18,000
	Karim [1]	1	1	--	1	2,000
	Uyun	6	5	--	5	20,300
	Umm al-Yusr	2	3	--	3	14,500
	Total GPC	13	12	1	13	54,800
GUPCO	El Morgan	1	1	--	1	9,500
NIPCO	Al-Razzaq	9	6	2	8	71,400
WEPCO	Al-Milihah	3	2	1	3	29,400
	Yidma	1	2	--	2	17,300
	Total WEPCO	4	4	1	5	46,700
Grand total 1972		30	27	5	32	232,300
Grand total 1971		24	20	--	[2] 21	167,100

[1] Final status not officially reported.
[2] Including one gas completion.

Source: The American Association of Petroleum Geologists.

50 participation for onshore acreage, covering a 12,500-square-kilometer tract in the northern part of the Nile Valley extending eastward from AMOCO's Western Desert concession. PETROBRÁS plans to spend $10 million on exploration over the next 8 years, and if oil is discovered will provide a $10 million loan to the Egyptian partner. The enterprise contains a 12.5% royalty with some incentives in the event of lower production. The contract also stipulated that if oil is not found, 30% of the concession will be relinquished in the third year, another 30% in the sixth year, and the remaining 40% in the eighth year.

Total footage for the 52 wells drilled in Egypt last year was slightly more than 419,000 feet for an average depth of 8,058 feet. Development drilling resulted in 27 producing wells out of 32 total wells completed. Most of the wells, including 12 of the producers, were drilled by EGPC.

AMOCO made a new oil discovery in the Western Desert in block 33 that produced 2,500 barrels per day of 32.7 gravity crude oil on initial test. The discovery was viewed with interest because it was on a sizable structure and because of its proximity to the Abu al-Gharadiq field; in addition, production could be cheaply and quickly connected to export facilities via Abu al-Gharadiq, Al-Razzaq, and El Alamein. This discovery was the sixth in the Western Desert. The previous five included the three producing fields of El Alamein, Yidma, and Al-Razzaq, together with Abu al-Gharadiq and Al-Milihah, both of which were being prepared for production at yearend.

The EGPC formed a special committee to study the performance of Soviet drilling rigs in Egypt and to determine the equipment needed to make the rigs suitable for efficient deep drilling operations. Five Soviet rigs were in use in the Siwa Oasis area in the western part of Egypt's Western Desert, in addition to others in the eastern desert oilfields.

The first well at the newly discoverd Al-Razzaq field produced at the rate of 4,800 barrels per day. The operator expects 10 development wells in the field would produce 40,000 barrels per day.

Nine wells were drilled at Abu al-Gharadiq oilfield in the Western Desert. Oil was discovered in four wells at depths ranging between 9,000 and 10,000 feet in separate oil-bearing zones. Natural gas was discovered in all nine wells at depths up to 11,500 feet. Estimated gas reserves were 63 billion cubic meters. This reserve is adequate to meet Egypt's industrial requirements for the next 60 years at an average consumption of 3 million cubic meters per day.

Egypt, Syria, and Libya considered forming a joint company to engage in oil exploration and international crude oil marketing. Plans for such a tripartite oil company were being studied in connection

with the proposed federation of the three nations.

Pipeline.—Following 8 months of bargaining, Egypt and a consortium of West European banks initiated a $240 million agreement to finance construction of an oil pipeline to bypass the Suez Canal. The 207-mile pipeline will link Suez City on the Red Sea with the Mediterranean port of Alexandria, and will initially transport 80 million tons of Persian Gulf crude oil per year. The agreement covers the provision and repayment in foreign currency of the $240 million. The capital will be supplied by France, West Germany, the United Kingdom, Italy, Spain, the Netherlands, Belgium, Greece, and Japan. Revenue from the pipeline is expected to reach an annual $113 million.

Plans are to construct a gas pipeline from the Abu al-Gharadiq field to Dahshur where a plant will be built to receive the gas before sending it to Cairo. A pipeline is planned for transporting natural gas from Abu Madi field in the northern sector of the delta to the fertilizer factories at Talkha. The line will carry 3 million cubic meters of natural gas per year for operating the factories. Furthermore, the line will supply neighboring industrial areas their raw materials requirements.

The Western Desert Oil Pipeline that connects the Abu al-Gharadiq oilfields with the Al-Razzaq oilfields was rescheduled to be completed in early 1973. This line will connect the existing line between Al-Razzaq and the Al-Alamayn oilfields. Another pipeline will be built within the next 2 years to move natural gas from Abu al-Gharadiq to the Helwan Industrial zone.

Production.—Crude oil production from Egypt's most prolific field, El Morgan, in the Gulf of Suez decreased about 165,000 barrels per day from a 1969 peak of 350,000 barrels per day. Production decreased about 13,000 barrels per day from a 40,000-barrel-per-day high in the Western Desert Operating Co. (WEPCO) El-Alamein field. AMOCO's Abu al-Gharadiq field was expected to produce about 20,000 barrels per day. The other two WEPCO fields, Al-Razzaq and Al-Milihah, had smaller productive potentials. The only other producing fields in Egypt were along the Red Sea Coast and owned by EGPC. Their monthly producing rates in May 1972 are shown in the following tabulation:

Field and company	Date of first production	Current production rate (barrels per day)	Gravity (°API)	Depth of producing horizon (feet)
Morgan:				
GUPCO	1967	165,000	31	6,200
Alamein:				
WEPCO	1968	13,000	33	8,400
Yidma:				
WEPCO	1971	8,000	40	8,400
Ras Gharib:				
GPC	1938	10,000	25.3	2,000
Umm al-Yusr:				
GPC	1968	10,000	22.2	4,100
Bakr:				
GPC	1958	10,000	20.3	2,500
Amir:				
GPC	1965	2,000	22.4	4,300
Karim:				
GPC	1958	2,000	17.6	2,000
Shuqair and al-Uyun:				
GPC	----	500	----	-----
Total		220,500		

Refining.—Egyptian refinery capacity returned to a level near that of 5 years ago, before two of the three refineries were incapacitated by war damage in the Suez area in 1967. This loss severely curtailed refined product output, leaving the Mex refinery, near Alexandria, in the north of the country, as the principal source of supplies. During the 1967 hostilities plants in the Suez area were severely damaged. The worst hit was Nasr Petroleum Co.'s Nasr refinery, built at a cost of $25 million in 1913. This state-owned complex was totally destroyed, for a loss of 84,000 barrels per day of capacity. The other refinery damaged was the Suez Company's Misr plant, built in the 1920's to process government royalty crude oil. Approxi-

mately 50% of this complex was affected and by the end of 1967, the plant was functioning at only about 30,000 barrels per day. The Alexandria Petroleum Co.'s Mex refinery, capable of yielding 28,000 barrels per day, was unaffected. Arrangements were made to process the El Morgan field crude, from the Gulf of Suez, at British Petroleum's Aden refinery to make up the loss, thus providing for processing up to 50,000 barrels of oil per day. However, some minor damage was inflected on the Suez plants in October 1968 and further major damage in April 1969. Following this experience, the equipment that had survived the raids was moved to Musturud, near Cairo, and added to the small topping unit, making a complete distillation unit with 60,000 barrels-per-day capacity.

The resiting of one of the damaged plants near Cairo, erection of what amounted to a second refinery there, and completion of a third refinery not far from the Mex restored refinery distillation capacity to the 1967 level.

The completion of the Nasr Petroleum Company's refinery in August 1972 at Amreya, near Alexandria, gave Egypt three operating refineries at yearend. With the reconstructed Suez area refinery's 60,000 barrels daily, Mex's 75,000 barrels per day, and Amreya's 32,000 barrels per day, Egypt's 1972 refinery capacity was approximately 167,000 barrels per day. An increase in refinery capacity to 240,000 barrels per day was projected over the decade.

Egyptian refiners were concentrating on high kerosine and gas-oil yields from a barrel of indigenous crude because by decree 50% of refinery output must be made into these products. Because there is a high proportion of nitrogen in Egypt's crude oil, the Government is interested in hydrofining lube oils. The Egyptians are also looking into hydrodesulfurization to eliminate 90% of the sufur from kerosine and reduce sulfur quantity in gas-oil from 1.0% to about 0.4%.

The Mineral Industry of Finland

By F. L. Klinger [1]

After a year of weak export demand and the loss of production from strikes in 1971, the Finnish mineral industry made a strong recovery in 1972. A substantial increase in exports, particularly of metals, helped to improve the balance of trade. There was record production of major commodities such as copper, nickel, steel, sulfuric acid, and cement, and output of most other commodities was relatively high.

Mine output of nickel increased sharply in 1972 and mine output of copper will increase in 1973 as the Vuonos and Hammaslahti ore bodies are brought into production. Production of lead ore and rare-earth concentrates at Körsnäs was discontinued during the year, a small talc mine was closed, and output of asbestos was sharply reduced. Development of new mines was continued at Kolari (iron ore) and Mustavaara (vanadium). The economic potential of deposits of columbium, rare-earth metals, and phosphate was being investigated near Savukoski. Mining of spodumene deposits was planned in south Finland.

In plant developments, new rolling mills for steel began regular production at Raahe and Hämeenlinna in 1972. The nickel smelter and refinery at Harjavalta was expanded. New chemical and fertilizer plants were completed at Siilinjärvi and several petrochemical plants began production at Skoldvik. Two nuclear powerplants were under construction at Loviisa. Automation of process-control in the milling and beneficiation plants of Outokumpu Oy. was increased in 1972, and the company's recently developed "Courier 300" on-stream analysis system was being installed at concentrators in Australia (Mount Isa), Canada (Ruttan Lake, Manitoba, and Bathurst, New Brunswick), and the United States (Morenci, Ariz).

Inflationary trends also continued in the Finnish economy. Industrial productivity increased about 3% in 1972 but the costs of living, wages, and materials were rising considerably faster. To help increase productivity, the principal firms in the minerals industry continued to invest 3% to 5% of their annual turnover in research and development work.

PRODUCTION

Volume indices of production for the principal sectors of the mineral industry in 1972, and revised indices for 1970 and 1971, follow:

Sector	(1959=100)		
	1970	1971	1972
Mining and quarrying	181	171	191
Nonmetallic mineral processing	341	360	372
Basic metal industry	320	286	388
Chemicals	336	363	389
All industry	232	238	258

Source: Central Bureau of Statistics (Helsinki). Bulletin of Statistics (Tilastokatsauksia). No. 3, 1973, pp. 8–9.

The relatively high indices for 1972, as compared with 1971, were partly due to resumption of normal production, particularly in the mining and primary metals sectors, after the crippling strikes early in 1971. The increases were also due, however, to new mine and plant facilities which were brought into regular production in 1972, and to a strong increase in export demand.

Compared with 1970 levels, output of mine copper was up 13%; refined nickel, 36%; crude steel, 21%; zinc metal, 45%;

[1] Physcial scientist, Division of Ferrous Metals.

sulfuric acid, 15%; and cement, about 8%. Although there were significant declines in mine output of lead and rare-earth metals and asbestos, declines in production of chromium and selenium were believed to be temporary.

Production of mineral commodities is detailed in table 1.

Table 1.—Finland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Cadmium, refined metal	89	120	174
Chromium, chromite concentrate:			
Gross weight	120,509	111,988	97,390
Chromic oxide content	50,614	48,267	41,488
Cobalt:			
Mine output, metal content e	1,300	r 1,300	1,300
Metal, refined	1,088	925	803
Copper:			
Mine output, metal content	30,935	28,500	34,824
Metal:			
Primary:			
Blister	34,728	32,984	39,191
Electrolytic	34,047	32,339	38,424
Secondary (unrefined)	14,844	14,969	17,425
Gold metal, troy ounces	20,319	17,490	17,619
Iron and steel:			
Iron ore:			
Magnetite concentrate, thousand tons	585	528	573
Pelletized iron oxide (from pyrite), do	275	215	280
Roasted pyrite (purple ore), do	148	135	142
Pig iron, do	1,164	1,029	1,183
Ferrochromium, do	33	35	24
Steel:			
Crude:			
Ingots, do	1,169	1,025	1,420
Castings, do	18	16	18
Semimanufactures (rolled), do	798	620	930
Lead, mine output, metal content	5,005	4,739	3,849
Mercury, 76-pound flasks	e 100	135	212
Nickel:			
Mine output, metal content	5,111	3,508	5,159
Sulfate, metal content	150	123	191
Metal, electrolytic	4,009	3,890	5,458
Platinum metal e, troy ounces	645	600	650
Rare-earth metals, lanthanide concentrate:			
Gross weight	6,750	1,244	--
Oxide content	163	35	--
Selenium metal, kilograms	6,946	6,273	5,069
Silver metal, troy ounces	739,755	622,663	625,138
Titanium concentrate, ilmenite, gross weight	151,000	139,500	149,500
Vanadium pentoxide:			
Gross weight	2,348	1,979	2,124
Vanadium content	1,315	1,109	1,190
Zinc:			
Mine output, metal content	62,609	50,887	49,893
Metal	55,820	63,702	81,096
NONMETALS			
Asbestos	13,625	10,360	6,388
Cement, hydraulic, thousand tons	1,839	1,811	1,984
Feldspar	62,126	64,062	59,858
Fertilizer materials, manufactured:			
Nitrogenous, thousand tons	215	255	305
Phosphatic, do	215	204	e 200
Mixed and other, do	830	911	968
Lime, do	230	230	235
Pyrite:			
Gross weight, do	r 963	860	857
Sulfur content, do	r 497	389	e 388
Stone:			
Limestone and dolomite:			
For cement, do	2,685	2,348	
For lime, do	488	481	3,902
For sulfite and metallurgical uses, do	222	170	
Other, do	r 779	753	
Quartz, do	87	86	92
Sulfur, byproduct (recovered):			
Elemental	114,822	101,456	119,221
Gaseous (in SO_2)	212,612	198,267	250,352
Talc	62,723	100,679	90,327
Wollastonite	6,051	5,549	6,491

See footnotes at end of table.

Table 1.—Finland: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS				
Coke, all types	thousand tons	r 119	112	86
Gas, manufactured	million cubic feet	2,095	1,800	1,708
Peat:				
For fuel use	thousand tons	r 88	102	151
For agricultural and other uses	do	r 144	235	127
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	9,087	9,962	10,377
Jet fuel	do	704	736	1,065
Kerosine	do	70	54	53
Distillate fuel oil	do	16,964	19,127	e 22,199
Residual fuel oil	do	23,490	24,389	e 24,827
Liquefied petroleum gas	do	673	5,044	784
Other	do	4,920		NA
Refinery fuel and losses	do	4,587	5,880	NA
Total	do	60,495	65,192	NA

e Estimate. p Preliminary. r Revised. NA Not available.

TRADE

Increased exports of nonferrous metals, steel, nonmetallic mineral manufactures, and fertilizers helped to improve Finland's balance of trade in 1972. Compared with 1971, the total value of exports of mineral commodities increased by 25% while the corresponding value of imports rose 3%. Reduced imports of solid fuels, crude phosphate, iron ore, and iron and steel scrap helped to offset increased costs of imported crude oil, petroleum products, and iron and steel. The net trade deficit attributable to mineral commodities in 1972 was approximately $527 million.[2]

Ratification of a free trade agreement between Finland and the European Economic Community (EEC) was delayed in 1972. Because of this delay Finland will not participate in the 20% reduction of tariffs being extended by the EEC in 1973 to those European Free Trade Association (EFTA) countries which have ratified such agreements. About 21% of the total value of Finnish exports in 1972 was destined for EEC countries. This share was expected to increase substantially in 1973 due to the accession of the United Kingdom and Denmark to full EEC membership.

Finland's trade in mineral commodities in 1970 and 1971 is detailed in tables 2 and 3.

[2] Where necessary, values have been converted from Finland markka (Fmk) to U.S. dollars at the rate of Fmk 4.10=US$1.00.

Table 2.—Finland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum metal, including alloys:			
Scrap		815	274
Unwrought		25	550
Semimanufactures		5,028	10,176
Antimony metal, unwrought and semimanufactures		8	NA
Chromite		4,386	37,043
Cobalt metal, unwrought and semimanufactures		703	1,036
Copper:			
Ore and concentrate		52	3
Unwrought, including matte		3,743	7,744
Semimanufactures		14,612	12,439
Gold metal, unworked or partly worked	troy ounces	--	7,764
Iron and steel:			
Ore and concentrate, except roasted pyrite		228,841	27,251
Roasted pyrite		2,402	NA
Metal:			
Scrap		r 4,403	3,194
Pig iron, ferroalloys, spiegeleisen, and similar materials		352,930	219,131
Steel, primary forms		205,993	179,323
Semimanufactures		r 218,221	235,051
Lead:			
Ore and concentrate		7,915	4,400
Metal, including alloys:			
Scrap		202	750
Unwrought		161	284
Semimanufactures		4	2

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Nickel metal, including alloys:		
Unwrought	3,720	3,402
Semimanufactures	r 22	54
Platinum-group metals including alloys troy ounces	--	170
Silver metal, including alloys do	r 290,009	118,755
Tin metal, including alloys:		
Scrap long tons	21	49
Unwrought do	20	20
Semimanufactures do	4	7
Titanium:		
Ore and concentrate	24,667	10,500
Oxides	3,583	3,627
Vanadium oxides	2,798	1,874
Zinc:		
Ore and concentrate	2,111	300
Oxide	24	8
Metal:		
Scrap	50	12
Unwrought	44,235	56,147
Semimanufactures	(1)	305
Other:		
Ore and concentrate of base metals, n.e.s	20	--
Ash and residue containing nonferrous metals	19,784	5,692
Waste and sweepings of precious metals kilograms	17,035	3,396
NONMETALS		
Asbestos	9,335	10,113
Cement	14,538	77,099
Clay products:		
Refractory (including brick)	515	373
Nonrefractory	1,976	1,511
Diamond, industrial carats	--	1,000
Diatomite and other infusorial earths	44	40
Feldspar	59,915	40,869
Fertilizer materials, manufactured:		
Nitrogenous	17,866	52,100
Phosphatic, other than Thomas slag	3,223	1
Other, including mixed	4,186	20,215
Graphite, natural	12	71
Lime	307	25
Mica, crude, including splittings and waste	--	50
Precious and semiprecious stones, except diamond:		
Natural carats	225,000	243,500
Manufactured do	10,000	11,500
Pyrite (gross weight)	17,517	NA
Sodium and potassium compounds, n.e.s.:		
Caustic soda	2,551	1,124
Caustic potash	1	NA
Stone, sand and gravel:		
Dimension stone	15,916	22,020
Other stone:		
Limestone	21,249	12,234
Quartz and quartzite	208	189
Crushed, broken, and gravel, n.e.s	3,494	6,380
Sand, excluding metal bearing	234	358
Sulfur:		
Elemental forms	68,177	37,643
Sulfuric acid	74,303	36,569
Talc and steatite	1,761	20
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal bearing:		
From manufacture of iron and steel	596	NA
Slag and ash, n.e.s	81	45
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	3,179	4,153
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	30	30
Coal, all grades, including briquets	32	NA
Coke and semicoke	--	3,415
Peat and peat briquets	7,501	10,103
Petroleum refinery products:		
Gasoline (including naphtha) thousand 42-gallon barrels	816	383
Distillate fuel oil do	283	119
Lubricants do	6	9
Liquefied petroleum gas do	83	65
Bitumen do	1	(1)
Other do	2,755	1,031
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	2,508	3,529

r Revised. NA Not available.
1 Less than ½ unit.

Table 3.—Finland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Ore and concentrate	1,016	1,348
Oxide and hydroxide	15,404	26,102
Metal, including alloys:		
Scrap	24	39
Unwrought	18,713	15,225
Semimanufactures	20,117	18,840
Antimony metal, including alloys, all forms	23	116
Arsenic trioxide, pentoxide and acids	294	311
Cadmium metal, including alloys, all forms	4	5
Chromium:		
Chromite	1,384	1,587
Oxide and hydroxide	559	375
Cobalt:		
Oxide and hydroxide	(1)	2
Metal, including alloys, all forms	9	5
Copper:		
Ore and concentrate	11	--
Copper sulfate	904	503
Metal, including alloys:		
Scrap	33	NA
Unwrought	14,305	10,459
Semimanufactures	3,543	5,243
Gold metal, unworked or partly worked, troy ounces	r 76,274	103,114
Iron and steel:		
Ore and concentrate, except roasted pyrite	747,551	895,359
Roasted pyrite	r 2,402	NA
Metal:		
Scrap	136,106	116,574
Pig iron, including cast iron	960	937
Sponge iron, powder and shot	4,471	3,827
Ferroalloys	24,330	22,382
Steel, primary forms	r 60,978	20,636
Semimanufactures:		
Bars, rods, angles, shapes, sections	325,749	202,351
Universal plates and sheets	324,712	255,948
Hoop and strip	36,706	32,650
Rails and accessories	2,346	1,533
Wire	19,716	16,640
Tubes, pipes, and fittings	137,877	97,267
Castings and forgings, rough	1,154	1,351
Lead:		
Ore and concentrate	505	580
Oxides	605	525
Metal, including alloys:		
Unwrought	12,262	8,411
Semimanufactures	960	925
Magnesium metal, including alloys, all forms	34	50
Manganese:		
Ore and concentrate	14,398	5,082
Oxides	1,376	560
Mercury, 76-pound flasks	1,540	531
Molybdenum metal, including alloys, all forms	3	2
Nickel:		
Ore and concentrate	6,829	7,521
Metal, including alloys:		
Scrap	154	218
Unwrought	r 200	145
Semimanufactures	216	234
Platinum-group metals, thousand troy ounces	6	11
Silver metal, including alloys, do	2,311	2,379
Silicon	290	209
Tin:		
Oxides, long tons	34	6
Metal, including alloys:		
Unwrought, do	r 340	431
Semimanufactures, do	43	42
Titanium:		
Ore and concentrate	243	7,295
Oxides	117	181
Tungsten metal, including alloys, all forms	28	31
Zinc:		
Oxides	262	335
Metal, including alloys:		
Scrap	50	46
Unwrought	3,162	1,980
Semimanufactures	r 686	739
Other:		
Ore and concentrate	73	6,038
Metal, including alloys, all forms:		
Metalloids n.e.s	--	2
Pyrophoric alloys	1	2
Base metals n.e.s	r 105	202

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, natural emery, corundum, and similar materials	242	251
Dust and powder of precious and semiprecious stones except diamond—kilograms	2	2
Grinding and polishing wheels and stones	2,233	2,293
Asbestos	7,744	8,049
Barite and witherite	526	814
Borates, crude, natural	5,650	4,391
Cement	r 7,631	7,477
Chalk	9,719	11,497
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	353,228	284,826
Products:		
Refractory (including nonclay bricks)	52,172	38,941
Nonrefractory	2,136	1,884
Cryolite and chiolite	67	71
Diamond:		
Gem, not set or strung—value, thousands	r $293	$216
Industrial—carats	33,000	25,500
Diatomite	1,124	765
Feldspar, leucite, and nepheline syenite	754	1
Fertilizer materials:		
Crude, phosphatic	394,420	571,041
Manufactured:		
Nitrogenous	56,927	25,402
Phosphatic	r 9,587	6,550
Potassic	219,459	247,325
Other, including mixed	56,899	38,844
Ammonia	137,646	83,666
Fluorspar	7,462	6,019
Graphite, natural	628	627
Gypsum and plasters	r 131,352	109,430
Lime	56	16
Magnesite	2,971	2,240
Mica, all forms	780	1,020
Pigments, mineral:		
Natural, crude	70	71
Iron oxides, processed	1,698	1,875
Precious and semiprecious stones, except diamond:		
Natural—kilograms	2,128	2,110
Manufactured—do	273	227
Salt (excluding brine)	490,416	470,766
Sodium and potassium compounds, n.e.s.:		
Caustic soda	23,749	30,103
Caustic potash	r 318	269
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	2,541	955
Worked	948	497
Dolomite, chiefly refractory grade	6,450	6,607
Gravel and crushed rock	1,891	823
Limestone, except dimension	283,225	318,993
Quartz and quartzite	3,590	2,785
Sand, excluding metal bearing	90,975	84,073
Sulfur:		
Elemental	37,235	56,594
Sulfuric acid	34	16,712
Talc and steatite	r 6,179	6,236
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal bearing:		
From manufacture of iron and steel	2,050	20
Slag and ash, n.e.s	100	200
Oxides and hydroxides of magnesium, strontium, and barium	8,203	6,645
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	375	466
Carbon black	5,635	6,361
Coal, all grades, including briquets—thousand tons	3,223	2,931
Coke and semicoke—do	843	714
Peat	7,501	56
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	70,245	65,307
Refinery products:		
Gasoline—do	154	142
Kerosine and jet fuel—do	146	63
Distillate fuel oil—do	13,816	13,816
Residual fuel oil—do	7,592	7,013
Liquefied petroleum gas—do	132	128
Lubricants—do	520	637
Other [2]—do	2,491	730
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals—thousand tons	15	14

r Revised. NA Not available.
[1] Less than ½ unit.
[2] Includes other finished products and unfinished oils requiring further processing, including topped crude.

COMMODITY REVIEW

METALS

Chromium.—The ferrochromium smelter at Tornio was shut down from July to October, to permit modification and expansion of plant facilities. Production capacity for ferrochrome was raised to 50,000 tons per year. At the Kemi mine, production of chromite was interrupted for 2 months, during which the ore-dressing method was changed. Ore dressing is now based on the use of high-intensity wet magnetic separators.

Cobalt.—Exports of cobalt in 1972 totaled 860 tons valued at approximately $4.3 million. The metal was produced by Outokumpu Oy. at Kokkola, from cobalt-bearing pyrite produced mainly at the Outokumpu mine. Other sources included about 5,000 tons of pyrite produced at Otanmäki and an estimated 4,000 tons of cobalt concentrate produced at the Luikonlahti copper mine. Mining of the Vuonos copper and nickel ores, which began in 1972, was expected to add about 70,000 tons of cobaltiferous pyrite to the country's annual supply by 1974.

Columbium.—Concentrating tests were continued by Rautaruukki Oy. on columbium-bearing materials from the Sokli carbonatite complex, in Savukoski municipality near the Soviet border. Investigation of the economic potential of Sokli materials was one of the principal metallurgical research projects of the company. No information was available on the tonnage or grade of columbium-bearing material, although 30 million tons of "phosphoric ore" (9% phosphorus) was reportedly outlined by drilling. The columbium-bearing mineral is pyrochlore.

Copper and Nickel.—Open pit production of nickel ore (0.2% Ni) was begun at the Vuonos mine by Outokumpu Oy. early in 1972. The expected rate of crude ore production was 1.5 million tons per year. Underground mining of copper ore (about 3% Cu) was scheduled to start by yearend, and that of nickel ore in 1973. Underground extraction rates planned for copper and nickel ores were each 300,000 tons per year. Open pit equipment includes a Finnish-made Tamrock bench-drilling rig powered by an Ingersoll Rand diesel compressor, a Bucyrus-Erie 45–R rotary drill, a Caterpillar model 992 front-end loader and several Caterpillar model 773 trucks. All underground transport will be by trackless machinery.[3] The Vuonos mill and concentrator is completely computer-controlled, through crushing, grinding, flotation, and drying operations. The computer is connected to a twin Courier 300 onstream analysis system (developed by Outokumpu Oy.) for determination of copper, zinc, nickel, and iron. A Courier system was also installed early in 1972 at the Kotalahti concentrator, where it analyzes nickel and copper from eight slurries. The Vuonos mine, now the largest in Finland, was expected to produce about 9,000 tons of copper and 2,000 tons of nickel per year when both underground and open pit operations reach planned levels. The principal sources of copper and nickel will continue to be the Outokumpu and Kotalahti mines, however. Nickel smelting and refining facilities at Harjavalta have been expanded to process the increase in mine output of nickel. Production capacity for nickel at Harjavalta was increased to 10,000 tons per year.

Outokumpu Oy. continued to mine small copper-nickel ore bodies at Hitura and Kylmäkoski in 1972. The average grade of crude ore mined at Kylmäkoski in 1971 (131,000 tons) was about 0.19% copper and 0.27% nickel, while ore mined at Hitura in 1971 (161,000 tons) averaged 0.53% nickel and an estimated 0.3% copper.

Mining of a small copper-nickel ore body at Petolahti began in 1972, with the ore being processed at the Körsnäs concentrator. (The Körsnäs mine, which produced ores of lead and rare-earth metals, ceased production in 1972). The Petolahti deposit reportedly consists of disseminated sulfides (pyrrhotite, pentlandite, and chalcopyrite) in diabase. Analysis of a 14-meter section from drilling in 1957–59 indicated 0.7% copper, 0.65% nickel, and small quantities of silver, gold, and platinum-group metals.

A copper mine was being developed at Hammaslahti, east of Outokumpu, for production in 1973. Extraction will be at the rate of 400,000 tons of crude ore per year. Known reserves of ore totaled 2.6 million tons, averaging 1% copper.

The increased domestic production of copper and nickel in 1972 was accompa-

[3] Mining Magazine (London). V. 127, No. 6, December 1972, pp. 526–539.

nied by increased exports of both metals. Exports of unwrought copper and semimanufactures totaled 23,200 tons, and of unwrought nickel, 4,750 tons. Imports of unwrought copper and semimanufactures totaled 16,500 tons. Imports of nickel concentrate, mostly from Norway, rose to 12,000 tons.

Cuprous oxide, nickel sulfate, and selenium continued to be produced at Pori as byproducts of copper refining.

Iron Ore.—Total output of iron concentrates appeared to decline slightly in 1972, compared with 1971, although increases in production were reported from the Raajärvi and Otanmäki mines. Initial production of iron ore began at the Leveaselkä deposit near Raajärvi in 1972 and probably accounted for the increased output of concentrates reported from Raajärvi.

Development of the Rautavaara mine near Kolari in northwest Finland was continued by Rautaruukki Oy. The underground mine was expected to begin production in 1974, at the rate of 1.0 to 1.2 million tons of crude ore per year. Output of magnetite concentrate (67% to 68% Fe) was expected to be 400,000 to 500,000 tons annually. Construction of the concentrator was begun in 1972.

Exports of iron ore continued to decline, to only 8,000 tons in 1972 (229,000 tons in 1970), as virtually all domestic production was used for production of pig iron at Raahe. Imports of iron ore in 1972 amounted to 771,000 tons, partly for consumption at Raahe and partly for consumption at the Koverhar and Turku blast furnaces of the Ovako Co.

The proposed joint development of iron ore deposits in the Kostomus area of the Soviet Union, by Finland and the Soviet Union, continued to be studied in 1972. The Finnish Ministry of Transport was reported to have begun an engineering survey in March of a new railroad line between Kontiomaki and the Soviet border (about 60 kilometers).[4] In November, the chairman of Rautaruukki Oy. reportedly stated that an agreement would probably be signed with the Soviet Union early in 1973.[5] Initial construction work was expected to begin late in 1973, and construction of an iron ore pelletizing plant may be started by 1976. The pelletizing plant would have a production capacity of 2.8 million tons of pellets per year, of which about 1 million tons would be utilized by Rautaruukki Oy. and the remainder exported from Finnish ports. Completion of the entire project was expected to require at least 8 years.

In northeast Finland, Rautaruukki Oy. was continuing a program of geophysical surveys and drilling to explore nonmagnetic, siliceous iron-bearing formations recently discovered in the Pelkosenniemi-Salla area, about 70 kilometers northeast of Rovaniemi.

Iron and Steel.—*Ferroalloys.*—Exports of ferrochromium in 1972 totaled 25,547 tons, slightly less than in 1971. Exports of other ferroalloys were negligible, but imports of ferroalloys totaled 22,875 tons of which 90% consisted of ferrosilicon, ferromanganese, and ferrosilico-manganese. Ferrochromium (53% to 57% Cr) is produced in Finland by Outokumpu Oy. from chromite mined near Kemi. Exports of chromite concentrates, presumably sold as foundry sand, amounted to about 15,000 tons in 1972, less than half the quantity exported in 1971.

Scrap.—Net imports of iron and steel scrap in 1972 totaled about 56,000 tons (113,000 tons in 1971), most of which probably came from the Soviet Union. No data on consumption were available for 1972. In 1971, United Nations statistics[6] indicated that Finnish consumption of scrap amounted to about 409,000 tons in steelworks and 111,000 tons in iron foundries. In the same year, net receipts of scrap were 260,000 tons in the steel industry and 61,000 tons in steel foundries.

Pig Iron and Steel.—Output of pig iron increased in 1972 but was only slightly greater than in 1970; of total output, 62% was produced at Raahe, 27% at Koverhar, and the remainder at Turku. Exports of all types of pig iron were less than in 1971; total exports in 1972 amounted to 163,000 tons valued at $10.6 million. Construction of the new blast furnace at Raahe was expected to be completed late in 1975.

Production of crude steel and output of rolled products reached record levels in 1972, as the oxygen steelworks of the Ovako Co. at Koverhar experienced its first full year of operation and, Rautaruukki Oy. completed new rolling mills at Raahe and

[4] World Mining. V. 8, No. 5, May 1972, p. 60.
[5] Metal Bulletin (London). No. 5749, Nov. 10, 1972, p. 37.
[6] Quarterly Bulletin of Steel Statistics for Europe (New York). V. 32, No. 4 (1971), tables B–6 and D–2.

Hämeenlinna. After trial production in December 1971, the five-stand hot rolling mill at Raahe began regular production in 1972. The mill produces finished sheets in widths up to 1,800 millimeters and has a production capacity of about 230,000 tons per year. The cold-rolling plant at Hämeenlinna began limited production in March. The three-stand tandem mill produces cold-rolled sheet in thicknesses from 0.4 to 3.0 millimeters and up to 1,575 millimeters in width; productive capacity is about 200,000 tons annually.

Exports of iron and steel semimanufactures in 1972 totaled 569,000 tons, of which 47% consisted of slabs and other crude forms and 33% consisted of universals, plates and sheet. Total value of exports was approximately $75 million ($53 million in 1971).

Imports of iron and steel semimanufactures in 1972 totaled 728,000 tons, consisting 45% of universals, plates and sheet; 27% of bars, rods, and sections; and 16% of tubular products. Total value of imports was approximately $169 million ($157 million in 1971).

Lead, Zinc, and Associated Metals.—Production of lead ore at the Körsnäs mine was discontinued in 1972. The mine concentrator was being used to process copper-nickel ore mined at Petolahti. Lead concentrates continued to be produced at the Vihanti and Metsämonttu mines. The Metsämonttu ore body will be exhausted early in 1974. Exports of lead concentrates increased to 5,900 tons in 1972. Imports of lead (including alloys and semimanufactures) rose to 13,200 tons, 40% more than in 1971.

Output of zinc metal at Kokkola continued to increase. Production was based largely on domestic ores (principally concentrates from the Vihanti and Pyhasalmi mines) supplemented by imported concentrates. Imports of concentrate rose to 85,000 tons in 1972, and exports of unwrought zinc increased to nearly 68,000 tons.

Cadmium, mercury, and some selenium were also recovered from the zinc plant at Kokkola. Exports of cadmium rose to 185 tons in 1972, nearly twice the quantity exported in 1971.

Rare-Earth Metals.—Production of lanthanide concentrates at the Körsnäs lead mine, which had been declining since 1967, was discontinued late in 1971, apparently due to unfavorable market conditions. Domestic production of rare-earth oxides, believed to be based partly on ore mined at Körsnäs and partly on apatite concentrate imported from the Soviet Union, may also have stopped. Typpi Oy., the only known Finnish producer, had expanded its plant at Oulu to an estimated production capacity of 500 tons of rare-earth oxides per year in 1967. The company was merged into Kemira Oy. (formerly Rikkihappo Oy.) in 1972. If production of rare-earth oxides is resumed, an important domestic source might be fluor-apatite deposits of the Sokli carbonatite complex near Savukoski (see section on columbium, this chapter).

Titanium.—All production of ilmenite concentrate was a byproduct of iron ore processing at Otanmäki. Approximately 9,000 tons of concentrate was exported, mainly to Czechoslovakia, and the remainder was destined for domestic consumption in the manufacture of titanium oxide and pigments for export. Exports in 1972 included about 40,000 tons of titanium white and 2,800 tons of oxide, with a combined value of approximately $18.6 million.

Vanadium.—Production of vanadium pentoxide, a byproduct of iron ore mined at Otanmäki, increased in 1972 compared with with the previous year but remained below the levels of 1969 and 1970. Exports during 1972 totaled 2,440 tons, 30% more than in 1971, and were valued at approximately $6.6 million.

Rautaruukki Oy., the only Finnish producer of primary vanadium, began developing the Mustavaara deposit in northeast Finland for production beginning in 1975. Plans were to produce 1.6 million tons of crude ore per year from an open pit mine; annual output of vanadium pentoxide was expected to be 3,000 tons. Explored reserves of titaniferous magnetite ore totaled about 40 million tons, sufficient for 25 years at the planned rate of mining. The Mustavaara deposit is located on the border between the municipalities of Taivalkoski and Posio, about 145 kilometers north of Otanmäki and 70 kilometers southeast of Rovaniemi.

Prospecting for additional deposits of vanadium-bearing titaniferous magnetite was being carried out in central Finland by Rautaruukki Oy., particularly in Kälviä (near Kokkola) and Nurmes (about 60 kilometers north of Outokumpu).

NONMETALS

Cement and Other Construction Materials.—The high level of building construction that was evident late in 1971 continued through the first half of 1972 but appeared to be declining by fall. Data for the first 9 months of 1972, compared with those for the same period of 1971, showed a 7% increase in the volume of all building completed and a 16% increase in residential completions. During the third quarter, however, the volume of building-starts was 18% less than in the same period a year earlier for industrial and commercial construction and 8% less in the residential field. More money was budgeted by the Government for housing loans in 1973 but this was expected to be offset by increased building costs. The building-cost index rose 8% in 1972, following a 10% rise in 1971.

Sales of cement grew by about 7% in 1972. The increase in production was accompanied by a notable increase in exports. Exports of cement in 1972 rose to 171,000 tons, approximately twice the quantity exported in 1971 and almost eight times the volume of 1970. Imports of gypsum also increased to 136,000 tons in 1972. Domestic production of limestone for industrial use increased to nearly 4 million tons in 1972 although imports rose 20% to 383,000 tons. Imports of kaolin and other clays totaled about 309,000 tons. The decline in domestic production of asbestos in 1972 was accompanied by sharp reductions in trade. Exports of unfinished dimension stone increased about 15%.

Production of limestone and industrial minerals continued to be dominated by two private companies, Paraisten Kalkkivuori Oy. (PK) and Lohjan Kalkkitehdas Oy. (LK). Limestone was produced at 11 mines or quarries (the two largest of which were partly or wholly underground operations), five of which were operated by PK, three by LK, and one each by Ruskealan Marmori Oy., Karl Forström AB., and Rauma-Repola Oy. PK and LK also accounted for practically all Finnish production of asbestos, feldspar, mica, quartz, and talc. Some statistics on crude ore production for the latter five minerals in 1970, 1971, and 1972 are shown in the accompanying tabulation:

Company	Mine	Principal mineral	Crude ore mined [1] (metric tons)		
			1970	1971	1972
Paraisten Kalkkivuori Oy	Paakkila	Asbestos	[2] 38,954	[2] 19,632	[2] 3,920
Do.	Haapaluoma	Feldspar	39,028	31,597	22,685
Do.	Jormua	Talc	6,137	6,905	NA
Lohjan Kalkkitehdas Oy	Lahnaslampi [3]	do.	189,612	271,876	258,927
Do.	Nilsiä	Quartz	71,000	74,570	102,000
Do.	Kemiö	Feldspar, quartz, mica	133,100	146,517	146,102

NA Not available.
[1] Excluding waste rock.
[2] Total material mined was 259,000 tons in 1970; 249,000 tons in 1971; and 189,000 tons in 1972.
[3] Operating company was Suomen Talkki Oy.

Source: Vuoriteollisuus/Bergshanteringen (Helsinki). V. 29, No. 1, 1971, p. 40; V. 30, No. 1, 1972, p. 41; and V. 31, No. 1, 1973, p. 38.

Fertilizer Materials.—Expansion of the Siilinjärvi chemicals and fertilizer works in southeastern Finland was nearly completed in 1972. New facilities included a plant for production of 200,000 tons of concentrated compound fertilizer per year, and a nitric acid plant with production capacity of 80,000 tons per year. A second phosphoric acid plant, with production capacity of 100,000 tons per year, was expected to be built in 1973. Units operating in 1972, in addition to the phosphoric acid plant, included a sulfuric acid plant (capacity 230,000 tons annually) and a monoammonium phosphate plant (capacity 150,000 tons annually). The raw material used for sulfuric acid production was pyrrhotite concentrate from the Luikonlahti copper mine, about 64 kilometers distant. Raw phosphate used in the phosphoric acid plant was Kola apatite rock imported from the Soviet Union. The monoammonium phosphate is shipped by rail to Kokkola, Harjavalta, and Kotka where it is used in production of compound fertilizers by Rikkihappo Oy. (now Kemira Oy.).

Imports of crude natural phosphate, mostly obtained from the Soviet Union and Morocco, totaled 443,000 tons in 1972. Imports of manufactured fertilizer materials included 234,000 tons of potassium salts, 42,000 tons of calcium and ammonium nitrates, and 4,600 tons of Thomas slag. Exports included 77,000 tons of superphosphate, 25,000 tons of calcium and ammonium nitrates, and 19,000 tons of compound fertilizer.

Investigations of apatite deposits in the Sokli carbonatite area of Savukoski were continued by Rautaruukki Oy. To date, 30 million tons of material containing an average of 9% phosphorus have been outlined by drilling. Although the phosphorus content is relatively low, the presence of columbium and rare-earth metals may improve the prospects for development of these deposits.

Lithium Minerals.—Paraisten Kalkkivuori Oy. was reportedly planning to mine a deposit of spodumene in south Finland.

Pyrite and Sulfur.—The Pyhäsalmi, Outokumpu, and Luikonlahti mines accounted for more than 95% of Finland's output of pyrite and pyrrhotite concentrates in 1972. Production from the Vihanti mine was reduced to one-fourth of the 1971 level. No exports or imports of pyrite were reported in 1972.

Production of sulfuric acid increased to 974,000 tons, 15% more than the record output of 1970. Most of the acid was produced from smelter gases at Kokkola and Harjavalta. Exports of sulfuric acid increased to 79,000 tons in 1972.

Production of elemental sulfur was the highest since 1968. Exports and imports of sulfur totaled 34,000 tons and 41,000 tons, respectively, in 1972.

Talc.—All talc produced in 1972 came from the Lahnaslampi mine. The Jormua mine, owned by Paraisten Kalkkivuori Oy., was closed in 1971.

MINERAL FUELS

Coal and Coke.—Imports of solid fuels in 1972 included 2,663,000 tons of coal and 722,000 tons of coke. Compared with 1971 figures, total imports were down about 8% in volume and 12% in value.

Finland's consumption of coal and coke in 1971 and 1972 was reported as follows, in thousand metric tons:

Consuming sector	1971	1972
Coal:		
Electric power generation	1,113	1,199
Paper and woodworking industry	r 600	630
Other industries	r 564	532
Gas and coke manufacturing	r 154	119
Space heating	r 159	315
Locomotive fuel	28	23
Total	r 2,618	2,818
Coke:		
Metals reduction	641	773
Other	59	59
Total	700	832

r Revised.

Source: U.S. Embassy, Helsinki, Finland. State Department Airgram A-166, June 9, 1973.

Natural Gas.—The Imatra-Kouvala and Kouvala-Karhula segments (700 millimeters and 400 millimeters diameter, respectively) of the main pipeline that will carry natural gas from the Soviet Union to southern Finland were reportedly under construction in 1972. Planning and construction of the pipeline was contracted to the Soviet firm, V/O Tsvetmetpromexport. Initial deliveries of gas were scheduled to begin in 1974, at the rate of 500 million cubic meters per year.

Nuclear Energy.—Construction of two nuclear powerplants was underway in 1972 near Loviisa, 50 miles east of Helsinki. The first plant was scheduled for completion in June 1976, and the second was to be completed in March 1978. Both plants will have pressurized-water reactors and generating capacities of 440 megawatts of electricity. A private company, Teollisuuden Voima Oy., planned to build a 660-megawatt (boiling water) plant near Rauma by 1978. The Finnish State power company, Imatran Voima Oy., was considering construction of a 1,000-megawatt plant near Loviisa.

Petroleum.—Imports of crude oil (including topped crude) in 1972 totaled about 9.2 million tons valued at approximately $200 million, an increase of 3% in volume and 8% in value compared with 1971 figures. About 65% of the oil came from the Soviet Union, 30% from Iran, and 5% from Venezuela and Norway.

Crude oil processed at the Porvoo and Naantali refineries totaled 9.5 million tons in 1972. Output of refinery products totaled 8.66 million tons (8.16 million tons in 1971). Imports of refined products totaled 3.9 million tons, 28% more than in 1971, while exports declined 15% to 148,000 tons. Fuel oils accounted for most of the increase in imports.

Total consumption of petroleum products in Finland in 1971 and 1972 was reported by Neste Oy. as follows, in thousand metric tons:

Product	1971	1972
Motor gasoline	1,074	1,170
Naphtha and solvents	148	194
Kerosine, including jet fuel	104	128
Light fuel oil, including diesel oil	4,024	4,266
Heavy fuel oil	4,538	5,109
Liquefied petroleum gases	65	80
Bitumen products	327	327
Other	116	116
Total	10,396	11,390

Source: Neste Oy. Annual reports for 1971 and 1972.

The Mineral Industry of France

By E. Shekarchi [1]

The French economy showed the classic symptoms of an economy expanding at or even beyond capacity in 1972. The mineral industry conformed to this trend, with near full utilization of capacity at many plants and mineral beneficiation facilities. The economy expanded by 5.6% and placed France behind the United States and Japan in the industrialized world's growth table. Most encouraging of all, however, was the fact that the French mineral industry became export-oriented in 1972 for the first time since 1965.

Buoyant overseas demands, coupled with steady growth in both domestic consumption and investment, stimulated industrial production during 1972. A firm rate of growth was maintained throughout the year and the gross national product (GNP) increased 5.5% over that of 1971. In particular the steel, aluminum, copper, lead-zinc, uranium, and chemical sectors operated at full capacity to meet demands.

The French Council of Ministers approved the following measures to encourage French firms to initiate operations overseas and to increase the export of French products: (1) French firms that establish foreign sales and market research offices were permitted to set up a tax-free reserve equal to the amount of losses sustained during the first 5 years of operation of such facilities up to the limit of the capital actually invested during those 5 years; (2) if the investments were in certain countries designated by the Minister of Economy as developing countries, the amount of the reserve could be equal to the capital invested during the first 5 years of operation of the facilities. To qualify for the foregoing tax deferral, the investor needed to make a declaration thereof to the Minister of Economy and Finance, who had 2 months within which to object. Amounts in the reserve were required to be reintegrated into taxable profits in equal annual installments during 5 consecutive financial years beginning with the sixth year, counting the ones in which the investment was started.

Several major labor laws adopted in 1971, were implemented in 1972. In summary, a law of December 24, 1971, reduced the average working week to 50 hours calculated over 12 weeks and limited the maximum number of hours to be worked during 1 week to 57 hours. Hours worked per week in excess of 40 must be paid for at the overtime rate. A law of July 16, 1971, enabled large numbers of employed people to improve their qualifications by attending training courses while being paid all or part of their salaries. The courses were to be financed by contributions of 0.80% of the sum of the salaries paid by businesses with 10 or more employees. A total of $312 million [2] was thus accumulated by the end of 1972. Businesses choose between making this obligatory contribution in the form of taxes or using the amount themselves for vocational training and advanced instructions of their employees. Also, a law of December 31, 1971, raised the amount of retirement benefits at age 65 to 50% of the maximum salary received, instead of 40%. In 1972 some 800,000 persons benefited from this increase.

According to Organization for Economic Cooperation and Development (OECD) estimates, the French public and private sector spent $3.5 billion, or about 1.7% of the country's GNP in 1972 on research and development. Of the total, the French Government contributed about 64%. Approximately 60% of the French Govern-

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.
[2] Where necessary, values have been converted from French francs (F) to U.S. dollars at the rate of F5.12=US$1.00.

ment's budget for research and development was administrated through the Recherche-Enveloppe, a program devised to facilitate centralized science planning. It excluded support of military, civil aeronautical, some telecommunications, and some university research and development, as well as certain administrative credits. Within the program a 21% increase was spent for pollution control research in 1972.

The Ministry for Environment and Protection of Nature, created in 1971, consisted of 200 persons by 1972, one-half of whom were still administratively attached to other ministeries. During the 18 months of its existance, the Ministry recodified a heterogenous mass of existing environmental legislation, coordinated a number of inherited programs, and formulated a coherent national environmental policy. The 1972 budget of the Ministry was approximately $37 million.

Bureau de Recherches Géologiques et Minières (BRGM) began preparation of a new geologic map of the country, in which mineralized horizons, as well as all new mineral finds were to be shown.

PRODUCTION

Overall 1972 production of primary metals and processed metals was greater than in 1971. The most significant production increases noted were: Antimony 37%, refined lead 18%, and zinc slab 20%. Detailed production data on mineral and processed metals and nonmetals are presented in table 1.

Although crude petroleum production in 1972 was 21% less than in 1971, production of natural gas and refinery products increased 1% and 13%, respectively, over that of 1971. Official production data on quarry products and construction material for 1972 are not available. An increase in the volume of public works and construction, however, indicated that production of these building materials continued the upward trend of 1970 and 1971.

Table 1.—France: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
METALS				
Aluminum:				
Bauxite, gross weight	thousand tons	2,992	3,184	3,258
Alumina	do	1,130	1,215	1,274
Metal:				
Primary	do	r 381	384	392
Secondary	do	87	98	112
Antimony, smelter production		r 2,174	1,526	2,090
Arsenic, white		r 10,193	e 10,000	e 10,000
Bismuth, metal	kilograms	72,000	77,000	67,000
Cadmium, metal		r 528	579	572
Cobalt, metal		244	576	774
Copper:				
Mine output, metal content		250	248	237
Metal:				
Blister (secondary)		9,020	6,860	8,340
Refined:				
Electrolytic		27,852	25,820	29,251
Other		5,675	3,330	860
Total refined copper		33,527	29,150	30,111
Gold:				
Mine output, metal content	troy ounces	62,726	65,620	58,128
Metal	do	56,521	56,392	53,531
Iron and steel:				
Iron ore and concentrate	thousand tons	56,805	55,862	54,253
Pig iron	do	r 19,221	18,345	19,002
Blast furnace ferroalloys	do	486	445	450
Electric furnace ferroalloys	do	339	350	355
Steel ingots and castings	do	23,773	22,859	24,089
Semimanufactures	do	18,727	18,363	19,237

See footnotes at end of table.

Table 1.—France: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Lead:			
Mine output, metal content	28,820	29,770	26,620
Metal refined:			
Primary	119,936	106,307	136,133
Secondary	18,123	18,758	17,261
Antimonial lead (lead content)	31,886	33,422	33,459
Total refined lead	169,945	158,487	186,853
Magnesium, metal, including secondary	4,611	7,210	6,849
Nickel, metal content of metallurgical products (pure nickel, ferronickel, and nickel oxide)	r 10,306	8,606	13,072
Silicon	35,490	37,290	31,580
Silver:			
Mine output, metal content, thousand troy ounces	2,282	2,283	1,858
Metal (content of final smelter products), do	4,812	3,611	4,210
Tin concentrate, metal content, long tons	332	344	308
Tungsten concentrate, metal content	58	300	561
Uranium:			
Mine output, uranium content	r 1,342	1,291	1,440
Chemical concentrate, uranium content [1]	1,764	1,755	1,743
Vanadium (byproduct from bauxite) e	100	100	100
Zinc:			
Mine output, metal content	18,580	15,140	13,290
Metal, including secondary:			
Slab	223,670	217,620	261,610
Dust	6,780	7,400	9,260
NONMETALS			
Alabaster	1,440	2,200	NA
Asbestos	r 710	710	e 500
Barite	94,780	110,000	100,000
Bromine, elemental	14,710	14,530	13,560
Cement, hydraulic, thousand tons	28,858	28,822	30,114
Clays:			
Bentonite [2]	19,337	17,320	NA
Brick and tile clay, thousand tons	10,352	10,816	
Ceramic and pottery clay	566,898	548,083	
Clay and marl for cement industry, thousand tons	11,879	13,929	
Kaolin and kaolinite clay, crude	521,444	542,552	e 526,000
Refractory clay, thousand tons	949	926	NA
Diatomite	159,803	168,467	e 170,000
Feldspar, crude	236,000	192,000	147,000
Fertilizer materials:			
Crude (natural):			
Phosphatic chalk	26,000	18,800	18,424
Potash:			
Gross weight, thousand tons	r 11,659	12,131	10,606
K_2O equivalent, do	1,904	2,000	1,760
K_2O equivalent (marketable), do	r 1,742	1,870	1,620
Manufactured:			
Nitrogenous, nitrogen content, thousand tons	1,344	1,548	NA
Phosphatic:			
Superphosphate, gross weight, do	1,297	1,233	
Thomas slag, do	2,540	2,540	
Potassic, do	1,742	1,850	
Mixed, gross weight, do	r 6,689	7,713	
Fluorspar, marketable e	290,000	372,000	372,000
Fly ash, thousand tons	e 4,000	e 4,000	NA
Gypsum and anhydrite, crude, do	r 5,734	5,112	5,853
Lime, quicklime and hydrated lime, including dead-burned dolomite, do	4,372	e 4,400	e 4,400
Mica	3,098	e 4,600	NA
Pigments, natural mineral, iron oxide	3,260	NA	NA
Pumice	587	e 600	NA
Pozzolana and lapilli	779,835	700,000	NA
Pyrite:			
Gross weight, thousand tons	85	82	33
Sulfur content, do	35	33	e 35
Quartz and glass sand:			
Quartz	563,311	621,600	453,000
Glass sand, thousand tons	2,220	2,390	5,886
Salt:			
Rock salt, do	295	292	198
Brine salt, do	933	845	926
Marine salt, do	1,296	1,250	1,006
Salt in solution, do	3,140	3,108	3,107
Total, do	5,664	5,495	5,237

See footnotes at end of table.

Table 1.—France: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NONMETALS—Continued			
Stone, sand and gravel, n.e.s.:			
Building stone:			
Granite and similar rocks—thousand tons	1,042	906	
Limestone—do	2,455	2,447	
Marble—do	554	226	NA
Other—do	29	22	
Crushed limestone and granite	3,426	5,484	
Dolomite:			
For agriculture	219,924	125,794	
Crude for calcining	724,774	771,202	NA
Other	647,979	578,857	
Total	1,592,677	1,475,853	NA
Limestone, agricultural and industrial:			
For agriculture—thousand tons	564	503	
For iron and steel industry—do	5,186	5,320	NA
For lime and cement—do	31,024	30,058	
For sugar mills—do	846	961	
Total—do	37,620	36,842	NA
Road building, foundation and ballast (other than alluvial sand and gravel):			
Ballast—do	83,574	86,066	
Foundation material—do	1,551	3,194	NA
Ground rock for road filler—do	614	172	
Paving block and curbing—do	466	159	
Slate:			
Roof	120,734	109,370	NA
Other	30,288	28,086	
Other stone:			
Beach pebble	262,206	214,632	
Lava	8,301	7,363	
Marl	204	165	NA
Mine fill—thousand tons	10,478	9,300	
Millstones and grindstones	1,287	505	
Sand and gravel:			
Industrial sands:			
Foundry—thousand tons	1,828	1,800	NA
Miscellaneous—do	702	539	
Other sand and gravel (alluvial):			
By dredging—do	96,538	104,503	NA
By other winning methods—do	96,284	100,713	NA
Sulfur, elemental, byproduct—do	1,733	1,806	1,730
Talc:			
Crude	219,120	253,630	268,400
Powder	232,992	245,997	236,075
MINERAL FUELS AND RELATED MATERIALS			
Bituminous asphaltic material	124,573	r 113,294	r 115,880
Carbon black	148,700	156,400	158,630
Coal:			
Anthracite—thousand tons	9,843	9,179	8,485
Bituminous—do	27,511	23,835	21,278
Lignite—do	2,785	2,751	2,964
Total—do	40,139	35,765	32,727
Coke:			
Metallurgical—do	r 14,152	12,505	11,509
Gashouse—do	10	4	13
Total—do	r 14,162	12,509	11,522
Coal briquets—do	4,322	3,735	NA
Gas, natural:			
Gross production—million cubic feet	r 361,974	380,690	385,761
Marketed—do	242,964	252,463	265,452
Peat—thousand tons	77	106	e 80

See footnotes at end of table.

Table 1.—France: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude—thousand 42-gallon barrels	16,825	13,651	10,811
Refinery products:			
Aviation gasoline—do	385	242	368
Motor gasoline—do	112,273	114,410	132,456
Jet fuel—do	23,294	22,216	24,972
Kerosine—do	373	340	532
Distillate fuel oil—do	295,893	301,962	320,690
Residual fuel oil—do	183,229	216,337	250,339
Lubricants—do	7,382	7,932	8,458
Liquefied petroleum gases—do	28,301	27,132	31,767
Bitumen—do	19,444	19,695	19,093
Other—do	25,158	23,268	29,411
Refinery fuel and losses—do	42,216	52,101	70,810
Total—do	737,948	785,635	888,896

e Estimate. p Preliminary. r Revised. NA Not available.
1 Produced in part from imported raw materials.
2 Including smectic clay.
3 Excludes bituminous material.

TRADE

Exports played a key role in the strong performance of the French economy. In 1972, the demand for French exports was buoyed by the expanding economies of France's principle trading partners and by France's sound competitive position in international markets. The French share of the total import market of its eight most important trading partners reached 9.6% in 1972, versus 8% in 1969. The French competitive edge increased for a number of reasons, among which are the following: (1) Exchange rate fluctuations made French exports relatively cheaper at a time when the productivity of French workers was increasing rapidly; (2) on the average, French prices were not rising as fast as those of other major industrial countries; and (3) French export prices were increasing more slowly than the general world price levels.

Table 2.—France: Exports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite	159,189	109,318	West Germany 44,619; United Kingdom 41,842; Italy 14,767.
Oxide and hydroxide [1]	263,809	347,392	Switzerland 89,947; Italy 49,298; Spain 47,683.
Metal, including alloys:			
Scrap	24,104	25,344	Italy 18,561; West Germany 4,407; Netherlands 1,007.
Unwrought	147,013	135,412	Belgium-Luxembourg 41,233; West Germany 33,264; Italy 26,393.
Semimanufactures	101,987	99,713	West Germany 28,429; United States 13,535; Italy 9,301.
Antimony, metal, including scrap	118	35	Madagascar 12; Italy 10.
Arsenic (anhydride)	10,443	7,205	United States 1,397; United Kingdom 1,084; Italy 824.
Beryllium	r 2	4	United States 3; United Kingdom 1.
Bismuth, all forms	82	112	Belgium-Luxembourg 66; Italy 26.
Cadmium	105	132	Belgium-Luxembourg 78; West Germany 39.
Chromium:			
Chromite	203	155	West Germany 128.
Oxide and hydroxide	r 48	56	Romania 20.
Metal	321	308	Sweden 131; West Germany 47; Italy 44.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Cobalt	275	340	United States 94; Switzerland 37.
Columbium value, thousands [2]	r $17	$12	All to United Kingdom.
Copper:			
Matte	701	909	Belgium-Luxembourg 309; West Germany 296; Italy 110.
Metal and alloys:			
Scrap	49,322	50,531	West Germany 17,050; Belgium-Luxembourg 15,635; Italy 12,200.
Blister and other unrefined	8,637	6,714	Mainly to Belgium-Luxembourg.
Refined	6,018	6,014	West Germany 1,702; Italy 1,553; Belgium-Luxembourg 986.
Semimanufactures	r 52,086	59,058	West Germany 18,218; United States 8,824; Netherlands 4,995.
Gallium [1] value, thousands [2]	r $567	$876	Switzerland $815; People's Republic of China $50.
Germanium, all forms	42	1	All to Belgium-Luxembourg.
Gold: [4]			
Ashes and sweepings troy ounces	112	45	Switzerland 40.
Metal:			
For domestic use do	138,859	141,785	Netherlands 36,009; West Germany 20,678.
Temporary imports do	5,385,917	4,244,053	Muscat and Oman 1,901,296; Lebanon 718,954; Kuwait 333,724.
Iron and steel:			
Iron ore thousand tons	18,643	18,304	Belgium-Luxembourg 14,179; West Germany 4,123.
Pyrite cinder do	219	150	Belgium-Luxembourg 105; West Germany 45.
Metal:			
Scrap do	2,637	2,741	Italy 2,266; Belgium-Luxembourg 287.
Pig iron, including spiegeleisen [5] do	200	145	Italy 52; West Germany 45; Belgium-Luxembourg 38.
Ferroalloys do	426	362	West Germany 94; Italy 83; United States 79.
Shot and powder do	27	25	West Germany 10; Italy 7; Spain 2.
Steel:			
Primary forms, including coil do	1,067	983	Belgium-Luxembourg 213; Italy 207; West Germany 118.
Semimanufactures:			
Bars, rods, wire rods, sections do	2,596	2,963	United States 736; West Germany 691; Belgium-Luxembourg 269.
Plates, sheets, universals do	2,576	2,752	West Germany 804; United States 488; Italy 239.
Hoop and strip do	217	254	West Germany 82; Italy 41; Belgium-Luxembourg 29.
Rails and accessories do	252	221	Italy 60; Tunisia 22; Netherlands 13.
Wire do	105	102	United States 21; West Germany 19; Italy 7.
Tubes, pipes, fittings do	951	822	Netherlands 137; United States 123; Belgium-Luxembourg 47.
Castings and forgings, rough do	27	29	Belgium-Luxembourg 10; United States 10; West Germany 3.
Lead:			
Ore	2,168	1,156	Mainly to Belgium-Luxembourg.
Oxides	8,996	10,244	U.S.S.R. 2,350; West Germany 1,743; Netherlands 1,632.
Metal, including alloys:			
Scrap	22,335	9,417	Italy 7,153; West Germany 2,020.
Pig iron, including alloys	27,706	30,159	Italy 10,717; Belgium-Luxembourg 8,165; West Germany 3,591.
Semimanufactures, including alloys	1,432	1,440	West Germany 309; Italy 155; Algeria 108.
Magnesium, all forms	667	840	West Germany 280; Italy 137; Greece 115.
Manganese:			
Ore	1,308	320	Brazil 81; Netherlands 61.
Oxide	445	253	Poland 140.
Metal, all forms	6,325	3,986	West Germany 1,221; Italy 1,054; Sweden 530.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Mercury——76-pound flasks	522	145	Belgium-Luxembourg 58; Cuba 58.
Molybdenum:			
Ore	45	--	
Oxide	22	114	West Germany 60; Italy 42; Sweden 10.
Metal, all forms	r 30	49	Italy 27; West Germany 18.
Nickel:			
Matte, speiss, etc	210	67	Mexico 40; Italy 20.
Oxide and hydroxide	196	318	Italy 113; United States 98; Belgium-Luxembourg 36.
Metal, including alloys:			
Scrap	1,686	1,046	West Germany 313; Italy 223; United Kingdom 177.
Ingots	5,359	4,339	People's Republic of China 1,100; West Germany 1,022.
Semimanufactures, including anodes	3,549	3,183	Spain 797; West Germany 438; Italy 372.
Platinum and platinum group: [4]			
Ashes and sweepings—troy ounces	r 10,996	682,077	Mainly to Switzerland.
Metal, including alloys——do	757,567	133,104	Belgium-Luxembourg 29,096; Spain 22,216; United Kingdom 19,580.
Selenium	41	5	United Kingdom 2; Netherlands 1.
Silver:			
Metal, including alloys——thousand troy ounces	6,515	7,660	Spain 1,733; Sweden 1, 290; Netherlands 1,235; Switzerland 1,221.
Ashes and sweepings—troy ounces	63,883	450	NA.
Tantalum, all forms—value, thousands [2]	$124	$200	Belgium-Luxembourg $74; West Germany $69; United Kingdom $25.
Thorium oxide	19	6	West Germany 4.
Tin:			
Ore——long tons	400	478	Mainly to Spain.
Oxide——do	34	26	Mainly to West Germany.
Metal, including alloys:			
Scrap——do	29	1	NA.
Ingots——do	295	379	Italy 194; Switzerland 36.
Semimanufactures——do	103	82	Belgium-Luxembourg 17; Madagascar 13.
Titanium:			
Ore	139	124	All to Algeria.
Oxide	14,569	13,648	United States 4,975; West Germany 1,478; Brazil 945.
Metal, all forms	r 142	140	Sweden 27; West Germany 27; Spain 14.
Tungsten:			
Ore	125	1,046	Mainly to West Germany.
Trioxide	147	47	Austria 34; West Germany 13.
Metal, all forms	246	189	West Germany 75; United Kingdom 30; Belgium-Luxembourg 18.
Zinc:			
Ore	4,819	3	NA.
Matte	1,462	652	Belgium-Luxembourg 554; Italy 39.
Oxide	24	45	Mainly to Belgium-Luxembourg.
Metal, including alloys:			
Scrap	1,610	1,495	Italy 1,136; Belgium-Luxembourg 176.
Dust (blue powder)	1,966	1,686	Belgium-Luxembourg 636; Norway 600; West Germany 151.
Slab and ingot	17,716	30,583	West Germany 14,822; Belgium-Luxembourg 4,389.
Semimanufactures	5,861	6,675	West Germany 4,037; Netherlands 574.
Zirconium:			
Ore	32	131	West Germany 85.
Oxide	101	108	Japan 46; Italy 24; Spain 17.
Metal, including nuclear grade	335	139	Sweden 75; West Germany 17.
Other:			
Ore and concentrate	319	353	Belgium-Luxembourg 121.
Ash and residues from nonferrous metals:			
Aluminum	6,961	5,476	Italy 3,415; West Germany 1,870.
Copper	4,171	4,330	Belgium-Luxembourg 2,016; West Germany 1,460; Spain 822.
Lead	7,890	7,521	Belgium-Luxembourg 6,861; West Germany 475.
Nickel	746	413	Italy 374; West Germany 34.
Zinc	5,485	5,034	Belgium-Luxembourg 4,109; West Germany 440.
Other	35,940	26,141	Sweden 13,546; Belgium-Luxembourg 8,814; West Germany 2,237.
Slag and ash, n.e.s	61,062	24,103	Belgium-Luxembourg 16,390; West Germany 3,664; Switzerland 1,935.
Metal, including alloys, all forms [6]	282	613	West Germany 136; Yugoslavia 110; Belgium-Luxembourg 72.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS			
Abrasives, natural:			
Pumice, emery and other	535	464	NA.
Dust and powder of precious and semiprecious stones value, thousands [2]	$189	$180	Switzerland $76; Netherlands $26.
Grinding and polishing wheels	2,880	2,470	West Germany 410; Belgium-Luxembourg 388; Italy 373.
Asbestos, crude	201	338	Senegal 101; Italy 75; Belgium-Luxembourg 37.
Barite, including witherite	19,052	21,314	Gabon 4,556; Belgium-Luxembourg 3,577; Italy 3,379.
Borates, natural	1,004	244	Cameroon 65.
Cement thousand tons	1,317	1,787	West Germany 437; Ivory Coast 282; Spanish Sahara 173.
Chalk	340,697	375,274	West Germany 163,336; Belgium-Luxembourg 66,205; Netherlands 48,846.
Clays and clay products:			
Crude:			
Kaolin	71,774	75,624	West Germany 41,801; Italy 11,664; Switzerland 4,131.
Bentonite	2,933	2,958	Tunisia 850; United Kingdom 537; Belgium-Luxembourg 464.
Refractory	446,499	431,251	Italy 252,685; West Germany 93,547; Belgium-Luxembourg 38,180.
Other	90,914	86,047	Italy 38,692; Belgium-Luxembourg 15,861; West Germany 10,515.
Clay and refractory construction materials (bricks, tile, etc.)	246,949	302,258	West Germany 105,305; Belgium-Luxembourg 60,689.
Corundum:			
Natural, including emery (included in abrasives above)	96	145	NA.
Artificial	16,642	15,254	West Germany 2,835; Belgium-Luxembourg 2,622; Italy 2,440.
Cryolite and chiolite, natural	1,478	930	Greece 492; Cameroon 249; Netherlands 157.
Diamond:			
Industrial, excluding powder value, thousands [2]	$1,305	$1,630	Ireland $508; Romania $430; Belgium-Luxembourg $267.
Gem, unset do	$11,997	$10,181	Switzerland $3,995; United States $2,702; Netherlands $2,093.
Diatomite	15,981	16,933	West Germany 8,056; Netherlands 1,741; Belgium-Luxembourg 1,672.
Feldspar	34,360	35,837	Belgium-Luxembourg 14,022; West Germany 12,522.
Fertilizer materials:			
Crude:			
Nitrogenous (natural sodium nitrates)	403	10	NA.
Phosphate rock	3,389	2,979	United Kingdom 996; Liberia 433.
Potassic salts	61,325	47,704	Belgium-Luxembourg 30,309; Netherlands 13,125; Switzerland 4,270.
Organic	25,444	23,362	Switzerland 14,483; West Germany 2,511; Belgium-Luxembourg 2,387.
Manufactured:			
Ammonia, anhydrous thousand tons	186	181	West Germany 98; Ireland 30; United Kingdom 16.
Nitrogenous do	495	307	Belgium-Luxembourg 75; Algeria 34; Morocco 30.
Phosphatic:			
Basic slag do	329	269	Switzerland 119; Austria 101; Italy 41.
Other do	37	43	Spain 9; United Kingdom 8; Switzerland 6.
Potassic do	850	1,228	Belgium-Luxembourg 554; Italy 122; United Kingdom 86.
Flint (pebbles)	110,142	102,444	West Germany 30,324; United Kingdom 19,321; United States 10,487.
Fluorspar	146,456	122,216	West Germany 69,070; Italy 15,097.
Graphite	1,758	1,613	Belgium-Luxembourg 430; Austria 222; Spain 220.
Gypsum and anhydrite, including plasters	r 1,208,789	1,154,856	Belgium-Luxembourg 422,061; Sweden 211,652; Netherlands 160,861.
Iodine	11	22	West Germany 4; Arab Republic of Egypt 4.
Lime	388,705	331,224	Belgium-Luxembourg 147,001; West Germany 145,929.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Magnesite, including calcined	692	1,509	Belgium-Luxembourg 1,207; United Kingdom 146.
Mica	1,491	1,423	West Germany 582; United Kingdom 530; Italy 101.
Pigments, mineral, including iron oxide	2,574	2,608	Morocco 551; United Kingdom 324.
Pozzolan, santorin, etc	3,273	2,142	Mainly to Switzerland.
Precious and semiprecious stones, except diamond [7]—value, thousands [2]	$14,554	$12,094	Switzerland $6,878; United States $1,857.
Pyrite, gross weight	3	275	NA.
Salt	283,830	113,822	West Germany 37,952; Belgium-Luxembourg 36,176; Netherlands 12,733.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	278,417	308,694	Guinea 83,867; Australia 53,153; Netherlands 34,500.
Caustic potash	10,372	11,831	Netherlands 4,223; Greece 1,273; United Kingdom 1,169.
Stone, sand and gravel: [8]			
Building stone:			
Crude and partly worked, n.e.s.	91,842	89,747	Belgium-Luxembourg 50,052; West Germany 16,700.
Worked:			
Slate, including crude	22,789	26,714	Netherlands 12,855; Belgium-Luxembourg 8,038; West Germany 1,764.
Not specified	8,936	11,613	West Germany 6,083; Belgium-Luxembourg 3,530.
Dolomite, chiefly refractory grade	67,061	92,722	Belgium-Luxembourg 55,559; West Germany 15,940.
Gravel and crushed stone thousand tons	10,833	11,448	West Germany 8,462; Switzerland 1,766; Belgium-Luxembourg 546.
Limestone (except dimension)	121,176	135,555	Belgium-Luxembourg 83,163; Switzerland 46,530.
Quartz and quartzite	2,519	5,137	Belgium-Luxembourg 2,816; West Germany 1,404.
Sand, excluding metal bearing thousand tons	2,533	3,367	West Germany 1,541; Switzerland 900; Italy 503.
Sulfur, elemental—do	1,142	952	United Kingdom 337; Netherlands 86; Republic of South Africa 65.
Talc and steatite	r 60,881	59,574	West Germany 12,522; United Kingdom 12,520; United States 7,464.
Other:			
Nonmetals, n.e.s.	233,709	203,937	Switzerland 172,168; West Germany 21,586; Belgium-Luxembourg 6,930.
Slag, dross and similar waste, not metal bearing, from iron and steel manufacture—thousand tons	1,095	1,214	West Germany 1,106; Netherlands 105.
Oxide and hydroxide of magnesium, strontium, barium	11,074	8,059	U.S.S.R. 4,531; West Germany 734.
Fluorine	890	297	Italy 40.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	14,863	7,913	United Kingdom 7,160.
Carbon black	42,535	40,160	Italy 10,278; West Germany 6,975; Spain 6,952.
Coal and briquets:			
Bituminous	r 1,213,577	932,027	West Germany 478,554; Belgium-Luxembourg 235,711.
Briquets of bituminous coal	95,433	110,444	United Kingdom 77,634; Italy 22,547.
Lignite	25,813	18,243	Spain 15,150; United Kingdom 2,366.
Coke	r 1,109,653	505,871	West Germany 84,425; Belgium-Luxembourg 82,996; Norway 49,835.
Gas, including liquid petroleum gas	583,599	568,324	Spain 260,604; Portugal 76,684; West Germany 46,513.
Hydrogen, helium and rare gases	1,123	831	Switzerland 271; West Germany 222; Brazil 92.
Peat, including briquets	2,897	3,395	West Germany 3,180.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	24,761	20,417	United Kingdom 6,877; West Germany 4,946; Switzerland 3,510.
Kerosine and jet fuel—do	5,404	4,705	Switzerland 1,804; West Germany 1,499; United Kingdom 727.
Distillate fuel oil—do	22,723	27,479	Switzerland 11,559; West Germany 8,701; Netherlands 4,520.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum refinery products—Continued			
Residual fuel oil thousand 42-gallon barrels	r 17,285	24,317	West Germany 6,389; United Kingdom 3,709; Belgium-Luxembourg 2,586.
Lubricants do	2,319	2,471	Belgium-Luxembourg 401; United Kingdom 354; West Germany 324.
Other: Bitumen, petroleum coke, and other residues do	2,551	2,542	West Germany 1,308; Switzerland 684.
Chemical derivatives of coal, petroleum, or gas	60,511	73,033	Belgium-Luxembourg 19,582; Switzerland 13,325; West Germany 12,553.

r Revised. NA Not available.
1 Excludes artificial corundum.
2 Based on par value of franc effective August 10, 1969; of 18.0044 U.S. cents equals 1 franc.
3 Includes indium and thallium.
4 Calculated from quantities reported in kilograms.
5 Includes cast iron and shot, grit, powder, and sponge of iron and steel.
6 Alkali, alkaline earth, and rare-earth metals except sodium.
7 Includes synthetic and reconstituted stone but does not include diamond.
8 Excludes slate, flint, or industrial limestone.

Table 3.—France: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite	488,888	504,628	Australia 325,018; Greece 93,766; Guyana 46,394.
Oxide and hydroxide 1	7,101	9,967	West Germany 4,536; Netherlands 1,768; Canada 1,621.
Metal, including alloys:			
Scrap	13,842	14,991	Belgium-Luxembourg 6,795; West Germany 4,115; Netherlands 1,325.
Unwrought	183,338	165,552	Greece 43,436; Cameroon 27,847; West Germany 20,705.
Semimanufactures	64,377	84,693	West Germany 31,464; Belgium-Luxembourg 28,802; Italy 8,254.
Antimony:			
Ore and concentrate	4,430	5,075	United States 1,571; Morocco 972; Bolivia 910.
Metal, all forms	389	801	Belgium-Luxembourg 306; People's Republic of China 295; Spain 92.
Arsenic, anhydride and acid	5	21	NA.
Beryllium, metal, all forms value, thousands 2	$379	$254	United States $241.
Bismuth	917	898	Peru 292; Japan 131; Bolivia 124.
Cadmium	606	491	Belgium-Luxembourg 165; Japan 105; Zaire 51.
Chromium:			
Ore	r 421,425	340,407	U.S.S.R. 93,690; Madagascar 69,691; Turkey 65,111.
Oxide and hydroxide	2,418	2,468	West Germany 1,589; U.S.S.R. 454; United Kingdom 350.
Metal	113	67	West Germany 30; U.S.S.R. 15.
Cobalt:			
Ore	7,671	4,100	All from Morocco.
Oxide and hydroxide	290	201	All from Belgium-Luxembourg.
Metal, all forms	983	609	Belgium-Luxembourg 437; United States 85.
Columbium:			
Ore (including tantalum ore)	723	515	All from Canada.
Metal, all forms, value, thousands 2	$341	$73	United States $36; West Germany $17.
Copper:			
Matte	1,062	574	United States 518; United Kingdom 45.
Metal, including alloys:			
Scrap	12,234	12,076	West Germany 3,621; Belgium-Luxembourg 1,751; Algeria 1,738.
Blister and other unrefined	16,469	16,425	Zaire 9,775; Belgium-Luxembourg 6,301.
Refined	317,049	303,937	Belgium-Luxembourg 105,055; Zambia 55,053; Chile 45,702.
Semimanufactures	r 37,450	37,337	Belgium-Luxembourg 13,297; West Germany 12,514.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Germanium, gallium, etc. value, thousands [2]	r $481	$391	Belgium-Luxembourg $263; Netherlands $82.
Gold: [3]			
Ashes and sweepings--troy ounces	87,964	70,732	Netherlands 28,550; Belgium-Luxembourg 20,287; Switzerland 18,487.
Metal:			
For domestic use-------do----	102,947	134,711	West Germany 80,763; Italy 34,240; United States 7,813.
Temporary imports-----do----	5,367,431	4,626,100	United Kingdom 3,292,939; Switzerland 565,434.
Iron and steel:			
Ore and concentrate, except roasted pyrite----------thousand tons--	9,635	9,370	Brazil 2,221; Mauritania 1,937; Sweden 1,322.
Roasted pyrite-------------do----	59	68	Spain 44; Italy 20.
Metal:			
Scrap-----------------do----	419	252	Belgium-Luxembourg 132; United Kingdom 50; West Germany 38.
Pig iron, spiegeleisen and other [4] do----	153	255	West Germany 201; Belgium-Luxembourg 14.
Ferroalloys-----------do----	133	117	New Caledonia 83; Belgium-Luxembourg 16.
Steel, primary forms----do----	2,456	1,841	Belgium-Luxembourg 667; West Germany 663.
Semimanufactures:			
Bars, rods, sections [5] do----	2,104	1,833	West Germany 849; Belgium-Luxembourg 711; Italy 144.
Plates, sheets, universals do----	2,115	2,226	Belgium-Luxembourg 1,181; West Germany 557; Netherlands 119.
Hoop and strip-----do----	364	325	Belgium-Luxembourg 210; West Germany 94.
Rails and accessories do----	84	87	United Kingdom 60; Belgium-Luxembourg 20.
Wire-------------do----	102	102	West Germany 48; Belgium-Luxembourg 37.
Tubes, pipes, fittings do----	278	367	West Germany 141; Italy 55; Netherlands 29.
Castings and forgings, rough----------	9,735	11,541	West Germany 4,070; Belgium-Luxembourg 3,928; Switzerland 2,314.
Lead:			
Ore and concentrate----------	137,821	149,886	Morocco 54,677; Ireland 41,963; Australia 20,686.
Oxides----------	2,571	2,517	Mexico 956; Belgium-Luxembourg 889; West Germany 362.
Metal, including alloys:			
Scrap----------	6,224	5,488	Belgium-Luxembourg 2,973; Netherlands 1,291; West Germany 354.
Unwrought----------	50,727	42,512	Belgium-Luxembourg 12,156; Morocco 11,075; West Germany 10,300.
Semimanufactures----------	r 504	611	Belgium-Luxembourg 406; West Germany 117.
Magnesium, including alloys:			
Scrap----------	2	72	Mainly from West Germany.
Unwrought----------	2,775	935	United Kindgom 329; U.S.S.R. 161; Canada 141.
Semimanufactures----------	123	64	West Germany 33; United States 14.
Manganese:			
Ore and concentrate----------	1,095,000	1,117,022	Gabon 460; Republic of South Africa 382; U.S.S.R. 104.
Oxide----------	3,605	1,955	Japan 786; West Germany 567; Belgium-Luxembourg 512.
Metal, all forms----------	320	235	Republic of South Africa 80; United States 63; Japan 60.
Mercury, all forms----76-pound flasks--	9,167	10,907	Mexico 3,394; Romania 1,915; Italy 1,827.
Molybdenum:			
Ore and concentrate----------	9,431	5,391	Canada 2,555; Netherlands 1,167; United States 949.
Oxide----------	39	28	Netherlands 16; Belgium-Luxembourg 11.
Metal, all forms----------	93	100	West Germany 34; Austria 33.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Nickel:			
Matte	18,189	13,661	New Caledonia 10,021; Cuba 2,038; Canada 1,424.
Oxide and hydroxide	85	80	Canada 57; Netherlands 14.
Metal, including alloys:			
Scrap	534	677	Spain 180; Belgium-Luxembourg 166; Canada 113.
Unwrought	11,610	11,284	Canada 4,229; United Kingdom 3,019; Norway 2,151.
Semimanufactures (including anodes)	4,296	5,832	United States 2,409; West Germany 1,882; United Kingdom 1,036.
Platinum and platinum group:			
Ashes and sweepings—troy ounces	34,787	32,890	Netherlands 14,886; Spain 3,987; Austria 2,958.
Metals—do	217,917	321,346	Switzerland 141,720; U.S.S.R. 50,605; United States 42,021.
Selenium	37	114	United States 67; Belgium-Luxembourg 18; West Germany 14.
Silver: [3]			
Ashes and sweepings thousand troy ounces	268	278	Netherlands 109; Spain 101; Switzerland 66.
Metal, all forms—do	17,189	20,306	United Kingdom 5,399; Mexico 2,650; United States 2,148.
Tantalum, all forms	18	15	United States 9; Belgium-Luxembourg 3.
Thorium:			
Ore (monazite)	2,441	2,557	Australia 2,336; Zaire 101; Malaysia 101.
Metal—value, thousands [2]	$7	$11	NA.
Tin:			
Oxide—long tons	97	93	Belgium-Luxembourg 43; West Germany 41.
Metal, including alloys:			
Scrap—do	174	223	Italy 118; Switzerland 90; People's Republic of China 15.
Ingots—do	9,871	10,429	Malaysia 4,523; People's Republic of China 1,848; Indonesia 1,783.
Semimanufactures—do	52	175	United States 88; West Germany 36.
Titanium:			
Ore	126,834	112,961	Mainly from Australia.
Oxide	18,892	22,362	West Germany 11,420; Netherlands 3,134; Belgium-Luxembourg 2,825.
Metal, all forms	1,095	1,556	U.S.S.R. 801; Japan 278.
Tungsten:			
Ore	2,675	2,311	Brazil 970; Mexico 173; United States 164.
Trioxide	102	104	West Germany 62; Netherlands 40.
Metal, all forms	145	92	West Germany 34; Netherlands 23.
Uranium:			
Ore	1,467	1,952	Gabon 1,464; Niger 488.
Metal, including alloys—kilograms	266,878	303,244	Belgium-Luxembourg 120,056; United States 76,987; West Germany 57,941.
Zinc:			
Ore and concentrate	411,147	384,844	Canada 137,404; Peru 82,690; Ireland 51,824.
Oxide	3,657	3,807	West Germany 1,165; East Germany 921; Italy 677.
Metal, including alloys:			
Scrap	17,428	20,331	Belgium-Luxembourg 7,865; Netherlands 7,120; West Germany 2,873.
Blue powder	4,458	4,419	Belgium-Luxembourg 4,119; Norway 217.
Unwrought	31,349	40,511	Belgium-Luxembourg 7,733; West Germany 7,518; North Korea 7,168.
Semimanufactures	5,941	4,436	West Germany 1,947; Belgium-Luxembourg 1,176; Yugoslavia 1,020.
Zirconium:			
Ore	27,813	32,732	Mainly from Australia.
Oxide	259	401	United Kingdom 226; U.S.S.R. 80; United States 59.
Metal	69	52	Sweden 34; United States 5.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Other:			
Ashes and concentrates	82,152	41,726	Iran 22,841; Ireland 7,468; Canada 5,070.
Ashes and residues containing nonferrous metals:			
Aluminum	4,644	6,644	West Germany 3,000; Belgium-Luxembourg 1,180.
Copper	2,352	1,636	Belgium-Luxembourg 970; West Germany 529; Switzerland 117.
Lead	64	349	West Germany 156; Malagasy Republic 71; Switzerland 50.
Nickel	67	331	United Kingdom 131; United States 106.
Zinc	16,120	14,799	West Germany 6,368; Belgium-Luxembourg 3,503; Switzerland 1,656.
Other	50,498	22,744	Mainly from Canada.
Metal, including alloys, all forms	194	230	West Germany 208.
NONMETALS			
Abrasives:			
Emery, natural corundum, other	53,157	47,576	Turkey 43,850; Greece 3,707.
Pumice	23,198	11,820	Italy 10,150; Netherlands 792.
Dust and powder of precious and semiprecious stones value, thousands [2]	$4,666	$5,068	United States $1,929; United Kingdom $1,071; Netherlands $1,005.
Grinding and polishing wheels	r 6,586	7,034	Italy 1,538; Belgium-Luxembourg 1,522; West Germany 1,434.
Asbestos	151,846	128,980	Canada 70,810; U.S.S.R. 29,618; Republic of South Africa 15,741.
Barite and witherite	87,414	80,287	Belgium-Luxembourg 72,426; People's Republic of China 5,899.
Boron materials:			
Crude natural borates	117,367	133,201	Turkey 75,125; United States 56,428.
Oxide and acid	657	716	United States 556; Turkey 80; Italy 79.
Bromine value [2]	$8,462	NA	
Cement	47,699	47,783	Italy 22,584; Switzerland 16,439; West Germany 5,975.
Chalk	4,066	8,504	Belgium-Luxembourg 5,237; West Germany 3,239.
Clays and clay products:			
Crude:			
Kaolin including calcined	317,594	302,535	United Kingdom 247,628; United States 36,939.
Bentonite	110,578	100,275	Italy 30,684; Greece 27,979; United States 8,849.
Refractory clays	182,380	183,691	West Germany 136,078; United Kingdom 22,045.
Clay and refractory construction materials (bricks, etc.)	607,452	718,726	West Germany 234,089; Belgium-Luxembourg 178,562; Italy 169,592.
Cryolite and chiolite, natural	8,172	3,874	Belgium-Luxembourg 2,538; Denmark 1,287.
Diamond:			
Industrial, except dust value, thousands [2]	$6,139	$5,962	Ireland $2,573; Belgium-Luxembourg $1,364; United Kingdom $1,020.
Gem, unset do	$31,041	$27,900	Belgium-Luxembourg $9,483; Switzerland $5,408; Israel $5,350.
Diatomite	5,821	5,302	United States 2,383; West Germany 1,578; Denmark 776.
Feldspar	31,336	31,003	Norway 20,521; Belgium-Luxembourg 4,174.
Fertilizer materials:			
Crude:			
Nitrogenous (natural sodium nitrate)	26,750	13,977	Mainly from Chile.
Phosphate rock thousand tons	3,637	3,924	Morocco 1,549; Togo 924; United States 545.
Manufactured:			
Ammonia, anhydrous	127,901	142,735	Belgium-Luxembourg 128,053; West Germany 14,355.
Nitrogenous	434,883	632,984	Belgium-Luxembourg 279,911; Romania 102,524; Poland 67,178.
Potassic	201,571	220,269	Belgium-Luxembourg 109,009; Israel 59,483; West Germany 32,856.
Phosphatic:			
Basic slag	876,721	892,358	Belgium-Luxembourg 740,015; West Germany 152,343.
Other	396,769	457,868	Netherlands 122,457; Belgium-Luxembourg 88,558; Tunisia 87,250.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Flint (pebbles)	r 447,437	1,057,932	United Kingdom 563,087; Belgium-Luxembourg 21,898.
Fluorspar	12,567	5,589	Republic of South Africa 1,516; Italy 1,358; People's Republic of China 1,316.
Graphite	6,789	5,707	Malagasy Republic 3,326; Italy 936; West Germany 646.
Gypsum and plaster	4,133	29,334	West Germany 26,896; Italy 1,891.
Iodine, crude	617	760	Japan 542; Chile 170; United States 35.
Lime	183,613	166,037	Belgium-Luxembourg 113,300; West Germany 49,500.
Lithium and strontium minerals	5,565	3,299	Republic of South Africa 1,264; United Kingdom 1,181; Netherlands 509.
Magnesite, including calcined	56,587	55,993	Austria 23,154; Greece 8,793; Czechoslovakia 4,428.
Mica	4,967	4,587	India 1,799; Norway 992; Mozambique 483.
Pigments:			
Earth pigments, including iron oxides	940	1,563	Iran 700; Austria 230; Spain 215.
Earth, other (pozzolanic), santorin, etc.	87	1,984	Republic of South Africa 197.
Precious and semiprecious stones [6] value, thousands [2]	$17,002	$15,363	India $4,980; Switzerland $3,841.
Pyrite	319,204	249,314	Cyprus 158,268; Spain 67,977; U.S.S.R. 22,403.
Salt	50,533	78,350	Algeria 28,000; Netherlands 20,913; West Germany 12,635.
Sodium and potassium salts, n.e.s.:			
Caustic soda	60,894	67,585	Belgium-Luxembourg 58,504; Italy 4,742.
Caustic potash and peroxides of potassium and sodium	217	172	West Germany 58; Sweden 52.
Stone, sand and gravel: [7]			
Dimension stone:			
Crude and partly worked:			
Slate	2,020	1,246	Italy 332; United Kingdom 205; Belgium-Luxembourg 203.
Other	202,535	205,451	Italy 80,474; Republic of South Africa 62,663; Norway 18,935.
Worked:			
Slate	33,939	36,138	Spain 33,534; United Kingdom 1,027.
Other	91,206	94,558	Italy 74,066; Portugal 3,465; Belgium-Luxembourg 2,029.
Dolomite, chiefly refractory grade	167,411	179,911	Belgium-Luxembourg 158,619; West Germany 19,168.
Gravel and crushed stone thousand tons	r 5,001	6,529	Belgium-Luxembourg 5,223; United Kingdom 563.
Limestone	155,770	158,494	Mainly from Belgium-Luxembourg.
Quartz and quartzite	36,344	30,670	Italy 16,542; Portugal 5,890; West Germany 4,529.
Sand, excluding metal bearing thousand tons	1,628	1,570	Belgium-Luxembourg 672; Netherlands 501; United Kingdom 300.
Sulfur, elemental, all grades	324,661	428,936	Poland 232,808; Canada 120,036; United States 69,542.
Talc and steatite	10,191	7,623	Italy 3,433; Belgium-Luxembourg 1,724; Austria 814.
Other nonmetals, n.e.s	764,415	810,116	Switzerland 692,609; Greece 42,975; West Germany 27,687.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,624	2,568	United States 1,708; West Germany 424.
Carbon black	69,075	64,279	Netherlands 28,831; West Germany 11,899; United States 11,766.
Coal and briquets:			
Coal thousand tons	14,189	13,522	West Germany 5,776; United States 2,804; Poland 1,957.
Coal briquets do	207	144	Netherlands 97; Belgium-Luxembourg 40.
Lignite and lignite briquets do	299	259	Mainly from West Germany.
Coke	2,858	2,626	West Germany 2,314.
Gas, hydrocarbon:			
Natural	r 3,009,443	4,194,533	Netherlands 3,578,883; Algeria 365,918; Venezuela 87,419.
Manufactured	49,342	25,875	West Germany 21,057; Switzerland 2,561.
Hydrogen and rare gases	6,681	8,615	West Germany 5,310; Belgium-Luxembourg 2,867.
Peat, including briquets thousand tons	44	51	West Germany 32; Netherlands 12; Poland 7.

See footnotes at end of table.

Table 3.—France: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude--thousand 42-gallon barrels--	729,886	716,364	Suadi Arabia 130,169; Libya 116,762; Iraq 111,305.
Refinery products:			
Gasoline----------do----	12,147	16,814	Italy 8,687; West Germany 4,659; U.S.S.R. 927.
Kerosine----------do----	772	863	Italy 311; Netherlands 215; United Kingdom 177.
Distillate fuel oil-------do----	26,028	32,920	Italy 16,343; U.S.S.R. 6,483; Romania 3,923.
Residual fuel oil--------do----	2,880	3,201	U.S.S.R. 1,193; Italy 897.
Lubricants----------do----	272	434	United Kingdom 102; Netherlands 76; West Germany 58.
Other (vaseline, waxes, petroleum coke, bitumens, etc.) do----	1,612	1,715	United States 928; West Germany 454.
Mineral tar and crude chemicals derived from coal, petroleum, or gas---------	r 266,020	268,750	United States 118,058; West Germany 54,677; United Kingdom 33,689.

r Revised. NA Not available.
[1] Excludes artificial corundum.
[2] Based on par value of franc effective August 10, 1969, of 18.0044 U.S. cents equals 1 franc.
[3] Calculated from quantities reported in kilograms.
[4] Includes cast iron and sponge, powder, etc., of iron and steel.
[5] Includes wire rod.
[6] Includes synthetic and reconstituted stone but does not include diamond.
[7] Excludes flint and industrial limestone.

COMMODITY REVIEW

METALS

Bauxite.—Bauxite mining was concentrated in the Mediterranean regions of the country. About 75% of the 3.3 million tons produced in 1972, was mined in the Var region, 24% in Hérault, and the small remainder in the Ariège region. Proven reserves of bauxite containing 50% to 60% Al_2O_3 and 8% to 9% SiO_2 were at 70 million tons, with probable reserves at 190 million tons.

The major portion of French bauxite production was delivered to the alumina plants of the Péchiney-Ugine Kuhlmann (PUK) group at La Barasse and Gardanne in Les Bouches du Rhône, and to the Péchiney-Saint Gobain plant in Gard.

Copper.—Production of copper decreased 4% in 1972 compared with 1971 output. However, since the 30,111 tons of refined copper produced met only a fraction of the nation's requirement, the Government agency, Groupement d'Importation et de Repartition des Métaux (GIRM), purchased about 264,000 tons of copper from overseas producers. Also, the Ministry for Industrial and Scientific Development sought to encourage the development of copper deposits, both in the country and abroad, by offering millions of dollars in aid to investors. GIRM maintained for French industry a copper stockpile of close to 60,000 tons at the end of 1972.

Iron Ore.—Iron ore production, which amounted to 54.3 million tons in 1972, originated in three regions: the Lorraine basin, the West basin, and the Pyrénées.

The Lorraine basin extends over a large area on the Meurthe and Moselle Rivers, where several mineralized iron ore beds have been exploited for many years. The mineral occurs either in the form of siliceous or calcareous ore and contains 33% iron and is high in phosphorous. The ores make ideal feed material for the Thomas steelmaking process when mixed in the proportions of 3 tons of calcareous iron ore to 1 ton of siliceous iron ore.

The West Basin iron ore deposits extend over the Normandy, Brittany, and Anjou areas. Total production from this section was about 2.3 million tons of hematite and iron carbonate ore with an average grade of 45% iron.

The Pyrénées region produced about 52,000 tons of iron ore in 1972 and continued to supply the Decazeville plant in Aveyron. The delivered ore contained 44% to 58% iron and 3% manganese.

Iron and Steel.—The French steel industry produced about 24 million tons of crude steel in 1972 and ranked sixth after the United States, the U.S.S.R., Japan, West Germany, and the United Kingdom. France was the world's third leading stainless steel producer in 1972 after Japan and the United States; its output was 490,000 tons for 1972, up 20% from 407,000 tons in 1971.

Following the consolidation and mergers of the last few years, two groups of producers have emerged in the steel industry: Wendel-Sidelor and Usinor which produced two-thirds of French steel; and Creusot Loire-Cockerill, Métallurgie de Normandie, Newes-Maisons, Ugine Aciers, and Pompey which produced the remaining third during 1972. These major producers and their steel capacity in 1972 were as follows:

Producers	Capacity (million tons)
De Wendel et Union Sidérurgique Lorraine	9.06
Union Sidérurgique du Nord de la France	8.10
Compagnie des Ateliérs et Forges de la Loire Société des Forges et Ateliérs du Creusot	1.06
Société des Acièries de Cockerill	1.00
Métallurgie de Normandie	.90
Société d'Electro-Chimie, d'Electro-Metallurgie et des Acièries d'Electriques de Ugine	.50
Société des Acièries de Pompey	.40
Other	5.10

PUK's Nogueres plant has an annual capacity of 115,000 tons and produced 30% of PUK's total production. Most of Nogueres plant output was slated for export.

The labor force for the steel industry was reduced from 189,447 in 1971 to 186,119 in 1972, and the average hourly wage rose to approximately $2.10. Total 1972 steel employment consisted of about 58,000 skilled laborers, 81,000 unskilled laborers, and 47,119 management personnel, engineers, and technicians. It required 12 hours and 39 minutes of work to produce 1 ton of steel in 1972 as compared with 14 hours and 5 minutes in 1968.

Sales of French steel rose 4%, from $4.69 billion in 1971 to about $4.87 billion in 1972. The primary market for French stainless steel was domestic. France exported about 142,000 tons of stainless steel products in 1972. Of this, about 60,000 tons was shipped to European Community (EC) countries. Despite a unilateral agreement in May 1972, in which the EC countries committed themselves to restrain sales of all types of steel to the United States, the United States was France's biggest single foreign stainless steel market. Most of the stainless steel exported to the United States was from the plants of Ugine Aciers, a division of PUK, and the plants of Wendel-Sidelor. The following tabulation of foreign trade shows a favorable trade balance in 1971; 8.9 million tons of steel was exported and 6.3 million tons was imported.

Country of origin	Exports (thousand tons)	Imports (thousand tons)
European Common Market:		
Belgium-Luxembourg	632	2,714
Germany, West	1,640	2,079
Italy	598	312
Netherlands	205	397
Total	3,075	5,502
Franc Zone: Total	411	--
Other contries:		
Spain	75	56
Sweden	152	88
Switzerland	401	--
U.S.S.R.	87	--
United Kingdom	78	50
United States	1,263	41
Other countries n.e.s.	3,449	556
Total	5,505	791
Grand total	8,991	6,293

According to the objective set forth in the sixth plan, French steel production is expected to rise to about 35 million tons by 1975.

Until a few years ago, 95% of French steel production was concentrated in the provinces of Lorraine and Le Nord, both in the north and northeast of France. A decision to move south and modernize the undercapitalized steel industry was made 2 years ago. The choice of Fos-sur-Mer near Marseilles as the main site for growth of the steel industry rather than Le Harve was decided by the economics of possible export markets. By the end of 1972, construction on the steel mill jointly owned and operated by Solmer division of Wendel-Sidelor and Usinor was progressing at Fos-sur-Mer, and initial production was expected by the end of 1973. The plant is scheduled to produce 3.5 million tons by 1976 and 7 million tons by 1978.

Ugine Aciers, with four stainless steelworks already in operation in north and northeastern France, was building another

steel plant at Fos-sur-Mer, adjacent to the Solmer steelworks. Production will begin in 1974 and capacity will reach 400,000 tons by 1976.

The French Steel Industry Association reported that in 1972 West Germany's August Thyssen-Huette A.G. (ATH) was discussing participation in the steel complex at Fos-sur-Mer. Participation, which will involve initially a 5% and eventually a 25% interest in the project, had to be approved by the two governments. ATH's participation was anticipated and steel industry officials were optomistic that the clearance would be obtained from both governments. From the French point of view, ATH's involvement means access to capital resources and, from ATH's point of view, this opportunity offers a seaside production site long sought by the land-locked German manufacturer.

Production capacity for 1973 was enhanced considerably by completion of a new coastal mill at Dunkirk. It's fourth blast furnace was to be fired early in 1973. The Dunkirk works has an annual capacity of 7.5 million tons. With the combined facilities of Fos-sur-Mer and Dunkirk, France will have more stainless steel production capacity in new plants in the next couple of years than its entire production in 1972.

Lead and Zinc.—Le Nickel Peñarroya Mokta group (LNPM), one of the principal European lead-zinc producers, mined and processed about 90% of the lead-zinc of France in 1972. Lead-zinc mines in production were as follows: The Malines mines in Gard; the Largentière mine in Ardèche; the Le Plague mine in Savoie; and the Peryebrumre mine in the Tarn area. All these mines except the Croix de Pallières, which is owned by the Société des Mines et Fonderies de Zinc de la Vieille-Montagne, S.A., were operated by LNPM. One of the most important mines was Largentière, which produced 300,000 tons of lead ore and 500,000 tons of zinc ore. Ore delivered from this mine to the processing plant contained from 2% to 8% lead in the form of lead-zinc-silver ore, with 2 kilograms of silver per 1 ton of lead metal, together with variable quantities of zinc. The capacity of the Largentière's concentrating plant is 1,200 to 1,500 tons per day.

French production of refined lead in 1972 increased 28,366 tons over that of 1971. The increased output from Malines and Le Prague mines compensated for the lost production of Croix de Pallières, which was completely exhausted. The opening and development work at Treves lead-zinc mine was expected to meet domestic demand.

Reportedly a large deposit of lead-silver in the Correze area was discovered by BRGM and Belgian geologists. By yearend, BRGM and Rhône-Poulenc of France and the Compagnie Royale Asturiénne des Mines, and Vieille Montagne of Belgium, both well established companies in France, were planning a processing plant of 100,000-ton capacity to exploit the deposit.

Nickel.—France's Société Le Nickel (SLN) signed a nickel stockpiling agreement that will add an estimated $20 million to the company's coffers, permitting it to continue mining New Caledonian nickel ore at the 1972 rate, while expanding facilities at Poum in northern New Caledonia, to meet expected future demand.

Under the agreement, GIRM will purchase 10,000 tons of SLN nickel ore in 1973 at a negotiated price. SLN will repurchase the nickel ore and metal, at the same price, over the next 5 years, according to market conditions.

Tin.—France produces very little tin ore within the country. A small deposit was worked in the Finisterre by the Compagnie Minière de St. Reman (Comiren). It is expected that the reserves of the Finisterre mine will be exhausted by 1975. However, strong exploration efforts both in France and Malayasia were made to find new ore bodies. Comiren reported the discovery of a new alluvial tin deposit in France in 1972. Location and details of reserves were not available by yearend.

According to statistics released by the customs department, France's tin trade, consumption, and stocks, at the end of 1972 were as follows in long tons:

Imports	11,230
Exports	60
Net imports	11,170
Increase in stock	140
Consumption	11,030

Uranium.—Positive results have been achieved in uranium research as the result of work performed since 1940 by the Commissariat à l'Énergie Atomique (CEA) and by several private organizations. France has thus established itself in an important po-

sition in relation to uraniferous ore reserves and the production of uranium.

As of July 1, 1970, uranium reserves in France were estimated at 51,000 tons of contained uranium. In 1972, mineral production included about 24,000 tons of uranium ore of which 23,000 was derived from CEA holdings and 1,000 tons from the Compagnie Française des Mines d'Uranium (CFMU) deposits.

The CEA operated uranium mines in various parts of the country. The major deposits are at Limousin where two mines, Bois Noire and Escarpière, were in production in 1972. The ore from these mines was concentrated in the form of uranyl nitrate or uranate of magnesia at three treatment plants situated at St. Priest de la Prugne, Bessines, and Escarpière. The capacity of these plants is 350 tons of contained uranium in uranyl nitrate, and 1,350 tons of contained uranium in uranate of magnesia annually.

The CFMU operated a concentration plant in Lozère with a capacity of 60 tons of uranium metal per year.

French output of U_3O_8 was about 4,000 tons in 1972, of which 50% came from France itself and the remainder from deposits in Nigeria and Gabon.

NONMETALS

Fertilizer Materials.—French fertilizer production and consumption in 1972 increased 1% and 6%, respectively, over those of 1971. According to the Union des Industries Chimiques (UCI), purchases from abroad and from subsidiaries of the French companies increased and met domestic requirements. The production and consumption of fertilizers[3] in France in thousand tons were as follows:

	1970–71			1971–72		
	Nitrogen	Phosphate	Potash	Nitrogen	Phosphate	Potash
Production	1,351.1	1,450.8	1,841.9	1,401.0	1,500.0	1,796.7
Consumption	1,453.4	1,809.4	1,388.8	1,498.0	1,932.0	1,505.6

Nitrogen.—Aga-France S.A.'s new industrial gas plant at Porcheville reached its full production level in 1972. The plant produced at the rate of 500 cubic meters of liquid nitrogen, 99.99% purity, and 4,000 cubic meters of nitrogen gas, 99.99% purity, per hour. Production rates and analysis of the plant's other two products, oxygen and argon, were not available.

Potash.—The state-owned potash company, Mines Dominales de Potasse d'Alsace (MDPA), plagued with a month long general strike for increased wages, managed to produce about 1.8 million tons in 1972. MDPA, a subsidized government mining venture is limited in production because of salt disposal problems. MDPA's plan for erecting a 1-million-ton-capacity salt extraction facility on the Rhine River remained in the planning stage.

To overcome the shortage of muriate of potash in France, Enterprise Minière et Chimique S.A. (EMC) contracted to purchase this material from Canadian potash producers in 1972. EMC's order involved 100,000 tons for immediate delivery, and 300,000 tons on a long-term agreement. Estimated cost of the purchase was given at $4.5 million.

Pyrite.—Société des Mines et des Produits Chimiques de Salsique continued to operate the only pyrite mine in France. In 1972 production of iron pyrite decreased 60% compared with 1971 output. Although exploration efforts continued during the year, no significant find was reported by the end of the year.

Refractories.—France is Western Europe's third largest refractories manufacturer, after West Germany and the United Kingdom. Total production in 1972 was 720,000 tons, 3% above the 1971 level. Distribution of specific refractories was as follows: Clay and lower alumina refractories 62%; high alumina refractories 10%; special refractories 9%; basic refractories 4%, insulating refractories 3.5%, and other refractories 8%. These percentages bore out the fact that France's strength in the refractories industry was based on its high quality fire clay and chamosite deposits. The bulk of the country's refractories output was in alumina-silica or their derivatives and included export of these materials. However, France was a small producer of such basic refractories as chro-

[3] Chemical and Engineering News. June 18, 1973, p. 13.

mium or magnesium, and was a major importer of these commodities.

The major refractory producers in 1972 were the Argiles and Minéraux-AGS group, Extéral S.A., and Denain-Anzin Minéraux. The location of refractory plants was governed partly by the location of clay deposits.

France's main refractory item in the world market in 1972 was fused-cast-refractories, manufactured by L'electro-Refractaire at the Le Pontet plant near Avignon.

Sulfur.—Sulfur production from desulfurization of natural gas at Lacq reached 1.7 million tons in 1972. France exported 650,000 tons of sulfur in 1972. However, according to projections of the sixth plan, by 1975 supply and demand for sulfur will be roughly in equilibrium.

MINERAL FUELS

A 40% increase in energy consumption in the 1950's and a 70% increase in the 1960's resulted from the rapid modernization and economic growth of France in those 2 decades. With the economy showing few signs of slowing down in the 1970's and with per capita energy consumption the lowest of any EC country except Italy, France is likely to increase its energy consumption.

On the production side, France has virtually switched to an oil economy in the last 2 decades. As shown in the following tabulation of percent totals of energy consumed in 1971 as opposed to that consumed in 1972, petroleum usage increased from 21% in 1952 to 62% in 1971:

Year	Coal	Petroleum	Natural gas	Hydropower	Nuclear power
1971--	22.7%	61.8%	7.4%	6.9%	1.2%
1952--	70.6%	21.3%	.4%	7.7%	--

The French nuclear program, both civil and military, had another difficult year in 1972, though the long-range prospect was better since CEA's research and development budget is to be raised 1.4% in 1973. The CEA continued to grapple with problems of excess manpower and facilities, brought to a head by the 1969 decision of the Electric Company of France to buy American designed enriched-uranium power reactors rather than the CEA's natural uranium reactors. CEA manpower declined from nearly 31,000 in 1968 to 18,000 at the end of 1972.

As part of its attempt to make its activities more commercially viable and its expertise more available to French industry, the CEA established, in 1972, three autonomous companies owned and staffed by the CEA to deal with nuclear engineering, information systems, and integrated circuits.

The strength of the French nuclear program continued to be its fast breeder reactors. The 250-megawatt prototype breeder reactor at Marconle, "the Phenix", was expected to go into service in mid-1973. Studies were underway on Phenix's successors, two fast breeder commercial power stations to be built jointly with Italy and West Germany.

In addition, the CEA concluded an agreement with Gulf General Atomic of the United States for feasibility studies on high temperature gas reactors, a possible intermediate stage between the light water reactor and the fast breeders.

The French special steel and heavy metalworking firm, Creusot-Loire, signed an agreement with Westinghouse of the United States to organize a company called Compagnie Nucléaire Française (CNF), in which Creusot-Loire will have 51% interest and Westinghouse 45%, with the remaining 4% split among several small, private companies. By yearend CNF already had contracts to build four light-water nuclear powerplants in France. A second investment project was that of PUK and Westinghouse in a yet unnamed company which will produce nuclear fuel. In this venture, Westinghouse was reported to hold a 35% interest, PUK 51%, CNF 10%, and Creusot-Loire 4%.

Coal.—As in other countries of the common market, the coal mining industry of France faced difficulties and a general recession in spite of technical progress in 1972. In addition to the problems related to mining and depletion of reserves, the coal industry met growing competition from other sources of energy, notably, petroleum, natural gas, nuclear power, and imported fuel.

In 1972, 79% of the 29.8 million tons of anthracite and bituminous coal produced in France was mined in the Nord-Pas-de-Calais and Lorraine coal fields. The seven smaller coal fields of the central region, comprised of Aquitaine, the Auvergne, Blansy, Cevénnes, Dauphine, the Loire, and

others produced a total of 6.2 million, while the open cast lignite mines at Arjuseux produced 2.9 million tons.

Solid fuel exports increased 6% in 1972 compared with those of 1971, while imports of solid fuel decreased by almost 1.7 million tons owing mostly to reductions in coal imports. Exports and imports of solid fuels, in thousand tons, in 1971–72 were as follows:

	Exports		Imports	
	1971 [1]	1972	1971 [1]	1972
Coal (anthracite and bituminous)	[2] 846	888	r 13,636	11,699
Coke	601	632	r 2,796	3,118
Patent fuel	72	88	146	120
Lignite briquets	--	--	253	234
Total	1,519	1,608	r 16,831	15,171

r Revised.
[1] Figures differ from those shown on tables 2 and 3 because of source.
[2] Includes a small amount of lignite.

Source: Statistique Annuelle Définitive, Monthly issues 1972 (Paris).

Table 4.—France: Salient statistics of the coal and lignite industry

(Thousand metric tons unless otherwise specified)

	1971	1972 p
COAL (ANTHRACITE AND BITUMINOUS)		
Production: [1]		
Nord/Pas-de-Calais	14,520	12,593
Lorraine	11,512	10,939
Aquitaine	1,459	1,308
Auvergne	592	562
Blansy	1,726	1,677
Cevénnes	1,299	1,130
Duaphine	569	518
Loire	1,298	1,015
Others	34	21
Total	33,009	29,763
Average number of days worked	261.4	239.3
Average daily output (tons)	137.7	124.4
Number of workers:		
Underground	59,964	53,475
Overall	90,489	82,786
Production per man-shift (tons):		
Underground	2.626	2.139
Overall	1.713	1.503
Stocks at yearend:		
Shipping ore	1,127	1,829
Low-grade	3,827	2,566
LIGNITE		
Production: [1]	1,560	1,510
Provence	1,192	1,452
Region Landaise	243.5	242.7
Number of days worked	11.3	12.2
Average daily output (tons)	2,041	2,090
Number of workers	5.545	5.837
Output per man-shift (tons)		

p Preliminary.
[1] Figures differ from those shown on table 1 because of source.

Source: Charbonnages de France. Statistique Annuelle, pp. 8, 9, 1973.

Imports of coke rose significantly, to 3.1 million tons, while receipts of patent fuel and lignite briquets were off 18% and 8%, respectively. A declining trend in imports of patent fuel and lignite has continued for more than a decade, reflecting the increased use of petroleum products and natural gas in home heating and small industries.

Coal (anthracite and bituminous) imports in 1972, which amounted to 11.7 million tons, were supplied principally by West Germany, the United States, Poland, and the U.S.S.R.; lesser but important tonnages were imported from the Republic of South Africa, the Netherlands, the United Kingdom, Belgium, and Australia. Receipts from West Germany in 1972 were virtually

unchanged while declines of 43%, 20%, and 17%, were noted for coal imported from the United States, Poland, and the U.S.S.R., respectively.

Imports of coal in thousand metric tons by country of origin, for the past 3 years, follows:

Origin	1972	1971 [1]	1970 [1]
Australia	69	--	46
Belgium	229	203	108
Germany, West	5,885	5,842	6,100
Netherlands	336	410	495
Poland	1,638	2,045	1,533
South Africa, Republic of	381	209	111
U.S.S.R.	1,169	1,416	1,454
United Kingdom	299	466	500
United States	1,691	2,958	3,340
Other	2	87	29
Total	11,699	13,636	13,716

[1] Figures differ from those shown on table 3 because of source.

Factors contributing to the drop in imports from certain countries in 1972 were reported to be (1) existing large stockpiles of coal and coke, (2) a moderate steel demand, and (3) a delay in the completion of the new battery of coke ovens at the Usinor steel complex at Dunkirk.

Coke and Coal Chemicals.—Production of coke and coal chemicals decreased 8% and 14%, respectively, in 1972 compared with 1971 output. Most of the production was from the Nord-Pas-de Calais basin with some small amount from the Lorraine basin.

Production in thousand tons of coke and coal chemicals in France for the past 2 years was as follows:

	1971 [1]	1972 [1]
Coke-oven coke:		
Plants annexed to colliers	7,387	6,807
Steel plants cokeries	5,120	4,738
Other coke	5	13
Total	12,512	11,558
Coal chemicals	3,738	3,219
Total	16,250	14,777

[1] Figures differ from those shown on table 1 because of source.

Source: Charbonnages de France. Statistique Annuelle, pp. 44, 45, 1973.

The construction of two new batteries of coke ovens at Usinor's steel complex in Dunkirk continued during the year with the completion expected in August 1973. The new ovens are part of the large increase in steelmaking capacity at Usinor. Usinor at present uses 450 kilos of coke to obtain 1 ton of pig iron. In its new blast furnace, it expects to reduce the coke input to 350 kilos.

The Fos-sur-Mer steel complex near Marseille was to begin operation by the spring of 1974. The Fos complex will require 2 million tons of coking coal for the first stage operation.

Natural Gas.—France is richer in natural gas than in many other natural mineral resources, but the 7 billion cubic meters produced in 1972, mainly from Aquitaine's Lacq deposits in the southwest satisfied only half of the country's requirements. The deficit was made up by supplies piped down from the Netherlands.

Two agreements signed during the year arranged for future natural gas imports. One of the contracts was between a European Consortium of Belgium, West Germany, and French companies, and Algeria. Under the contract, an Algerian company, SONATRACH, will supply 3 billion cubic meters of gas over a 20-year period at a price elastic enough to cope with currency fluctuations. The site of the gas pipeline remained undecided by yearend. The other natural gas contract was between the U.S.S.R. and three European countries, France, Italy, and the Netherlands. This contract calls for delivery of Russian natural gas to Italy and in return, Ente Nazionale Idrocarburi (ENI) of Italy will cede to France equivalent quantities of the Netherland's natural gas. The U.S.S.R. will receive payments from France in the form of natural gas industry machinery and other equipment. The first delivery of 2.5 billion cubic meters per year of Soviet gas will take place in 1976 and will continue for about 20 years.

Petroleum.—France has virtually no domestic petroleum reserve and is dependent on the Middle East and North Africa for more than 80% of its petroleum needs. In the first half of 1972, the Persian Gulf area provided 55% of France's total crude oil imports, a 24.2% increase from the first half of 1971. Saudi Arabia was again the most important source of oil with 369,000 barrels per day, up 35.9%, followed by Kuwait, Nigeria, Libya, and Algeria. In addition, France received 37,430 barrels per day from Gabon, 33,720 from Venezuela, and 29,130 barrels from the U.S.S.R.

An agreement between France and Spain on Continental Shelf boundaries in the

Bay of Biscay was virtually concluded and ready for affirmation by both countries at the end of 1972. Discussions between France and Spain and France and Great Britain regarding Continental Shelf boundaries on their respective territories continued during the year.

Domestic consumption of petroleum products exceeded 100 million tons in 1972, an increase of more than 11% over the 1971 level. According to Comité Professionnel du Pétrole, sales of heavy fuel oil continued to set the pace, with deliveries to Electricité de France alone up by one-third. The increase in gasoline sales was marginally ahead of that for 1971. Consumption of major oil products in thousand tons for 1971–72 and percentage of change follows:

Product	1971	1972 [1]	% change
Inland:			
Regular gasoline	3,183	2,858	−10.2
Premium gasoline	10,138	11,674	+15.1
Aviation gasoline	50	46	−8.0
Jet fuel	1,503	1,735	+15.4
Special gasoline	73	70	−4.1
White spirit	132	143	+8.3
Kerosine	57	48	−15.8
Gas oil	5,173	5,768	+11.5
Fuel oil domestic	31,510	33,862	+7.5
Light fuel oil	2,286	2,168	−5.2
Heavy fuel oil	25,365	29,998	+18.3
Lubricants	911	970	+6.5
Liquefied petroleum gas	2,331	2,500	+7.2
Bitumen	2,720	2,980	+9.6
Parafin wax	59	55	−6.8
Petroleum coke	225	230	+2.2
Incandesabile gas	242	270	+11.6
Light fractions	791	930	+17.6
Petrochemical fuel stocks	3,260	3,600	+10.4
Bunkers:			
France	1,762	1,950	+10.7
Foreign	2,393	2,900	+21.2
Natural gas (billion cubic meters)	12.3	14.0	+13.8

[1] Figures for products from gasoline down to fuel oil based on actual deliveries; remaining products, and natural gas consumption was estimated.

Source: Comité Professionnel du Pétrole (Paris). 1972, p. 171.

Refineries.—In terms of crude petroleum capacity, the Compagnie Française des Pétroles refinery in Gonfreville became the world's second largest refinery in 1972. The plant capacity is 637,000 barrels daily, second only to a newly expanded 630,000-barrel-per-day Amuay plant in Venezuela.

A contract was signed between the U.S.S.R. and Enterprise de Recherche et d'Activités Pétrolières (ELF-ERAP) to expand refinery capacity of the Bordeaux plant from 2 million tons per year to 6 million tons per year, and to construct a petroleum coke plant with 200,000 tons capacity as part of the expansion project. The refinery expansion will require an investment of $81 million and the coke plant about $40 million. The U.S.S.R. will supply equipment for the refinery valued at $12 million. The new capacity and coke plant production were scheduled to go into operation in late 1975.

French refinery capacity in million tons for the years 1965, 1971, and 1972, as well as location and ownership, follows:

Refinery	1965	1971	1972
North:			
Dunkerque (BP)	5.5	5.5	5.5
Valenciennes (Antar)	--	3.5	3.5
Le Havre/Basse-Seine:			
Gonfreville (CFR) [1]	10.6	14.3	23.3
Port-Jerome (Esso)	4.0	7.2	7.2
Petite-Couronne (Shell)	5.5	9.2	9.2
Gravenchon (Mobil)	3.6	3.6	3.6
Vernon (BP)	--	3.0	3.0
Ile de France (Paris):			
Grandpuits (ELF)	--	3.6	3.6
Gargenville (ELF)	--	3.7	6.0
Atlantic:			
Donges (Antar)	4.1	8.0	8.0
Vern-sur-Seine (Antar)	1.2	1.4	1.4
Pauillac (Shell)	.5	4.5	4.0
Ambès (ELF)	1.8	2.0	2.0
Bordeaux (Esso)	2.4	2.8	2.9
Mediterranean:			
Frontignan (Mobil)	1.7	4.0	4.0
La Mède (CFR)	6.4	10.2	10.2
Berre (Shell)	6.0	7.5	13.5
Lavéra (BP)	4.4	4.9	11.0
Fos-sur-Mer (Esso)	3.0	3.0	3.0
Alsace/Lorraine:			
Reichstett (CRR) [2]	3.7	3.7	3.7
Herrlisheim (SRS) [3]	3.9	4.4	4.5
Hauconcourt (SRL) [4]	--	4.4	4.4
Lyonnais:			
Feyzin (ELF)	2.0	6.9	7.2
Total	70.3	121.3	144.7

[1] Compagnie Française de Raffinage (CFR).
[2] Compagnie Rhénane de Raffinage-Shell/Mobil/ELF.
[3] Société de la Raffinerie de Strasbourg-Antar/BP/CFR.
[4] Société de la Raffinerie de Lorraine—CFR/Esso/ELF.

Prices.—In October 1972, the French Government decided to raise gasoline and gas oil taxes in 1973. An increase of about 2.3 cents per gallon in the price of regular grade gasoline and gas oil, and 3 cents for premium-grade gasoline was announced by the Finance Ministry. The Minister noted that the Government had not raised gasoline taxes since 1969. It is estimated that, the tax increase will raise an additional $85-million revenue. In 1972, various taxes made up over 72% of the price of ordinary-grade gasoline in France.

The price of domestic Lacq gas, frozen since 1963 and lagging far behind fuel oil

prices, was freed in early 1972. In three steps the Lacq price, and those of all natural gas including imports sold by the state utility to industrial users, moved up 25%. Simultaneously, fuel oil prices slumped, reflecting excess supplies owing to the big switchover by refineries to heavy Persian Gulf crude oil.

Transportation.—A 40-inch oil trunkline from Fos to Strasbourg was completed in 1972, bringing total capacity of the South European crude oil pipeline to about 1.3 million barrels daily. When all work under construction is completed, the South European crude pipeline will be able to carry 1.8 million barrels per day.

Commercial pipelines for the transport of petroleum products in France, at the end of 1972, as well as those under study, are shown as follows:

Region and route	Start of operation	Length (kilometer)	Diameter (inches)	Capacity (million tons per year)	Owner and operator
Le Havre:					
Le Havre-Petite Couronne	1972	72	14	--	Shell.
Nantes:					
Donges-Cordemais	1969	18	12	--	Antor Pétroles de L'Atlantique.
Cordemais-Cheviré	1969	26	8	--	Do.
Strasbourg:					
Reichstett-Strasbourg	1963	11	10	--	Compagnie Rhénane de Aaffinage.
Do	1963	11	12	--	Dentsche Shell 48%, Elf-Union 10%.
Herrlisheim-Strasbourg	1963	21	10	--	Shell Française 37%; Mobil 5%.
Do	1963	21	8	--	Société de la Raffinerie de Strasbourg.
Klarenthal-Carling	1968	18	6	--	CFP 16% to 67%; Antar 32% to 33%.
Bordeaux:					Saarland Raffinerie G.m.b.H.
Pauillac-Bassens	1969	43	12	2	Shell.
Bec d'Ambès-toulouse	(1)	270	--	--	--
Mediterranean:					
Frontignan-toulous	(1)	240	--	--	--
Berre l'Etang-Nice	(1)	200	--	--	Société des dépôts de Pétrole Cotiers.
La Mède-Garonte	(2)	8	12	--	CFR.
Do	(2)	8	8	--	Do.
Berre L'Etange-Lavéra	(2)	35	14	--	Shell.
Do	1972	24	20	6	Do.
Fos-Lavéra	1965	11	10	--	Esso.
Do	1965	11	8	--	Do.
Do	1965	11	6	--	Do.
Lyon region:					
Feyzin-St Quentin fallavier	1964	26	10	--	Elf-Union.
Feyzin-St. Fons	1965	5	4	--	Do.

[1] Under study; date of start in doubt.
[2] In operation (prior to 1972).

Source: Petroleum Press Service, No. 12, December 1972, p. 458.

The Mineral Industry of Gabon

By Henry E. Stipp [1]

The mineral industry of Gabon continued to forge ahead with increased output of manganese ore, crude oil, and natural gas. Although production of gold and uranium concentrate decreased from that of 1971, the value of gold increased sharply. Production of mineral commodities (excluding petroleum refinery products) in 1972 increased in total value to an estimated $145 million [2] compared with $128 million in 1971. Mining was the most dynamic sector of Gabon's economy in 1972, accounting for about 40% of the gross domestic product (GDP) estimated at $361 million.

The mining of additional mineral deposits such as iron, lead and zinc, copper, diamond, and phosphate rock, known to occur in the interior of the country, depends upon construction of a railroad. The proposed Trans-Gabon Railroad, which eventually will run from the Port of Owendo to Belinga and provide access to an 860-million-ton iron ore deposit, received a setback. The World Bank indicated that the railroad project was not economically sound and refused a loan for construction of the line. However, the European Development Fund (FED) concluded that the railroad could be built economically and provided a loan of about $9 million towards construction of the rail line. A number of foreign governments, including the United States, also were expected to advance loans. The cost of building the first leg from Owendo to Booue recently was estimated at over $200 million, and was scheduled for construction beginning sometime in 1973.

Construction on the Port of Owendo was expected to be completed in 1974. Infrastructure at the port will include a petroleum depot, an industrial park, warehouses, and several other facilities.

The Gabon Government planned to develop domestic industries, which would process indigenous raw materials and produce items presently imported. Mineral industry projects envisaged an expansion of the oil refinery at Port Gentil, a marble works, and plants for cement, nails, fertilizers, and batteries.

The United Nations Development Program (UNDP) was conducting a mineral survey in the Koulamoutou-Franceville region of southeastern Gabon and in the Woleu-Ntem region of northern Gabon. Cost of the 3-year project, which will be completed in 1973, was reported as follows: United Nations $578,000, and the Government of Gabon $450,000. In addition to the project previously described, the UNDP was engaged in aeromagnetic and geomorphological studies costing $480,000; Gabon's share of the cost of this project was $300,000.

The Government reaffirmed its policy of liberal economic development and private enterprise management; however, recently it has been applying pressure on foreign controlled companies for government participation of from 10% to 55% in the capital equity of the firms. Placing of Gabonese in senior administrative positions and giving employees certain benefits also has been advocated by the Government.

Investment in Gabon by U.S. mineral commodity producing companies was estimated at $124 million in 1972.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from African Financial Community Francs (CFAF) to U.S. dollars at the rate of CFAF 228=US$1.00.

PRODUCTION AND TRADE

Mineral commodities produced in Gabon consisted mainly of manganese ore, gold, uranium concentrate, crude petroleum, natural gas, and petroleum products as shown in table 1.

Statistics on foreign trade in mineral commodities are shown in tables 2 and 3.

Table 1.—Gabon: Production of mineral commodities

Commodity [1]	1970	1971	1972 [p]
Gas, natural:			
Gross production ---million cubic feet--	[r] 9,900	10,594	12,000
Marketed production ---do---	[r] 763	1,077	1,240
Gold, mine output, metal content ---troy ounces--	16,108	13,728	11,413
Manganese:			
Ore, 50% to 53% Mn, gross weight ---thousand tons--	1,453	1,866	1,903
Pellets, battery and chemical grade, 82% to 85% MnO_2, gross weight ---do---	24	37	34
Total ---do---	1,477	1,903	1,937
Petroleum:			
Crude ---thousand 42-gallon barrels--	39,292	41,911	45,671
Refinery products:			
Gasoline ---do---	1,218	1,329	1,180
Jet fuel and kerosine ---do---	881	810	724
Distillate fuel oil ---do---	1,386	2,087	2,059
Residual fuel oil ---do---	2,604	2,517	2,488
Other ---do---	52	61	57
Refinery fuel and losses ---do---	190	274	213
Total ---do---	6,331	7,078	6,721
Uranium oxide (U_3O_8) content of concentrate ---metric tons--	377	545	523

[p] Preliminary. [r] Revised.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, sand, gravel, and stone) was also produced but output is not reported and available information is not adequate to make reliable estimates of outpul levels.

Table 2.—Gabon: Apparent exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
Chromite	5,158	700	All to France.
Copper metal, including alloys:			
Scrap	54	---	All to France.
Unwrought, refined	24	38	All to Italy.
Manganese ore	1,049,913	926,957	France 459,581; United States 277,225; West Germany 150,588.
Petroleum:			
Crude --thousand-42-gallon barrels--	13,022	17,352	France 11,924; Belgium-Luxembourg 2,211; West Germany 2,054.
Refinery products, residual fuel ---do---	105	166	United States 111; Belgium-Luxembourg 55.
Uranium and thorium ores and concentrates	[2] 1,467	1,464	All to France.

[1] Source: Unless otherwise noted, Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. III (Africa), Walker and Company, New York, pp. 139–140.

[2] Source: Statistical Offices of the European Communities. 1971 Foreign Trade Analytical Tables, V's. B and I, Luxembourg.

Table 3.—Gabon: Apparent imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity		1970 [1]	1971 [2]
Aluminum and alloys, all forms		130	81
Barite and witherite		2,599	4,556
Cement		37,143	35,526
Clay products, nonrefractory		1,408	NA
Copper metal and alloys, all forms		41	9
Iron and steel semimanufactures		25,031	22,190
Petroleum refinery products:			
Lubricants	thousand 42-gallon barrels	21	16
Other	do	2	(3)
Sodium and potassium compounds, caustic soda		—	468
Stone, sand and gravel, dimension, worked		292	69
Other, crude minerals, n.e.s		2,849	336

NA Not available.
[1] Source: Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. III (Africa), Walker and Company, New York, pp. 141–149.
[2] Source: Statistical Offices of the European Communities. 1971 Foreign Trade Analytical Tables. V's. B and I, Luxembourg.
[3] Less than ½ unit.

COMMODITY REVIEW

METALS

Iron Ore.—Japanese steel companies were invited to participate in the development and financing of the Mékambo iron ore deposits by government and Société des Mines de Fer Mékambo (SOMIFER) representatives.[3] SOMIFER reportedly planned to ship a minimum of 15 million tons per year of iron ore and concentrates starting in 1981. Construction of harbor facilities and a railroad from the port to the deposits near Mékambo was expected to be completed by 1978.

Manganese.—The manganese produced in Gabon by Compagnie Minière de l'Ogooué (COMILOG) represents about 21% of the world's annual supply and in 1972 ranked Gabon as the third largest producer in the world after the Republic of South Africa and the U.S.S.R.[4] Reserves are estimated at more than 200 million tons of ore containing 50% to 52% manganese. However, the 148-square-mile concession is still being charted, and COMILOG also has two prospecting permits and three exploration permits. COMILOG produces ore of 50% to 52% manganese content, 44% to 48% manganese content, and since 1965, a manganese concentrate containing 77% to 80% manganese, for use in dry-cell batteries.

During the 5-year period (1971–76) COMILOG planned to spend about $5.3 million for new railroad equipment, $1.8 million for the modernization of the cable hauling system, and $4.4 million for new equipment to increase production to 2.5 million tons per year.[5] In 1972 COMILOG employed 1,500 persons, and paid $2.5 million for salaries.

Construction of a plant at Libreville to produce 7 million round, 1.5-volt dry cells was being studied by Société des Piles Electriques. Cost of the plant was estimated at $701,754. The United Nations Industrial Development Organization also was conducting a supplementary study of the plant.

Uranium.—Uranium has been produced since 1961 by Compagnie des Mines d'Uranium de Franceville (COMUF). Reserves, which now total 20,600 tons of uranium, are about 5 times higher than estimated at the start of exploitation.[6] The Mounana deposit has been estimated to contain 1,780 tons of uranium; 3,280 tons are estimated to occur in a deep deposit at Boyindzi and 10,000 tons in a deposit at Oklo. In addition, 5,540 tons probably occur in the Mikouloungou deposit, (Mingara permit) between Mounana and Franceville. The ore, which is mined at Mounana, has a 4% to 5% uranium content. A sulfuric acid bath process is used to concentrate the ore into a 30% to 35% uranium product, which is shipped through Congo (Brazzaville) to

[3] World Mining. Gabon. V. 26, No. 3, March 1973, pp. 112–113.
[4] U.S. Embassy, Libreville, Gabon. State Department Airgram A–038, May 1, 1973, 5 pp.
[5] Afrique Industrie Informations (Paris). Importance of Mining Production Increasing. Nov. 1, 1972, pp. 48–51.
[6] Work cited in footnote 5.

France. At current rates of production the ore should last until 1990. Geological explorations are being conducted to find other deposits of uranium. COMUF has an annual employment of 1,000 persons.

NONMETALS

Cement.—A clinker crushing plant, consuming raw materials imported from Senegal, began operating at Owendo in December 1969 and produced 22,695 tons in 1970.[7] The plant belonging to Société des Ciments d'Owendo represented an investment of about $1.5 million. The second 5-year plan (1971–76) called for an integrated cement works to be built by 1974, using the limestone deposit on Coniquet Island as a raw material source.

MINERAL FUELS

Natural Gas.—Société Gabonaise de Chimiques (SOGACHIM) planned to construct a fertilizer plant at Port Gentil, which would use natural gas as a raw material source.[8] Capacity of the plant would be 800 tons per day of ammonia and 1,100 tons per day of urea. SOGACHIM planned to invest about $110 million for plant and port installations.

Petroleum.—Production of crude oil totaled about 45.7 million barrels in 1972 compared with about 42.0 million barrels in 1971. Société Elf des Pétroles d'Afrique Equatoriale (Elf-Spafe) was the major producer with output of about 35.8 million barrels, followed by Shell Oil Co. of Gabon with output of 9.9 million barrels. Production was increased utilizing secondary recovery methods at the Port Gentil field of Elf-Spafe and the Gamba-Ivinga fields of Shell Oil Co. The Torpille field of Elf-Spafe also added to total production. The Grondin Marine field of Elf-Spafe, located about 50 miles south of Port Gentil, was scheduled to begin producing in late 1973 or early 1974. Elf-Spafe reported two new discoveries during the year.[9]

At midyear, the Mandaros Marine well, offshore and 12.4 miles south of Grondin Marine, tested 2,200 barrels per day of viscous, high-sulfur crude from a zone between the 5,250-foot and 5,578-foot levels. The Pageau Marine well located 6 miles west of the Torpille field in the Port Gentil area gave a small flow of heavy crude from a sandstone zone at a depth of 9,187 feet. At yearend, Elf-Spafe discovered oil at its Barbier Marine No. 1, located offshore about 5 miles south of Mandaros Marine well. Initial tests gave 2,988 barrels per day of 0.89-density crude from a depth of 6,234 feet to 6,411 feet.[10] Reportedly, Elf-Spafe will invest about $72 million during the 1972–74 period. At yearend, six drilling rigs were working in Gabon; five were operating at sea and the other one was drilling on land. Elf-Spafe in association with Standard Oil Co. of California, was scheduled to resume exploration north of Lambaréné. The Elf-Spafe Port Gentil oil terminal was being enlarged to take 125,000-ton tankers.

The Port Gentil Oil refinery was preparing to make asphalt to sell in the Union Douanière et Économique de l'Afriquè Centrale (UDEAC) countries and Chad.[11] Total production would be about 18,000 tons, of which Gabon would consume one-third. Up to now, all asphalt has been imported. The Port Gentil refinery operated by Société Gabonaise de Raffinage (SOGARA) has a crude oil capacity of 17,200 barrels per stream-day, and a catalytic reforming capacity of 1,500 barrels per stream-day.[12] It purchases 15% of the crude produced in Gabon and refines products for the domestic market, the four UDEAC countries, and Chad. Some fuel oil also is exported to Europe. SOGARA is owned by eight oil companies (75%) and the UDEAC countries plus Chad (25%). The refinery is clean, modern, highly automated, and producing above its original designed capacity.

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[7] Afrique Industrie Informations (Paris). The Most Important Plans Concern the Textile, Chemical, and Lumber Industries. July 1, 1972, pp. 804–809, 811.

[8] Work cited in footnote 5.

[9] World Petroleum Report. Gabon. V. 19, 1973, p. 63.

[10] Marches Tropicaux et Mediterraneens (Paris). Oil Discoveries. Jan. 19, 1973, p. 162.

[11] U.S. Embassy, Libreville, Gabon. State Department Airgram A–036, Apr. 17, 1973, 6. pp.

[12] U.S. Embassy, Libreville, Gabon. State Department Airgram A–015, Mar. 5, 1973, 4 pp.

The Mineral Industry of East Germany

By Joseph B. Huvos [1]

In 1972, East Germany was the world's leading producer of lignite, accounting for about one-third of the world's output. It was fourth in the production of potash, providing about one-seventh of the world's total. Other mineral commodities were produced but in lesser quantities by world standards. These included salt, iron ore, bituminous coal, nonferrous metals, fluorspar, natural gas, and crude oil. Efforts continued to switch East Germany's chemical industry from its lignite base to one using imported crude oil and domestic and imported natural gas.

East Germany official statistics were not complete; data on only selected commodities were reported. East Germany's mineral-processing industries continued to operate mainly on imported raw materials, including most notably bauxite, aluminum, iron and steel, phosphates, and crude oil.

During 1972, the value of all industrial goods produced in East Germany increased by 11 billion marks,[2] to 192.9 billion marks.

The increase in production values of minerals and related industries in 1972 follow:

Plants in area of ministries	Increase in percent as compared with 1971
Coal and energy	1.2
Ore mining, metallurgy, potash	5.9
Chemical industry	8.0
Glass and ceramics	6.1
Geology	26.0

Source: Neues Deutschland (East Berlin). V. 28, No. 19, Jan. 19, 1973, p. 3.

PRODUCTION

East Germany's iron and steel industry continued to expand at a moderate rate, while domestic production of most nonferrous metals ores decreased in 1972.

In the potash area, the effect of new developments for expanding production were not yet evident. Among the fossil fuels, lignite production decreased only insignificantly and is to be stabilized at this level in the future; production of bituminous coal declined as expected. East Germany's small crude oil production remained insignificant in spite of a 25% increase. East German natural gas production continued its spectacular increase and reached a position of national economic significance.

[1] Foreign mineral specialist, Division of Fossil Fuels—Mineral Supply.

[2] Values have not been converted from East German currency units (marks) to US dollars owing to fluctuating exchange rates. The official East German exchange rate not recognized by the International Monetary Fund was 2.22 marks = US$1.00.

Table 1.—East Germany: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Aluminum:				
Alumina		54,796	47,348	50,000
Metal, primary [e]		60,000	[r] 60,000	60,000
Cadmium metal, primary [e]		15	[r] 15	16
Copper:				
Mine output, metal content [e]		10,000	[r] 5,000	3,000
Metal:				
Smelter		10,000	2,000	2,400
Refined [e]		40,000	40,000	40,000
Iron and steel:				
Iron ore [2]	thousand tons	422	318	268
Pig iron (excluding ferroalloys)	do	1,994	2,028	2,150
Crude steel	do	5,053	5,350	5,670
Steel semimanufactures (rolled products only)	do	3,407	3,551	3,705
Lead: [e]				
Mine output, metal content		10,000	10,000	7,000
Metal, refined, including secondary		25,000	25,000	20,000
Silver, mine output, metal content [e]	thousand troy ounces	4,800	5,000	5,000
Tin: [e]				
Mine output, metal content	long tons	1,000	1,000	1,000
Metal, including secondary	do	1,200	1,200	1,180
Zinc: [e]				
Mine output, metal content		10,000	10,000	8,000
Metal, including secondary		15,000	15,000	15,000
NONMETALS				
Barite [e]		30,000	30,000	30,000
Boron minerals, processed borax		4,211	3,911	[e] 4,000
Cement, hydraulic	thousand tons	7,987	8,473	[e] 8,950
Fertilizer materials, manufactured:				
Nitrogenous, nitrogen content:				
Ammonium sulfate	do	167	163	
Calcium ammonium sulfate	do	123	168	NA
Unspecified	do	105	57	
Total	do	395	388	NA
Phosphatic, P_2O_5 content:				
Superphosphate	do	206	207	
Calcined phosphate	do	134	122	NA
Thomas slag	do	14	13	
Unspecified	do	76	72	
Total	do	430	414	410
Potassic, marketable potash, K_2O equivalent	do	2,419	2,426	2,458
Fluorspar [e]	do	80	80	80
Gypsum and anhydrite:				
Crude [e]	do	289	315	315
Calcined	do	244	266	[e] 266
Lime and dead-burned dolomite	do	2,673	2,810	[e] 2,900
Pyrite: [e]				
Gross weight	do	140	140	140
Sulfur content	do	58	58	58
Salt:				
Marine	do	49	50	[e] 50
Rock	do	2,131	2,171	[e] 2,200
Sand and gravel	do	7,167	7,424	[e] 7,600
Stone, crushed	do	9,391	10,281	[e] 11,000
Sulfur:				
Elemental	do	109	100	105
Sulfuric acid	do	1,099	1,076	1,044
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous	do	1,300	1,200	1,000
Lignite	do	260,582	262,814	248,400
Total	do	261,882	264,014	249,400
Coke:				
From anthracite and bituminous coal	do	2,572	2,316	[e] 2,100
From brown coal:				
High temperature	do	1,308	1,759	1,944
Low temperature	do	4,968	4,415	3,792
Total	do	8,848	8,490	[e] 7,836

See footnotes at end of table.

Table 1.—East Germany: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Fuel briquets (from brown coal)	thousand tons	57,078	55,439	50,800
Gas:				
Manufactured	million cubic feet	150,758	158,213	169,299
Natural [e]	do	14,000	100,000	180,000
Petroleum:				
Crude [e]	thousand 42-gallon barrels	[r] 438	[r] 1,460	1,825
Refinery products:				
Gasoline	do	19,006	20,051	NA
Kerosine, jet fuel, and distillate fuel oil	do	27,504	27,507	
Residual fuel oil	do	30,663	33,940	
Lubricants	do	2,464	2,421	
Asphalt	do	3,430	4,170	
Total [3]	do	83,067	88,089	[e] 88,000

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, magnesium, nickel, peat, and additional varieties of crude nonmetallic construction materials are produced, but information is inadequate to make reliable estimates of output levels.
[2] Source indicates that data includes "roasted ore"; presumably roasted pyrite.
[3] Total of reported figures only; no estimates have been made for unreported products or for refinery fuel and losses.

TRADE

East Germany's limited mineral exports consisted mainly of lignite, briquets, potash, rock salt, gypsum, kaolin, chalk, and iron and steel semimanufactures.

As in previous years, the U.S.S.R. supplied an important part of the basic or raw materials needed by the key branches of East Germany's industry; the materials supplied were crude oil, coal and coke, iron ore, rolled steel, nonferrous metals, and chemical products. Hungary and Yugoslavia provided bauxite.

The intensive shipbuilding program at East German Baltic Ports continued to move toward the goal of enabling East Germany to transport a larger share of its trade in East German flag vessels.

Table 2.—East Germany: Exports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
METALS			
Aluminum metal and alloys:			
Scrap	2,327	1,376	Netherlands 1,107; Austria 269.
Unwrought	3,941	NA	
Copper and alloys:			
Scrap	2,109	666	All to Netherlands.
Unwrought and semimanufactures	2,165	211	Netherlands 143.
Iron and steel:			
Pig iron and ferroalloys—thousand tons	490	123	Sweden 77; Italy 35; Belgium-Lxembourg 11.
Scrap—do	40	835	Mainly to Denmark.
Steel, primary forms—do	46	4	All to Austria.
Steel semimanufactures—do	205	NA	
Lead:			
Oxides	1,536	1,643	Italy 932; Sweden 560; France 151.
Metal and alloys:			
Scrap	101	275	All to Netherlands.
Unwrought and semimanufactures	1,459	4,855	Netherlands 2,281; Italy 1,575; France 999.
Nickel and alloys, all forms	186	45	All to Netherlands.
Zinc:			
Oxides	3,705	3,415	Italy 1,266; Norway 1,208; France 941.
Metal and alloys, unwrought and semimanufactures	1,821	1,650	Netherlands 1,082; Belgium-Luxembourg 543.
Other, metal-bearing slag, ash and similar residues	14,723	12,025	Austria 10,343; Netherlands 1,682.
NONMETALS			
Chalk	35,776	[3] 35,924	NA.

See footnotes at end of table.

Table 2.—East Germany: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
NONMETALS—Continued			
Clays and clay products:			
Kaolin, crude	85,222	[3] 86,627	NA.
Refractory bricks	5,062	NA	
Products:			
Nonrefractory	9,717	6,709	Belgium-Luxembourg 3,219; Denmark 2,034; Austria 1,161; France 295.
Refractory	12,212	8,022	Belgium-Luxembourg 4,187; Sweden 3,806.
Cryolite	220	NA	
Feldspar and fluorspar	29,919	10,551	Austria 6,668; Yugoslavia 3,883.
Fertilizer materials:			
Potassic, crude and manufactured, K_2O equivalent—thousand tons	[4] 1,739	[3] 1,757	Poland 465; Czechoslovakia 448; United Kingdom 182; Hungary 160.
Gypsum, calcined	61,399	[3] 71,605	NA.
Pyrite, unroasted	3,950	NA	
Salt, rock—thousand tons	838	[3] 845	Sweden 70; Finland 60.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	14,476	7,612	All to Sweden.
Caustic potash, sodium and potassium peroxides	2,850	3,706	Denmark 2,193; Yugoslavia 1,168; Switzerland 345.
Stone, sand and gravel:			
Dimension stone	923	NA	
Crushed—thousand tons	169	[3] 214	NA.
Gravel—do	15	[3] 103	NA.
Sand—do	18	23	All to Austria.
Sulfur:			
Elemental	2,600	40,700	Do.
Sulfuric acid and monohydrate	10,209	[3] 6,737	NA.
Other, crude nonmetals n.e.s	18,604	13,649	Belgium-Luxembourg 4,996; Norway 4,797; Netherlands 3,856.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	8,600	[3] 8,500	NA.
Coal, brown coal briquets—thousand tons	3,786	[3] 2,760	Austria 238.
Coke—do	43	28	Sweden 27.
Gas (natural or manufactured not specified)—million cubic feet	1,300	[3] 932	NA.
Petroleum refinery products: [3]			
Gasoline—thousand 42-gallon barrels	3,946	3,776	NA.
Distillate fuel oil—do	3,648	1,810	NA.
Residual fuel oil—do	1,365	731	NA.
Paraffin—do	354	350	NA.
Montan wax—do	158	185	NA.
Crude chemicals from coal, gas, and oil distillation	7,528	NA	

NA Not available.
[1] Sources for 1970 data are as indicated in previous edition to this chapter.
[2] Unless otherwise indicated, data is derived from official import statistics of trading partners and United Nations sources.
[3] Official East German trade statistics.
[4] Erroneously reported as metric tons only in 1971.

Table 3.—East Germany: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971
METALS			
Aluminum:			
Bauxite	255,700	[3] 285,700	Hungary 224,100; Yugoslavia 58,512.
Alumina, Al_2O_3 content	63,303	[3] 63,392	West Germany 48,684.
Metal and alloys:			
Unwrought	99,494	[3] 102,400	U.S.S.R. 101,300.
Semimanufactures (rolled)	34,800	[3] 29,900	U.S.S.R. 22,900; Italy 609.
Cadmium metal and alloys, unwrought	261	171	All from U.S.S.R.
Chromium, chromite, Cr_2O_3 content	41,700	[3] 49,400	NA.
Copper:			
Ore and concentrate	4,442	8,067	Sweden 3,650; Austria 3,476; Italy 941.
Metal and alloys:			
Scrap	665	323	Switzerland 162; Canada 161.
Unwrought	2,143	NA	
Semimanufactures	495	872	Yugoslavia 775; Belgium-Luxembourg 64.

See footnotes at end of table.

Table 3.—East Germany: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971
METALS—Continued			
Iron and steel:			
Iron ore, iron content ..thousand tons..	1,490	[3] 1,561	U.S.S.R. 1,540.
Scrap ..do..	224	256	All from U.S.S.R.
Pig iron ..do..	748	[3] 822	Mainly from U.S.S.R.
Ferroalloys	17,300	[3] 16,700	NA.
Steel semimanufactures: [3 4]			
Rod ..thousand tons..	575	597	NA.
Hot-rolled strip ..do..	206	218	NA.
Light sheet ..do..	84	108	NA.
Heavy sheet ..do..	575	519	NA.
Lead, unwrought, unalloyed	44,400	46,400	All from U.S.S.R.
Magnesium, unwrought, unalloyed	3,202	3,371	Do.
Manganese ore:			
Metallurgical grade ..thousand tons..	175	193	Do.
Battery and chemical grade ..do..	3	2	Do.
Mercury ..76-pound flasks..	6,150	11,256	Spain 9,138; Italy 2,118.
Nickel metal, all forms	66	295	Netherlands 205; Sweden 90.
Titanium oxides	80	887	Belgium-Luxembourg 832.
Tungsten ore and concentrate	736	73	All from Spain.
Zinc, unwrought	38,552	43,309	U.S.S.R. 40,600; Spain 2,198.
Other:			
Ores and concentrates of molybdenum, tantalum, titanium, vanadium, and zirconium	167	48	All from United States.
Metals and alloys, n.e.s	429	NA	
NONMETALS			
Abrasives, natural:			
Dust and powder of precious and semiprecious stones, except diamond value, thousands..	$140	NA	
Grinding wheels and stones	155	207	Sweden 143; Austria 64.
Asbestos	44,968	[3] 58,342	U.S.S.R. 43,700.
Cement, hydraulic ..thousand tons..	200	205	All from U.S.S.R.
Clays and clay products:			
Kaolin, crude	34,906	331,721	Czechoslovakia 5,000.
Bentonite	905	5,172	All from Yugoslavia.
Refractory clays and burnt slate	2,559	--	
Products:			
Nonrefractory	--	155	All from Italy.
Refractory	2,344	968	France 954.
Diamond, industrial ..value, thousands..	$606	$898	All from Belgium-Luxembourg.
Feldspar and fluorspar	21,505	17,636	Norway 10,037; Yugoslavia 4,989; Sweden 2,610.
Fertilizer materials:			
Crude, phosphate rock and apatite concentrates, P_2O_5 content thousand tons..	488	463	U.S.S.R. 50.
Manufactured:			
Nitrogenous, N content ..do..	160	[3] 194	West Germany 169.
Phosphatic, P_2O_5 content ..do..	24	[3] 10	NA.
Graphite	4,927	[3] 6,327	U.S.S.R. 2,964.
Magnesite, crude, calcined and sintered	1,336	37,501	Mainly from Czechoslovakia.
Mica	1,165	[3] 1,073	NA.
Precious and semiprecious stones, except diamond ..value, thousands..	$225	NA	
Pyrite, sulfur content	106,582	[3] 74,433	NA.
Talc and related materials	1,405	1,353	All from Austria.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	28,400	[3] 35,400	U.S.S.R. 21,700.
Coal:			
Anthracite ..thousand tons..	100	101	All from U.S.S.R.
Bituminous ..do..	8,192	[3] 7,973	U.S.S.R. 3,753.
Coke ..do..	3,123	[3] 3,045	U.S.S.R. 1,294; Czechoslovakia 796; Poland 707.
Gas, manufactured ..million cubic feet..	5,640	[3] 3,888	NA.
Petroleum:			
Crude ..thousand 42-gallon barrels..	75,955	[3] 80,255	U.S.S.R. 76,278.
Refinery products, gasoline ..do..	169	NA	
Crude chemicals from coal, gas, and oil distillation	166	NA	

NA Not available.

[1] Sources for 1970 data are as indicated in previous edition to this chapter.

[2] Unless otherwise indicated, data is derived from official export statistics of trading partners and United Nations sources.

[3] Official East German trade statistics.

[4] Partial figures only; several classes of steel semimanufactures are not reported in official East German sources.

COMMODITY REVIEW

METALS

Aluminum.—In 1972, East Germany's aluminum production was estimated to have remained unchanged from that of 1971. All necessary raw materials were imported. In 1971, East Germany imported 285,700 tons of bauxite, most of it from Hungary. Some 63,392 tons of alumina were imported with 48,684 from West Germany.

A new aluminum broad strip mill of unspecified capacity was commissioned at Nachterstedt, which is part of the Mansfeld Kombinat, located between Magdeburg and Halle. The plant was designed in cooperation with the Kamakersk, U.S.S.R. aluminum works and the Moscow Aluminum Processing Institute, with plant and equipment imported from the U.S.S.R.[3]

Copper.—It was estimated that East German copper production declined further during the year. East Germany's copper occurs in polymetallic sulfide deposits underlain by the Central European Zechstein (higher Permian system). Mineralized layers average 25 to 30 centimeters in thickness. They are inclined 5° to 10° and require considerable development expenditures.[4]

East Germany and Chile concluded an agreement whereby Chile will sell to East Germany 46,000 tons of various copper products ranging from blister to fabricated products worth $50 million. Deliveries will be spread over 3 years, starting in 1973.[5]

Gold.—During the first quarter of 1972, East Germany sold 582,346 troy ounces of gold on the London market.[6]

Iron and Steel.—In 1972, East Germany's output of pig iron and crude steel both increased by 6%. The small domestic iron ore production declined further, making increased iron ore imports, mainly from the U.S.S.R., necessary. In addition, substantial quantities of steel semimanufactures had to be imported.

The Berlin Kombinat Metallaufbereitung collects scrap in East Germany. In 1972, its deliveries to the iron and steel industry averaged 8,500 tons daily. Iron and steel scrap collection in 1972 totaled 4.3 million tons.[7]

The Romanian foreign trade enterprise Metarom, using Romanian labor, completed the reconstruction of a furnace installation at the Maxhütte metallurgical works at Unterwellenborn. East Germany concluded a contract for purchasing unspecified quantities of steel semiproducts from the Nippon Steel Co.[8]

East Germany obtained an order from the Krivoi Rog works in Russia to supply a 250-millimeter light section mill with a capacity of 1 million tons per year.[9]

The Ernst Thälmann works of East Germany supplied a wire rodmill to the Cheliabinsk works in the U.S.S.R.[10]

In 1972, East German shipyards launched 87 oceangoing ships totaling 311,845 gross registered tons.

NONMETALS

Cement.—The first two production lines at the third Karsdorf cement plant became operative during the year. Their total productive capacity is 1.1 million tons per year.[11]

Chalk.—Chalk mining continued near Sassnitz on Rügen Island, where a fully mechanized processing plant of unspecified capacity operates.[12]

Fertilizer Materials.—During 1972, fertilizer productive capacity continued to expand rapidly. New plants, designed to use hydrocarbon feedstock, contrasted with the older pre-World War II plants that were based on brown coal.

Nitrogenous fertilizer plant construction continued in 1972. A 1,360-ton-per-day ammonia plant at the Leuna works, was reported under construction and scheduled for completion in 1974. Toyo Engineering Co. was the contractor, and the technology used was that of the Kellogg Co. A 400,000-

[3] Metal Bulletin (London). No. 5705, June 6, 1972, p. 15.
[4] Seventh International Mining Congress (Bucharest). Complex Economic Valuation of Deposits. J. Freudenberg & Assoc., September 1972.
[5] Mining Journal (London). V. 279, No. 7147, Aug. 11, 1972.
[6] Frankfurter Allgemeine Zeitung (Frankfurt). May 3, 1972, p. 17.
[7] Neues Deutschland (East Berlin). Daily 8,500 Tons of Scrap Reach Steelplants. V. 28, No. 64, Mar. 3, 1973, p. 2.
[8] Metal Bulletin (London). No. 5684, Mar. 17, 1972, p. 28.
[9] Metal Bulletin (London). No. 5746, Oct. 31, 1972, p. 31.
[10] Metal Bulletin (London). No. 5713, July 4, 1972, p. 30.
[11] Neues Deutschland (East Berlin). On Fulfillment of the 1972 Plan for the National Economy. V. 28, No. 382, Jan. 19, 1973.
[12] Neues Deutschland (East Berlin). Story of Chalk on the Island of Rügen. V. 28, No. 390, Jan. 27, 1973, p. 11.

ton-per-year urea plant was also under construction at the same location, with technology by Stamicarbon N.V.

At the Piesteritz works, a 1,360-ton-per-day ammonia plant was in the planning stage.[13] A 347,000-ton-per-day Stamicarbon process urea plant was also under construction at Piesteritz with completion scheduled for 1974. Main contractors were the Chemoproject of Czechoslovakia, with Rudex of Poland subcontracting most of the onsite work.[14]

East Germany ranked fourth in world potash production. Published economic plans include an expansion of potash mining capacity. Work continued on the important new mine of the VEB Kalibetriebe Zielitz near Magdeburg. The new mine came into production during 1972 and shipped its ore to other plants for processing. Its own processing facility is scheduled for completion in 1973. Although the Zielitz project absorbed most of the available investment funding, other, older, projects were also improved.[15]

Plans were announced to add 50,000 tons storage capacity to the existing potash storage facilities at Wismar. Wismar, on the Baltic coast, is a transshipment port with facility for potash exports.[16]

Production of phosphatic fertilizers decreased slightly in 1972. East Germany imports raw phosphatic fertilizer raw materials, (apatite concentrate) mainly from the Kola Peninsula in the U.S.S.R. Imports in 1972 also included 51,000 tons of phosphate rock from Morocco and 22,000 tons from Tunisia.

The average fertilizer consumption per hectare of cultivated land in East Germany in 1971 was as follows: 83.7 kilograms nitrogen, 64.3 kilograms phosphorus pentoxide, and 99.1 kilograms potassium oxide.[17]

Sulfuric Acid.—Sulfuric acid production decreased 3% during 1972. In 1971, almost 40% of East Germany's sulfuric acid output was derived from pyrite roasting, 10% from elemental sulfur, and the balance from nonferrous ore smelting and coke processing. At Magdeburg, a double contact sulfuric acid plant based on Polish Frasch sulfur was nearing completion in 1972.[18]

MINERAL FUELS

East Germany's total estimated energy production in 1972 amounted to 94.8 million tons in standard coal equivalent and was comprised of lignite (91.2%), bituminous coal (1.1%), natural gas (7.1%), crude oil (0.3%), and other sources which include hydroelectric and nuclear energy (0.3%).

Total energy production in East Germany in 1970, the last year for which detailed data are available,[19] amounted to 81.5 million tons in standard coal equivalent showing a gain of 3.4% over the output of 1969. Of the total national energy production, 97.14% was derived from coal and lignite, 0.48% from crude petroleum, 2.12% from natural gas, and 0.26% from other sources.

East Germany's primary energy consumption in 1970 and published plan figures for 1975 as shown in the below tabulation.

[13] Oil and Gas Journal. V. 70, No. 14, Apr. 3, 1972, p. 93.
[14] Nitrogen (London). No. 79, September–October 1972, p. 15.
[15] Phosphorous and Potassium (London). No. 62, November-December 1972, p. 33.
[16] Seewirtschaft (East Berlin). February 1972, p. 95.
[17] Statistische Praxis (East Berlin). V. 27, No. 5, May 1972, pp. 180-181.
[18] Sulfur (London). No. 102, September–October 1972, p. 12.
[19] United Nations. World Energy Supplies 1961–70. Statistical Papers, Series J, No. 15, United Nations, New York, 1972, p. 30.

Commodity	1970			1975 plan		
	Quantity (million metric tons)	Standard coal equivalent (million metric tons)	Percent	Quantity (million metric tons)	Standard coal equivalent (million metric tons)	Percent
Bituminous coal and coke	1.3	1.0	1.0	10	10	8.0
Lignite	260.6	87.6	85.1	255	74	58.7
Crude oil and refined products	10.3	12.2	11.9	18	26	20.6
Natural gas ____million cubic feet	98,000	1.7	1.7	494,403	15	12.0
Other (nuclear, hydroelectricity)	XX	.3	.3	XX	1	.7
Total energy	XX	102.8	100.0	XX	126	100.0

XX Not applicable.

Source: Glückauf Essen, V. Fricken: The Energy Situation in the DDR. V. 108, No. 23, Nov. 9, 1972, pp. 1090–1095.

As in previous years, lignite was East Germany's principal source of energy. In the future, however, a larger share of national energy requirements is to come from natural gas, crude oil, and nuclear energy. Published data indicate an expected average annual increase of 5% in East Germany's total national energy consumption in the next 5 years.

The U.S.S.R. is the major supplier of the crude oil imported and is also to supply East Germany with natural gas. Imports of energy sources are to increase in 1975 to 32% compared with 25% in 1970.

During the 1971–75, 5-year plan, more than 30% of East Germany's industrial investment is programed to be in the area of energy.

Coal and Lignite.—East Germany's lignite output decreased an estimated 5.0% in 1972, compared with that of the previous year. Thus East Germany is the world's leading producer of lignite in 1972, followed by the U.S.S.R. (second), West Germany (third), and Czechoslovakia (fourth). According to existing plans, East Germany's lignite production will be kept at a constant or slightly decreasing level in the near future. Estimated reserves of lignite of the nation were in excess of 24,000 million tons in 1970.

East German lignite is a lower rank fuel and has a calorific value of approximately one-third that of standard bituminous coal. The moisture content ranges from 45% to 56% for the Magdeburg deposits and 52% to 62% for the Lausitz deposits. The ash content of typical lignite ranges between 6% and 13%.

Principal East German lignite deposits and estimates of reserves are the Lausitz deposit (Seftenberg-Cottbus-Görlitz-Zittau) with 15,000 million tons and Borna (Leipzig-Halle and Magdeburg) with 9,000 million tons.

East German bituminous coal production decreased 16.7% in 1972 compared with that of the previous year. Reserves of bituminous coal were estimated to be 10 to 15 million tons. Geological circumstances make the mining of these deposits expensive. Production will be reduced further in the future.

Natural Gas.—In 1972 East Germany's natural gas production increased by an estimated 80% over that of 1971. According to published production plans for 1975, East Germany's natural gas production will increase by another 75% to 315,000 million cubic feet per year.

East Germany's natural gas reserves that were discovered recently could exceed an estimated 3,500,000 million cubic feet.

East Germany's natural gasfields are located in the Magdeburg Area (near Langensalza and Salzwedel) and the Reinkenhagen Area.

The quality of East German natural gas is different from that of other known natural gas because it contains substantial amounts of nitrogen.

In 1972 East Germany was a net importer of natural gas, with imports of 5,600 million cubic feet. According to published plans, imports of natural gas, all from the U.S.S.R., will reach 140,000 million cubic feet per year in 1975.

In the past, East Germany's gas supplies consisted exclusively of manufactured gas, which was used principally as a feedstock for the petrochemical industry. According to published plans, East Germany's manufactured gas production, which was 158,213 million cubic feet in 1971, will not be increased further in the future and will constitute 20% of East Germany's gas supply in 1975. Domestic and Soviet natural gas will provide the remaining 80%.

In 1972, East Germany's gas pipeline network consisted of separate lines for indigenous natural gas, imported U.S.S.R. natural gas, and manufactured gas. Soviet natural gas imports will become possible in 1973, when the "Northlight" transcontinental gas pipeline joining Soviet gasfields to East Germany becomes operational.[20]

Petroleum.—Although production increased by an estimated 25% in 1972, crude oil production remained an insignificant factor in the national economy, in spite of concerted exploration efforts.

East Germany was a net importer of crude oil in 1972. The U.S.S.R. supplied the bulk of the 11 million tons of imported crude oil; about 1 million tons were imported from the United Arab Republic of Egypt. It was reported that East Germany attempted to purchase additional supplies of crude oil from Middle East

[20] Glückauf, Essen, V. Fricken: The Energy Situation in the DDR. V. 108, No. 23, Nov. 9, 1972, pp. 1090–1095.

countries.

Apparent consumption of crude oil and petroleum products increased by an estimated 5% during 1972. Crude oil was used mainly as a feedstock for East Germany's petrochemical industry, where it is increasingly replacing solid fuels previously used.

East Germany's petroleum refining capacity was about 12 millions tons per year in 1970. At the same time, throughput was 10.3 million tons of crude per year. According to published plans, refining capacity is to be expanded by 1975 to 20 million tons, making a throughput of 18 million tons per year possible. East Germany's refining capacity was concentrated in two main areas: the Halle Area and Schwedt an der Oder. Leuna, Böhlen, and Lützkendorf, the most important plants in the Halle Area, have a total estimated capacity of 4 million tons per year, of which Leuna accounts for 2.5 million tons per year. Schwedt an der Oder has at present a throughput of 8 million tons per year.

East Germany has a well-developed pipeline system feeding its refineries, the main lines of which are from the Urals (U.S.S.R.) to Schwedt (Friendship pipeline, north branch); from Schwedt to Rostock; from Schwedt to Leuna; and from Schwedt to East Berlin. At present, the Friendship pipeline is under expansion to double capacity, and the line from Schwedt to East Berlin, a product line, is to be extended to Dresden.

There are plans to expand the Rostock port facilities by creating an artificial port with capacity to handle supertankers. At present, Mideast crude is transshipped to Rostock via Europort (Rotterdam) in the Netherlands.

Primary electric energy from sources other than those mentioned previously accounted for 1.2% of East Germany's 1970 generating capacity. Total generating capacity, however, is to be expanded by approximately 50% (5,900 to 6,400 megawatts) by 1975, of which 60% is to be fueled by lignite, and 14% (900 megawatts) by nuclear energy.

In 1972 there was only one nuclear powerplant in operation, located at Rheinsberg. By 1980, plans call for 2,000 megawatts of new nuclear capacity to be built, including 880 megawatts under construction in 1972 at Lubmin, on the Baltic Sea, of which the first 440-megawatt unit is programed to go critical during 1973.

The Mineral Industry of the Federal Republic of Germany

By F. E. Brantley [1] and Henry E. Stipp [2]

The general economy of West Germany showed increases in demand and output at the beginning of 1972, which slowed somewhat at midyear. However, the latter part of the year saw a general economic recovery, and total mineral demand and output exceeded those of 1971.

The Deutsche mark (DM) was one of the world's strong currencies, and compared with the U.S. dollar, increased during the year from DM3.225 = US$1.00 to DM3.1999 = US$1.00 at yearend. The relative general increase in the value of the currency had an adverse effect on sales opportunities in many sectors, especially where strong competition existed such as with iron and steel.

The gross national product (GNP) for 1972 was estimated at $258.9 billion, equivalent to approximately $4,200 per inhabitant. Total imports of goods and services were valued at $54.7 billion, and exports at $58.8 billion, compared with $53.8 billion and $50.6 billion, respectively, in 1971.

Turnover values for the mineral industry compared with those of 1971 are given in table 1. Average employment was down 7.1%, with decreases in coal mining and in iron and steelmaking. West Germany pursued its previous exploration policies outside the country for needed minerals in short supply. Activity was high in the oil and gas sector, and future requirements for energy in general were of increasing concern. Installation of pollution abatement equipment was continued by the mineral industry as it attempted to minimize this problem.

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Table 1.—Federal Republic of Germany: Employment and turnover in the mineral industry

	Average 1972 employment (thousand persons)	Turnover (million dollars)			
		1971 [1]		1972 [2]	
		Domestic	Foreign	Domestic	Foreign
MINES					
Iron	3	43	--	47	--
Nonferrous metals	3	32	3	27	5
Potash and salt	13	196	78	195	77
Other nonmetallic minerals	1	12	6	12	5
Coal	231	1,930	688	1,895	675
Lignite	21	284	14	308	13
Peat	4	38	7	36	8
Oil and gas	7	429	1	508	2
Total	283	2,964	797	3,028	785
QUARRIES					
Stone	25	504	6	539	7
Sand and gravel	15	395	18	416	19
Slate, clays, other	27	r 773	r 40	887	42
Cement	17	742	19	802	22
Refractories	16	216	72	232	76
Lime, gypsum, chalk	14	346	24	387	28
Limestone, sandstone	6	175	--	206	--
Pumice	7	197	2	232	--
Total	127	r 3,348	r 181	3,701	194
PROCESSING PLANTS					
Iron and steel	312	6,215	2,327	6,349	2,457
Nonferrous plants	87	2,237	475	2,390	483
Petroleum refineries	37	6,091	242	6,359	239
Coal chemicals	4	86	26	85	26
Total	440	14,629	3,070	15,183	3,205
Grand total	850	r 20,941	r 4,048	21,912	4,184

r Revised.
[1] Values have been converted from Deutsche marks to U.S. dollars at the rate of DM3.22 = US$1.00.
[2] Values have been converted from Deutsche marks to U.S. dollars at the rate of DM3.20 = US$1.00.

PRODUCTION AND TRADE

The index of industrial production was up 2.7% in 1972, compared with the previous year. Although the industrial sector showed gains in most major commodities, the potash and salt industry declined. Mining was down, because coal had a particularly bad year in 1972.

Industry sector	Index of production (1962 = 100)		Change (%)
	1971 r	1972 p	
Mining	100.1	92.3	−7.8
Coal	84.7	74.0	−12.6
Metal ores:			
Iron	40.4	38.5	−4.7
Nonferrous	125.9	108.5	−13.8
Potash and salt	144.7	140.6	−2.8
Crude oil and natural gas	259.8	280.6	+8.0
Iron and steel	130.9	140.1	+7.0
Nonferrous metals	162.5	168.0	+3.4
Petroleum refined	221.1	227.1	+2.7
Stone and sand	144.6	151.2	+4.6

p Preliminary. r Revised.

Table 2.—Federal Republic of Germany: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
METALS				
Aluminum:				
Bauxite, gross weight		3,038	2,871	e 2,700
Alumina	thousand tons	757	826	916
Metal:				
Primary	do	309	428	445

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Aluminum—Continued			
Metals—Continued			
Secondary:			
Unalloyed—thousand tons	26	29	32
Alloyed—do	232	247	262
Bismuth, smelter e	350	400	300
Cadmium, smelter	1,035	981	914
Cobalt, smelter	826	601	457
Copper:			
Mine output, metal content	1,477	1,484	1,320
Metal:			
Blister and anodes:			
Primary	84,400	82,646	99,903
Secondary	133,200	122,639	84,171
Refined, including secondary:			
Electrolytic	307,240	305,001	300,584
Fire, refined	98,600	95,051	97,940
Gold:			
Mine output, metal content—troy ounces	1,952	1,704	e 1,700
Metal (including secondary)—do	101,789	198,338	199,752
Iron and steel:			
Iron ore and concentrate—thousand tons	5,531	5,020	4,824
Pig iron and blast furnace ferroalloys—do	33,627	29,990	32,002
Electric furnace ferroalloys—do	269	234	240
Steel ingots and castings—do	45,041	40,313	43,706
Semimanufactures—do	32,291	28,717	31,192
Lead:			
Mine output, metal content	40,952	41,339	38,458
Metal, unalloyed:			
Primary	112,500	98,400	102,000
Secondary	192,900	202,800	171,600
Magnesium metal and alloys:			
Unwrought (secondary only)	1,900	1,800	NA
Castings	40,196	39,110	33,654
Mercury (secondary only)—76-pound flasks	1,973	2,002	2,031
Molybdenum metal	251	130	e 150
Nickel, including secondary 1	564	200	200
Platinum—troy ounces	1,736	3,537	2,283
Silver:			
Mine output, metal content—thousand troy ounces	1,814	1,871	1,736
Metal, including secondary—do	24,382	18,049	20,120
Tin, metal (including secondary)—long tons	r 2,200	2,334	2,375
Tungsten, metal	966	809	e 800
Zinc:			
Mine output, metal content	128,617	131,984	122,160
Metal, unwrought, unalloyed, primary	150,224	126,436	124,670
NONMETALS			
Barite	412,586	408,862	368,711
Bromine, fluorine and iodine	3,991	4,196	4,347
Cement, hydraulic—thousand tons	r 38,324	41,013	43,146
Chalk—do	NA	192	206
Clays:			
Fire clay (exclusive of Klebsand)—do	4,485	4,597	NA
Kaolin (marketable)—do	447	417	417
Bleaching—do	612	614	NA
Other (Schieferton)—do	117	127	NA
Corundum, artificial—do	106	98	93
Diatomite and similar earths (marketable)	76,392	66,553	58,046
Feldspar (marketable)	408,809	353,693	305,553
Fertilizers:			
Crude, potassic:			
Gross weight—thousand tons	21,030	22,306	23,023
K_2O equivalent—do	2,645	2,815	2,845
Manufactured:			
Nitrogenous (nitrogen content):			
Nitrogen fertilizers—do	1,143	964	959
Mixed fertilizers—do	425	421	420
Total—do	1,568	1,385	1,379
Phosphatic (P_2O_5 content):			
Superphosphate—do	50	46	57
Thomas slag fertilizers—do	313	347	312
Other phosphatic fertilizers—do	117	133	NA
Mixed fertilizers—do	432	433	419
Total—do	912	959	NA

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NONMETALS—Continued			
Fertilizers—Continued			
Potassic, K_2O equivalent:			
Marketable crude—thousand tons	40	45	53
Chemically processed—do	2,266	2,398	2,395
Total—do	2,306	2,443	2,448
Content of mixed fertilizers [2]—do	504	483	427
Mixed fertilizers, gross weight—do	3,136	3,087	2,943
Fluorspar (marketable)	75,114	84,687	84,070
Graphite:			
Crude	18,346	15,700	NA
Marketable	16,406	[3] 12,688	e 12,700
Gypsum (inclusive of anhydrite)—thousand tons	2,061	2,534	1,788
Lime, quicklime and hydrated lime including dead-burned dolomite—do	10,716	10,554	10,913
Pigments, natural mineral—do	15	15	NA
Pumice:			
Crude and washed—do	7,054	7,914	8,263
Marketable—do	4,214	5,020	5,020
Pyrite (marketable):			
Gross weight—do	573	495	e 455
Sulfur content—do	234	219	e 200
Quartz, quartzite, glass sand:			
Quartzite—do	251	245	NA
Quartz sand (ground)—do	1,144	898	716
Quartz sand (unground) and glass sand—do	5,682	5,500	5,554
Salt (marketable):			
Rock—do	8,325	6,719	6,981
Marine and other—do	2,122	2,201	2,200
Stone, sand and gravel, n.e.s.:			
Dimension stone—thousand cubic meters	257	270	286
Limestone, industrial—thousand tons	63,465	64,852	67,766
Crushed and broken—do	117,612	120,762	124,627
Slate: [4]			
Roofing for office and industry—do	23	18	13
Splittings and ground—do	79	69	48
Basalt lava and lava sand—do	8,379	7,593	NA
Calcite—do	15	11	NA
Grinding and whetstone—cubic meters	82	616	56
Printing stone—thousand cubic meters	31	35	38
Tuff—thousand tons	3	3	NA
Industrial sands:			
Molding sand—do	1,000	1,094	1,050
Other (Klebsand)—do	172	140	150
Sand and gravel—do	206,475	212,329	219,999
Sulfur, elemental byproduct—do	176	184	219
Talc, including talc schist—do	34	30	32
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	237,452	262,171	264,106
Coal:			
Anthracite—thousand tons	10,216	9,920	7,470
Bituminous—do	101,055	100,875	95,000
Pech—do	671	68	--
Lignite—do	107,768	104,479	110,416
Total—do	219,710	215,342	212,886
Coke:			
Metallurgical—do	39,914	37,537	34,452
Gas house—do	2,565	2,014	1,718
Total—do	42,479	39,551	36,170
Fuel briquets:			
Anthracite and bituminous—do	3,725	2,716	2,427
Lignite—do	9,571	7,758	6,751
Gas:			
Manufactured gas (excluding that from petroleum refineries):			
Blast furnace gas—million cubic feet	518,134	445,492	458,418
Coke oven gas [5]—do	644,807	606,597	555,144
Other gas—do	259,279	233,464	201,646
Total—do	1,422,220	r 1,285,553	1,215,208
Natural:			
Gross production—do	r 466,654	562,779	645,111
Marketable production—do	r 459,820	555,194	635,549
Petroleum:			
Crude—thousand 42-gallon barrels	54,427	53,597	51,271

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products:			
Gasoline, aviation and motor--thousand 42-gallon barrels--	110,843	112,824	115,927
Jet fuel-----do----	9,196	11,955	8,833
Kerosine-----do----	716	849	1,101
Distillate fuel oil-----do----	276,722	301,225	302,096
Residual fuel oil-----do----	221,749	186,564	193,087
Lubricants-----do----	7,384	8,342	6,638
Liquefied petroleum gas-----do----	29,477	23,621	34,939
Bitumen-----do----	28,509	28,504	28,319
Other-----do----	51,885	87,258	21,605
Refinery fuel and losses-----do----	45,534	39,636	49,437
Total-----do----	782,015	800,778	761,982

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Primary nickel and nickel contained in ferronickel, monel metal and nickel oxide directly used by the steel industry.

[2] K_2O equivalent of potassic constituent not added to K_2O equivalent of marketable crude and chemically processed potassic fertilizers because this apparently would result in double counting.

[3] In part produced from imported crude graphite.

[4] Exclusive of slate recovered from mine dumps.

[5] Includes water gas and generator gas from coke ovens.

Table 3.—Federal Republic of Germany: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite-----	6,493	3,020	Austria 1,578; Finland 348; Belgium-Luxembourg 316.
Alumina-----	95,903	151,923	Austria 67,239; Belgium-Luxembourg 3,477.
Aluminum hydroxide-----	75,808	81,456	Sweden 24,171; Netherlands 14,539; Belgium-Luxembourg 10,918.
Metal including alloys:			
Scrap-----	12,058	15,288	Italy 6,858; Netherlands 4,511; France 3,455.
Unwrought-----	48,787	63,258	France 20,893; Belgium-Luxembourg 15,214; Italy 11,338.
Semimanufactures-----	136,037	142,213	France 35,514; Netherlands 23,307; Belgium-Luxembourg 16,584.
Antimony metal including alloys, all forms	146	34	Netherlands 20; Spain 10.
Arsenic, hydroxides and acids-----	439	82	NA.
Beryllium metal including alloys, all forms kilograms--	146	92	NA.
Bismuth metal including alloys, all forms--	236	262	Belgium-Luxembourg 71; United Kingdom 55; France 41.
Cadmium metal including alloys, all forms	249	287	NA.
Chromium:			
Chromite-----	2,900	5,590	Netherlands 1,369; Austria 1,257; France 1,128.
Oxide and hydroxide-----	9,038	8,525	NA.
Metal including alloys, all forms kilograms--	214,200	119,100	United States 56,600; France 32,800; Belgium-Luxembourg 15,500.
Cobalt metal including alloys, all forms----	197	231	Japan 38; Netherlands 32; United States 28.
Columbium and tantalum:			
Metal including alloys, all forms:			
Columbium---------kilograms--	1,521	1,574	Belgium-Luxembourg 692; France 67.
Tantalum----------do----	62,134	34,364	NA.
Copper:			
Ore and concentrate-----	351	1,100	Mainly to Spain.
Matte-----	3,024	6,848	All to Belgium-Luxembourg.
Copper sulfate-----	1,530	1,725	NA.
Metal including alloys:			
Scrap-----	35,265	35,664	Italy 13,286; Belgium-Luxembourg 8,011.
Unwrought:			
Blister-----	946	594	Spain 524; Switzerland 65.
Refined-----	79,944	103,135	Austria 20,186; United Kingdom 10,675; France 10,128.
Alloys-----	4,148	7,751	Belgium-Luxembourg 2,673; Yugoslavia 1,329; Italy 820.
Master alloys-----	360	337	Belgium-Luxembourg 174; Netherlands 102.
Semimanufactures-----	110,766	105,059	United States 23,692; Netherlands 16,730; France 11,602.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Germanium metal including alloys, all forms kilograms	600	1,500	All to Belgium-Luxembourg.
Gold:			
Ashes, residue and scrap thousand troy ounces	14	(1)	NA.
Metal:			
Unwrought do	504	298	Italy 92; Switzerland 76; United Kingdom 19.
Semimanufactures do	6,623	7,591	Italy 1,928; Netherlands 1,896; France 1,824.
Iron and steel:			
Iron ore and concentrate	9,548	8,658	NA.
Roasted pyrite	11,886	28,573	Austria 13,585; Belgium-Luxembourg 9,737; United Kingdom 4,203.
Metal:			
Scrap thousand tons	2,295	2,185	Italy 1,817; Belgium-Luxembourg 205.
Pig iron, including cast iron do	881	776	Italy 252; France 196; Belgium-Luxembourg 87.
Sponge iron, powder and shot do	17	16	Netherlands 4; Switzerland 3; France 2.
Spiegeleisen do	16	3	Belgium-Luxembourg 1; Italy 1.
Ferroalloys:			
Ferrochrome do	32	32	Belgium-Luxembourg 11; United States 11; United Kingdom 3.
Ferromanganese do	39	38	France 12; Italy 6; Romania 5.
Ferronickel do	56	233	Belgium-Luxembourg 162; Austria 54.
Ferrosilicon do	15	15	NA.
Ferrosilicochrome do	1	1	Mainly to Norway.
Ferrosilicomanganese do	2	3	Mainly to Italy and Belgium-Luxembourg.
Other do	8	8	Austria 1; Belgium-Luxembourg 1; Yugoslavia 1.
Steel, primary forms do	1,707	2,524	France 674; United States 515; Italy 429; Belgium-Luxembourg 113.
Semimanufactures:			
Bars, rods, angles, shapes, and sections do	3,121	3,054	France 877; United States 553; Netherlands 356; Switzerland 183.
Universals, plates and sheets do	4,172	4,275	United States 1,080; France 553; Netherlands 315.
Hoop and strip do	614	603	France 94; Netherlands 93; Belgium-Luxembourg 75.
Rails and accessories do	123	158	Italy 36; Netherlands 31; Portugal 18.
Wire do	264	249	France 52; United States 29; Netherlands 29.
Tubes, pipes and fittings do	2,057	2,348	U.S.S.R. 669; Netherlands 496; France 134.
Castings and forgings, rough do	54	58	Netherlands 9; Switzerland 9; France 8; Belgium-Luxembourg 7.
Lead:			
Ore and concentrate	1,884	2,806	All to Belgium-Luxembourg.
Oxides	7,237	6,845	Netherlands 2,586; Belgium-Luxembourg 582; Yugoslvaia 582.
Metals including alloys:			
Scrap	15,524	15,409	Netherlands 5,207; Italy 5,101; Belgium-Luxembourg 4,599.
Unwrought	52,627	72,134	Italy 28,688; Belgium-Luxembourg 6,317; France 3,391.
Semimanufactures	5,837	6,104	Switzerland 1,121; Sweden 962; Denmark 760.
Magnesium:			
Oxides, hydroxide and peroxide	2,615	2,647	Austria 545; Italy 492; Poland 212.
Metal including alloys:			
Scrap	1,558	1,892	United Kingdom 678; United States 524; Italy 305.
Unwrought	120	115	Netherlands 43; United States 21; Italy 14.
Semimanufactures	240	220	Sweden 47; Austria 36.
Manganese:			
Ore and concentrate	402	4,625	Netherlands 4,098.
Oxides	2,257	2,350	NA.
Metal	141	188	Belgium-Luxembourg 112; Italy 22.
Mercury 76-pound flasks	998	1,326	Netherlands 305; United States 200.
Molybdenum:			
Ore and concentrate	265	448	Italy 175; Czechoslovakia 134; Austria 110.
Metal including alloys, all forms	262	153	NA.
Nickel:			
Matte and speiss	10	103	All to Canada.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Nickel—Continued			
Metal including alloys:			
Scrap	1,033	936	Netherlands 598; United Kingdom 192.
Unwrought	1,887	4,203	Netherlands 1,810; France 643; United States 366.
Semimanufactures	r 8,106	9,083	Netherlands 1,737; France 1,111; Switzerland 704.
Platinum-group metals and silver:			
Waste and sweepings—kilograms	8,865	3,500	United Kingdom 2,390; United States 500.
Metals including alloys, all forms:			
Platinum group—thousand troy ounces	362	517	Japan 108; Italy 97; Netherlands 60; Hong Kong 45.
Silver—do	32,802	32,475	Italy 10,802; Sweden 3,111; Switzerland 2,999.
Thorium, uranium, and rare-earth compounds	142	212	United States 175.
Tin:			
Ore and concentrate—long tons	24	6	All to United Kingdom.
Oxides—do	246	304	Finland 49; France 39; Brazil 39.
Metal including alloys:			
Scrap—do	199	34	Netherlands 25.
Unwrought—do	863	1,161	France 839; Austria 69.
Semimanufactures—do	393	460	Netherlands 76; Switzerland 51.
Titanium:			
Ore and concentrate	147	312	Switzerland 138; Austria 70; Yugoslavia 40.
Oxides	41,916	35,432	Italy 5,668; France 4,251; Belgium-Luxembourg 4,048.
Metal including alloys, all forms	915	435	Italy 134; France 118; Sweden 64.
Tungsten:			
Ore and concentrate	208	362	United States 312; Netherlands 20.
Metal including alloys, all forms	502	435	United States 57; France 36.
Uranium and thorium metal including alloys, all forms—kilograms	12,500	5,500	France 4,400.
Vanadium metal including alloys, all forms—do	r 300	900	Mainly to United States.
Zinc:			
Ore and concentrate	49,852	55,187	Belgium-Luxembourg 34,164; Netherlands 11,933.
Oxide and peroxide	10,005	9,190	NA.
Metal including alloys:			
Scrap	5,904	5,846	France 2,367; Italy 1,529; Netherlands 988.
Dust	3,840	3,057	Netherlands 1,613; Switzerland 777.
Unwrought	54,125	49,575	United States 11,758; Italy 9,124; Switzerland 8,205.
Semimanufactures	8,019	12,604	NA.
Zirconium metal including alloys, all forms	16	29	United States 14; Sweden 11.
Other:			
Ore and concentrate:			
Of columbium, tantalum, vanadium, and zirconium	1,609	1,492	Austria 387; Italy 271; Netherlands 226.
Ash and residue containing nonferrous metals	175,411	169,600	Netherlands 66,015; Belgium-Luxembourg 58,636; Sweden 18,051.
Oxides, hydroxides and peroxides of metals, n.e.s	7,122	7,377	Belgium-Luxembourg 958; Netherlands 886; France 858.
Metals including alloys, all forms:			
Metalloids:			
Arsenic and tellurium	10	7	NA.
Selenium and phosphorus	16,067	10,238	NA.
Silicon	243	143	Netherlands 38; Italy 26; Belgium-Luxembourg 26.
Alkali, alkaline earth and rare-earth metals	8,587	8,952	NA.
Pyrophoric alloys	103	--	
Base metals including alloys, all forms, n.e.s	1,140	758	France 207; Sweden 131; Italy 82; Switzerland 72.
NONMETALS			
Abrasives:			
Natural:			
Pumice, emery, and corundum	559,933	694,015	Netherlands 548,492; Belgium-Luxembourg 144,962.
Dust and powder of precious and semiprecious stones—thousand carats	165	205	Netherlands 90; United Kingdom 30; France 25.
Grinding and polishing wheels and stones	10,052	9,669	France 1,959; Switzerland 1,483; Italy 1,285; Netherlands 1,258.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Abrasives—Continued			
Artificial:			
Corundum	37,321	37,328	Sweden 5,500; Italy 5,190; Netherlands 3,404; France 3,355.
Silicon carbide	8,609	9,995	NA.
Asbestos	925	1,271	Austria 610; Italy 164; France 133.
Barite and witherite	111,687	122,452	France 67,966; Netherlands 36,023.
Boron materials:			
Crude natural borates	r 9,287	11,566	Italy 3,903; Belgium-Luxembourg 3,048; Sweden 2,570.
Oxide and acid	350	237	Netherlands 90; Italy 42; Yugoslavia 30.
Bromine	20	401	Poland 200; Switzerland 174.
Cement, hydraulic thousand tons	1,524	1,394	Netherlands 1,114.
Chalk	10,168	10,416	Netherlands 4,914; Denmark 2,795; Switzerland 1,409.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Fire clay thousand tons	349	309	Italy 69; Netherlands 68; Belgium-Luxembourg 49; France 43.
Kaolin do	98	89	Austria 25; Italy 23; Belgium-Luxembourg 13.
Kyanite, sillimanite, andalusite, mullite do	1	(1)	Mainly to Netherlands and Switzerland.
Other do	908	895	Netherlands 458; Belgium-Luxembourg 145; Italy 113; France 106.
Products:			
Refractory (including nonclay bricks) do	443	520	France 110; Belgium-Luxembourg 85; Italy 56.
Nonrefractory do	474	479	France 132; Netherlands 109; Belgium-Luxembourg 77.
Cryolite and chiolite	10	--	
Diamond:			
Gem:			
Crude or rough cut thousand carats	40	25	NA.
Other do	60	55	Belgium-Luxembourg 20; Netherlands 15; Italy 10.
Industrial do	100	155	Netherlands 40; United Kingdom 40; Switzerland 30.
Diatomite and other infusorial earths	4,770	6,236	Netherlands 1,873; United Kingdom 1,462; Italy 1,133.
Feldspar, leucite, nepheline, and nepheline syenite	14,287	8,714	Italy 2,006; Switzerland 1,447; Belgium-Luxembourg 1,429.
Fertilizer materials:			
Crude:			
Phosphatic	4,658	6,724	France 3,896; Switzerland 1,635; Netherlands 1,143.
Potassic	48,176	47,034	Belgium-Luxembourg 27,450; Netherlands 12,062; United Kingdom 7,495.
Manufactured:			
Nitrogenous thousand tons	1,261	952	Belgium-Luxembourg 288; Brazil 154; Spain 66.
Phosphatic:			
Thomas slag do	275	196	France 151; Austria 20; Netherlands 17.
Other do	11	4	NA.
Potassic do	1,783	1,855	Belgium-Luxembourg 257; Denmark 174; Brazil 155.
Mixed do	699	708	France 126; Turkey 88; Denmark 54; United Kingdom 46.
Ammonia, anhydrous do	15	29	France 13; Belgium-Luxembourg 8; Austria 4.
Fluorspar	7,988	10,220	Austria 3,299; Belgium-Luxembourg 2,017; Netherlands 1,858.
Graphite, natural	9,321	7,235	Italy 2,346; United States 1,186; France 452.
Gypsum and plasters	258,992	289,802	Netherlands 87,873; Switzerland 58,700; Belgium-Luxembourg 52,873.
Iodine	26	22	France 7; Yugoslavia 3; Algeria 3.
Lime	549,914	545,613	Netherlands 451,862; France 45,458.
Lithium minerals	212	155	NA.
Magnesite	9,017	9,348	France 3,845; Spain 3,707.
Mica:			
Crude, including splittings and waste	838	912	Switzerland 350; Sweden 224; Austria 85.
Worked, including agglomerated splittings	174	118	NA.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Pigments, mineral:			
Natural, crude	9,496	8,613	Netherlands 2,914; Denmark 2,542; Switzerland 811.
Iron oxides and hydroxides	113,896	114,191	United States 16,919; France 15,737; United Kingdom 11,447.
Precious and semiprecious stones, except diamond:			
Natural—kilograms	142,364	144,587	Italy 23,918; United Kingdom 22,142; Czechoslovakia 12,867.
Manufactured—do	7,922	7,770	United States 3,320; Switzerland 1,158; Netherlands 620.
Pyrite (gross weight)	271	412	Brazil 106; France 99; Sweden 69.
Salt—thousand tons	1,595	1,442	Belgium-Luxembourg 876; Sweden 221; Denmark 85.
Sodium and potassium compounds, n.e.s.:			
Caustic soda—do	244	362	Netherlands 70; Yugoslavia 50; United States 39.
Caustic potash, sodic and potassic peroxides—do	11	12	U.S.S.R. 3; United States 2; Italy 1.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	3,421	3,763	Austria 1,535; Netherlands 1,349.
Slate	21,130	23,375	Netherlands 7,403; Belgium-Luxembourg 5,266; Denmark 3,885.
Other	605,276	541,403	Netherlands 501,994; Switzerland 35,525.
Worked:			
Building and monumental stone	15,827	15,741	Netherlands 5,265; Belgium-Luxembourg 4,538; France 2,145.
Slate	924	641	Netherlands 340; Belgium-Luxembourg 217; Switzerland 61.
Paving and flagstone	21,110	18,253	Netherlands 12,712; Denmark 2,601.
Dolomite	132,546	82,197	Netherlands 40,854; France 20,015; Belgium-Luxembourg 13,036.
Gravel and crushed rock—thousand tons	11,752	11,175	Netherlands 9,448; Switzerland 1,054.
Limestone—do	130	166	Netherlands 145; Belgium-Luxembourg 11.
Quartz and quartzite:			
Quartz crystal—kilograms	12	15	Italy 13.
Other	54,844	50,372	Austria 15,288; Belgium-Luxembourg 7,106; Italy 6,785.
Sand, excluding metal bearing—thousand tons	7,025	7,061	Netherlands 6,410; Switzerland 237; Austria 152.
Sulfates, natural, magnesium sulfate (Kieserite)—do	305	310	Norway 52; Netherlands 47; Denmark 33; United States 32.
Sulfur:			
Elemental:			
Other than colloidal	34,135	43,923	Switzerland 12,033; Austria 6,775; Hungary 4,862.
Colloidal	2,892	2,792	Italy 486; United Kingdom 402; Romania 237.
Sulfur dioxide	13,392	13,521	Poland 6,563; Belgium-Luxembourg 2,776; Austria 1,133.
Sulfuric acid	107,965	281,183	Belgium-Luxembourg 201,865; France 41,882.
Talc, steatite, soapstone	6,268	4,446	Denmark 2,112; Switzerland 362; United Kingdom 296.
Vermiculite, chlorite, perlite	301	686	Austria 516.
Other nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, jet—kilograms	100	500	NA.
Pottery	5,820	6,307	Austria 2,920; Netherlands 1,075; United Kingdom 813.
Other—thousand tons	1,552	1,600	Netherlands 1,532.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture—do	1,542	1,302	Netherlands 1,068; France 204.
Slag and ash, n.e.s—do	516	493	Netherlands 424; France 50.
Oxides and hydroxides of strontium and barium	3,029	3,707	France 1,977; U.S.S.R. 500; Belgium-Luxembourg 484.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s.	89,147	87,727	Netherlands 29,709; France 23,263; Belgium-Luxembourg 10,651.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	544	3,338	Switzerland 1,929; France 369.
Carbon black	58,402	71,687	France 12,175; Austria 9,961; Poland 6,735; Netherlands 6,625.
Coal and briquets:			
Anthracite and bituminous thousand tons	15,597	14,057	France 5,823; Italy 3,274; Belgium-Luxembourg 2,839.
Briquets of anthracite and bituminous coal ---do---	309	221	United Kingdom 123; Austria 57.
Lignite and lignite briquets ---do---	968	733	France 255; Austria 190; Italy 95; Belgium-Luxembourg 91.
Coke and semicoke ---do---	10,214	9,162	Belgium-Luxembourg 4,143; France 2,490; Netherlands 1,055.
Peat and briquets ---do---	252	270	Netherlands 138; Switzerland 43; France 31.
Gas, natural ---do---	299	312	Switzerland 101; Netherlands 84; Belgium-Luxembourg 50.
Helium and other rare gases	11,323	11,231	France 5,220; Belgium-Luxembourg 2,345; Denmark 682.
Petroleum:			
Crude and partly refined thousand metric tons	134	1	All to Austria.
Refinery products:			
Gasoline, motor spirit ---do---	799	701	Switzerland 479; Austria 151; France 29.
Kerosine, white spirit ---do---	888	1,034	Bunkers 893; Switzerland 130.
Distillate fuel oil ---do---	1,738	2,032	Switzerland 1,311; bunkers 247; France 185; Netherlands 171.
Residual fuel oil ---do---	4,146	3,887	Bunkers 1,317; Netherlands 497; Belgium-Luxembourg 449.
Lubricants ---do---	396	409	United Kingdom 68; Belgium-Luxembourg 66; Switzerland 38.
Mineral jelly and wax ---do---	109	123	Italy 14; Denmark 13; Netherlands 10.
Other ---do---	2,599	2,537	France 773; United Kingdom 630; Netherlands 283.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ---do---	224	266	United Kingdom 57; France 53; Netherlands 40; United States 39.

r Revised. NA Not available.
1 Less than ½ unit.

Table 4.—Federal Republic of Germany: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite thousand tons	2,627	2,831	Australia 1,459; Yugoslavia 607.
Alumina	119,523	342,202	Surinam 179,824; Guinea 129,387.
Aluminum hydroxide	1,438	1,236	United States 1,008.
Metal including alloys:			
Scrap	67,377	58,947	Netherlands 13,548; United States 7,879; Austria 7,078.
Unwrought	433,818	315,496	Norway 128,498; France 33,053; Netherlands 27,191.
Semimanufactures	93,768	122,647	Belgium-Luxembourg 33,093; France 32,244; Netherlands 23,158.
Antimony:			
Ore and concentrate	2,048	3,269	Turkey 1,612; Thailand 607; Bolivia 373.
Metal including alloys, all forms	1,826	1,260	Italy 480; People's Republic of China 453; Belgium-Luxembourg 257.
Arsenic hydroxides	1,157	905	Belgium-Luxembourg 726; France 159.
Beryllium metal including alloys, all forms kilograms	369	937	United States 161; United Kingdom 97.
Bismuth metal including alloys, all forms	218	165	Japan 32; Belgium-Luxembourg 27; United Kingdom 26.
Cadmium metal including alloys, all forms	1,224	962	Belgium-Luxembourg 361; U.S.S.R. 149; Japan 133.
Chromium:			
Chromite	491,455	483,488	Republic of South Africa 273,323; U.S.S.R. 120,425; Turkey 26,004.
Oxide and hydroxide	1,025	1,713	Netherlands 97; Yugoslavia 60.
Metal including alloys, all forms	125	236	U.S.S.R. 112; United Kingdom 56; France 47.
Cobalt metal including alloys, all forms	1,487	993	Zaire 335; Norway 198; Belgium-Luxembourg 162.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Columbium and tantalum:			
Metal including alloys, all forms:			
Columbium kilograms	1,775	13,799	United Kingdom 11,524.
Tantalum do	68,645	68,983	United States 54,625.
Copper:			
Ore and concentrate	195,400	171,247	Chile 62,443; Cyprus 40,780; Nicaragua 17,727.
Matte	5,536	2,349	Australia 1,818; United Kingdom 521.
Copper sulfate	4,834	4,040	France 2,057; U.S.S.R. 885; Belgium-Luxembourg 685.
Metal including alloys:			
Scrap	113,377	80,453	United States 18,549; France 17,177; Netherlands 14,509.
Unwrought:			
Blister	133,317	155,679	Republic of South Africa 47,260; Zambia 45,707; Chile 33,355.
Refined	384,432	363,121	Chile 114,409; Belgium-Luxembourg 60,694; Zambia 45,707.
Alloys	53,972	50,009	United Kingdom 13,894; U.S.S.R. 7,552; Czechoslovakia 5,314.
Master alloys	1,629	1,444	United Kingdom 694; Switzerland 455.
Semimanufactures	79,417	83,622	Belgium-Luxembourg 39,203; France 20,618; Netherlands 8,430.
Germanium metal including alloys, all forms kilograms	2,200	100	All from Italy.
Gold:			
Ashes, residues and scrap thousand troy ounces	6,788	6,803	Switzerland 2,854; Sweden 1,284; Netherlands 998.
Metal:			
Unwrought do	3,460	4,162	Switzerland 1,835; United States 1,013; Republic of South Africa 639.
Semimanufactures do	59	94	France 38; Switzerland 34.
Iron and steel:			
Iron ore and concentrate thousand tons	47,818	40,322	Sweden 9,621; Brazil 6,913; Liberia 6,881.
Roasted pyrite do	1,562	1,184	Spain 571; Belgium-Luxembourg 244; Denmark 108.
Metal:			
Scrap do	1,431	1,044	Netherlands 503; Belgium-Luxembourg 198; France 131.
Pig iron, including cast iron do	166	143	Canada 55; France 40; Norway 19.
Sponge iron, powder and shot do	27	28	France 10; Sweden 9; United Kingdom 5.
Spiegeleisen	209	246	All from France.
Ferroalloys:			
Ferrochrome thousand tons	54	49	Republic of South Africa 30; U.S.S.R. 4.
Ferromanganese do	161	126	France 47; Norway 37; Belgium-Luxembourg 22.
Ferronickel do	21	15	New Caledonia 13; United States 1.
Ferrosilicon do	137	105	Norway 47; France 26.
Ferrosilicochrome do	16	15	Republic of South Africa 10; United States 2.
Ferrosilicomanganese do	74	62	Norway 40; Czechoslovakia 10.
Other do	15	11	France 5; Norway 2.
Steel, primary forms do	2,176	1,476	Belgium-Luxembourg 396; Austria 367; Netherlands 227.
Semimanufactures:			
Bars, rods, angles, shapes, and sections do	2,953	3,510	France 716; Italy 441; Netherlands 130.
Universals, plates and sheets do	2,950	3,589	Belgium-Luxembourg 1,266; France 837; Netherlands 268.
Hoop and strip do	441	499	Belgium-Luxembourg 303; Netherlands 70.
Rails and accessories do	44	28	Netherlands 8; France 6; Belgium-Luxembourg 5.
Wire do	121	133	Belgium-Luxembourg 70; France 19; Netherlands 13.
Tubes, pipes and fittings do	320	445	Netherlands 107; Belgium-Luxembourg 82; Spain 26.
Castings and forgings, rough do	26	33	Romania 12; Belgium-Luxembourg 8.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Lead:			
Ore and concentrate	283,307	223,009	Canada 73,449; Peru 42,612; Ireland 33,486.
Oxides	4,323	5,578	Mexico 1,579; Belgium-Luxembourg 1,382; France 1,382.
Metal including alloys:			
Scrap	26,314	13,232	United States 2,329; Netherlands 2,307; France 1,973.
Unwrought	126,278	126,443	United Kingdom 57,233; Australia 19,955; Netherlands 14,409.
Semimanufactures	2,480	2,947	Belgium-Luxembourg 1,662; France 950.
Magnesium:			
Oxides, hydroxide and peroxides	3,080	2,729	United States 1,164; France 747; Italy 328.
Metal including alloys:			
Scrap	819	590	Czechoslovakia 309; Switzerland 87; Netherlands 78.
Unwrought	52,233	46,629	Norway 21,989; United States 14,321; U.S.S.R. 4,902.
Semimanufactures	150	179	United States 129; France 17.
Manganese:			
Ore and concentrate thousand tons	713	821	Republic of South Africa 450; Gabon 151; Brazil 90.
Oxides	3,651	4,075	Belgium-Luxembourg 2,881; Netherlands 790.
Metal	5,188	3,757	Republic of South Africa 1,167; France 1,159; Japan 822.
Mercury 76-pound flasks	25,237	17,434	Spain 7,136; Yugoslavia 2,553; Mexico 2,524.
Molybdenum:			
Ore and concentrate	15,976	12,453	United States 4,963; Netherlands 2,230; Chile 2,218.
Metal including alloys, all forms	411	384	Austria 234; U.S.S.R. 70; Netherlands 38.
Nickel:			
Ore and concentrate	230	120	NA.
Matte and speiss	4,246	1,990	Canada 1,845; United Kingdom 106.
Metal including alloys:			
Scrap	7,720	5,031	United States 1,440; Netherlands 889; Switzerland 570.
Unwrought	r 38,781	32,604	Norway 7,259; United Kingdom 6,396; U.S.S.R. 4,167.
Semimanufactures	3,470	2,464	United Kingdom 1,055; France 419; United States 384.
Platinum-group metals and silver:			
Waste and sweepings kilograms	250,516	517,206	United States 180,699; Netherlands 87,489; Switzerland 44,664.
Metals including alloys, all forms:			
Platinum group thousand troy ounces	645	630	U.S.S.R. 226; United Kingdom 173; United States 99.
Silver do	63,536	59,331	Mexico 10,572; Belgium-Luxembourg 8,113; Yugoslavia 8,101.
Thorium, uranium, and rare-earth compounds	480	424	France 155; United States 103; United Kingdom 81.
Tin:			
Ore and concentrate long tons	5,891	6,184	Mainly from Bolivia.
Oxides do	167	113	Belgium-Luxembourg 78; France 25.
Metal including alloys:			
Scrap do	298	395	Netherlands 212; Switzerland 74.
Unwrought do	14,847	15,239	Malaysia 4,814; Indonesia 2,614; Thailand 2,313.
Semimanufactures do	r 70	147	Netherlands 104; Switzerland 19.
Titanium:			
Ore and concentrate	576,902	487,209	Norway 276,075; Canada 178,091; Australia 32,566.
Oxides	15,515	15,257	Belgium-Luxembourg 7,160; Netherlands 4,856; France 1,563.
Metal including alloys, all forms	r 2,978	2,018	U.S.S.R. 1,405; United States 275; Japan 225.
Tungsten:			
Ore and concentrate	6,946	5,432	Canada 1,075; Thailand 614; United States 548.
Metal including alloys, all forms	905	396	United States 109; Austria 98.
Uranium and thorium:			
Ore	5,445	4,717	Mainly from France.
Metal including alloys, all forms kilograms	25,300	4,400	France 3,700; United Kingdom 700.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Vanadium metal including alloys, all forms	25	28	United States 16; Belgium-Luxembourg 12.
Zinc:			
Ore and concentrate	363,758	355,231	Canada 195,682; Sweden 59,543; Ireland 19,303.
Oxide and peroxide	3,994	4,891	United States 1,212; France 1,151; Belgium-Luxembourg 823.
Metal including alloys:			
Scrap	2,487	3,233	Netherlands 1,315; Denmark 505; Yugoslavia 318.
Dust	13,609	12,763	Belgium-Luxembourg 11,540; Norway 662.
Unwrought	154,958	170,918	Belgium-Luxembourg 77,006; Netherlands 16,709; Norway 13,372.
Semimanufactures	15,626	13,857	Yugoslavia 4,603; France 4,442; North Korea 1,312.
Zirconium metal including alloys, all forms—kilograms	88,000	159,600	United States 114,600.
Other:			
Ore and concentrate:			
Of columbium, tantalum, vanadium, and zirconium	44,310	39,279	Australia 33,671; United Kingdom 1,891.
Of precious metals	397	--	
Of base metals, n.e.s	2,109	1,205	Bolivia 1,041.
Ash and residue containing nonferrous metals	r 166,226	138,277	United States 18,861; Italy 11,456; Netherlands 11,283; Austria 10,722.
Oxides, hydroxides and peroxides of metals, n.e.s	r 5,213	3,618	Belgium-Luxembourg 1,187; Switzerland 1,074; United States 525.
Metals including alloys, all forms:			
Metalloids:			
Arsenic and tellurium	82	51	Sweden 26; Belgium-Luxembourg 10; U.S.S.R. 8.
Selenium and phosphorus	28,897	21,091	NA.
Silicon	34,877	27,592	France 10,401; Norway 7,623; Italy 3,507.
Alkali, alkaline earth and rare-earth metals	769	727	United Kingdom 587; France 120.
Pyrophoric alloys	51	70	NA.
Base metals including alloys, all forms, n.e.s	1,518	2,020	Sweden 1,174; United States 291; Austria 137.
NONMETALS			
Abrasives:			
Natural:			
Pumice, emery, and corundum	11,500	8,181	Italy 3,844; United States 1,813; Netherlands 938.
Dust and powder of precious and semiprecious stones—thousand carats	4,241	4,329	Ireland 1,548; United States 1,522; Belgium-Luxembourg 421.
Grinding and polishing wheels and stones	4,982	5,029	Austria 1,033; Spain 693; France 413.
Artificial:			
Corundum	12,817	9,479	Austria 4,087; Netherlands 1,965; France 1,874.
Silicon carbide	16,936	13,263	Norway 8,252; U.S.S.R. 2,135; Italy 754.
Asbestos	175,612	167,941	Canada 76,947; U.S.S.R. 34,105; Republic of South Africa 28,973.
Barite and witherite	97,397	99,960	People's Republic of China 25,931; Turkey 13,185.
Boron materials:			
Crude natural borates	129,661	118,973	United States 77,602; Turkey 37,614.
Oxide and acid	15,693	12,711	France 5,745; United States 3,579; Turkey 1,817.
Bromine	1,470	1,046	Israel 760; United Kingdom 286.
Cement, hydraulic—thousand tons	727	974	France 427; Belgium-Luxembourg 171; Netherlands 100.
Chalk—do	89	87	France 76.
Clays and clay products (including all refractory brick):			
Crude clays:			
Fire clay—do	282	270	Czechoslovakia 89; Republic of South Africa 77; France 43.
Kaolin—do	642	591	United Kingdom 312; United States 133; France 62.
Kyanite, sillimanite, andalusite, mullite—do	27	29	India 12; Republic of South Africa 10; United Kingdom 5.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Clays and clay products (including all refractory brick)—Continued			
Crude clays—Continued			
Other—thousand tons	283	283	Netherlands 69; United States 65; France 42.
Products:			
Refractory (including nonclay bricks)—do	265	234	Austria 54; Czechoslovakia 52; Yugoslavia 35.
Nonrefractory—do	734	945	Netherlands 492; Italy 138; France 75.
Cryolite and chiolite	2,556	1,833	Mainly from Denmark.
Diamond:			
Gem:			
Crude or rough cut—thousand carats	225	150	NA.
Other—do	280	385	Belgium-Luxembourg 205; Israel 90; Netherlands 35.
Industrial—do	785	680	Belgium-Luxembourg 225; Netherlands 180; Republic of South Africa 150.
Diatomite and other infusorial earths	70,372	53,408	Denmark 37,627; France 7,850; United States 7,098.
Feldspar, leucite, nepheline, and nepheline syenite	81,560	87,753	Norway 56,636; France 13,951; Italy 9,170.
Fertilizer materials:			
Crude:			
Nitrogenous	1,366	725	All from Chile.
Phosphatic—thousand tons	2,802	2,757	United States 1,362; U.S.S.R. 848; Morocco 329.
Manufactured:			
Nitrogenous	348,358	578,386	Belgium-Luxembourg 297,112; Romania 65,505; Yugoslavia 51,252.
Phosphatic:			
Thomas slag	421,369	432,612	Belgium-Luxembourg 412,505; United Kingdom 15,252.
Other	27,605	22,751	Belgium-Luxembourg 7,578; Netherlands 6,127.
Potassic	22,528	34,149	France 18,512; Canada 15,612.
Mixed	194,310	272,425	Belgium-Luxembourg 152,631; France 76,392; Yugoslavia 31,296.
Ammonia, anhydrous	310,448	200,617	France 106,863; Netherlands 86,021.
Fluorspar	268,560	239,568	Spain 58,083; Republic of South Africa 27,330; Italy 10,509.
Graphite, natural	26,882	25,163	Austria 4,805; People's Republic of China 4,100; Malagasy Republic 3,283.
Gypsum and plasters	150,214	179,612	Austria 130,336; France 46,568.
Iodine	892	978	Japan 853; Chile 99.
Lime	199,998	154,449	Mainly from France.
Lithium minerals	10,843	6,543	Netherlands 3,951; Republic of South Africa 2,417.
Magnesite	r 423,774	390,606	Austria 112,488; Greece 108,258; North Korea 66,622.
Mica:			
Crude, including splittings and waste	9,108	7,896	India 2,095; Republic of South Africa 1,481; Argentina 1,435.
Worked, including agglomerated splittings	452	482	France 267; Belgium-Luxembourg 108.
Pigments, mineral:			
Natural, crude	2,161	1,815	Austria 1,571.
Iron oxides and hydroxides	1,043	1,454	France 624; United States 535; Sweden 152.
Precious and semiprecious stones, except diamond:			
Natural—thousand kilograms	1,810	2,245	Brazil 1,238; Republic of South Africa 461.
Manufactured—do	20	25	Switzerland 17; France 4.
Pyrite (gross weight)—thousand tons	1,630	1,381	U.S.S.R. 408; Norway 408; Spain 312.
Salt	337,378	428,550	Netherlands 349,344; France 45,080.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	190,451	171,282	Belgium-Luxembourg 54,030; Netherlands 25,813.
Caustic potash, sodic and potassic peroxides	5,774	NA	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	218,164	263,292	Austria 106,943; Italy 62,474; Portugal 22,463.
Slate	8,038	13,188	United Kingdom 4,089.
Other	522,452	441,851	Sweden 121,043; Denmark 97,289; Austria 69,383.
Worked:			
Building and monumental stone	269,174	348,725	Italy 304,123; Spain 11,666.
Paving and flagstone	150,935	100,367	Portugal 57,963; Poland 16,507; Romania 12,101.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Dimension stone—Continued			
Worked—Continued			
Slate	10,397	12,279	Italy 6,152; France 1,646; United Kingdom 1,464.
Dolomite	356,018	276,137	Belgium-Luxembourg 209,681.
Gravel and crushed rock, thousand tons	13,523	15,994	France 8,592; Denmark 4,238.
Limestone, do	1,505	1,557	Austria 1,187; Sweden 165.
Quartz and quartzite:			
Quartz crystal, kilograms	97	101	Japan 91.
Other	83,463	82,017	Belgium-Luxembourg 34,290; Sweden 18,069; Yugoslavia 6,209.
Sand, excluding metal bearing, thousand tons	2,576	3,654	France 1,929; Denmark 829; Netherlands 530.
Sulfates, natural, magnesium sulfate (Kieserite)	143	149	NA.
Sulfur:			
Elemental:			
Other than colloidal	291,518	331,692	United States 133,920; Poland 128,882; France 55,204.
Colloidal	980	730	United States 538; France 191.
Sulfur dioxide	(1)	--	
Sulfuric acid	173,835	115,236	Poland 25,467; France 21,699; Sweden 20,882.
Talc, steatite, soapstone	97,878	93,486	Austria 36,004; Italy 15,425; France 12,300.
Vermiculite, chlorite, perlite	56,574	76,594	Greece 32,174; Hungary 17,077; Republic of South Africa 15,092.
Other, nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, jet	6	538	Mainly from Spain.
Pottery	13,487	13,994	U.S.S.R. 7,019; Czechoslovakia 1,578; Poland 1,238.
Other	347,117	367,383	Austria 122,811; France 91,270; Norway 85,532.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture, thousand tons	1,724	1,687	France 995; Belgium-Luxembourg 516.
Slag and ash, n.e.s., do	128	110	Belgium-Luxembourg 48; Denmark 30.
Oxides and hydroxides of strontium and barium	77	223	United States 152.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals n.e.s.	125,948	163,542	Belgium-Luxembourg 48,373; Sweden 23,070; Austria 19,040.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	21,603	22,003	Trinidad 17,629; United States 4,195.
Carbon black	40,326	35,395	Netherlands 14,342; France 7,263; United States 5,897.
Coal and briquets:			
Anthracite and bituminous, thousand tons	8,838	7,268	United States 2,904; United Kingdom 1,468; Poland 864.
Briquets of anthracite and bituminous coal, do	300	127	Mainly from Netherlands.
Lignite and lignite briquets, do	1,103	1,179	Czechoslovakia 1,151.
Coke and semicoke, do	610	406	United States 119; France 75; United Kingdom 53.
Peat and briquets, do	36	36	Netherlands 19; Poland 9.
Gas, natural, do	6,297	9,336	Netherlands 9,210.
Helium and other rare gases	1,382	2,039	Belgium-Luxembourg 1,228; United States 218.
Petroleum:			
Crude and partly refined, thousand tons	98,786	100,230	Libya 29,940; Saudi Arabia 16,845; Algeria 11,327.
Refinery products:			
Gasoline, motor spirit, do	2,280	3,324	Netherlands 866; Belgium-Luxembourg 784; France 494.
Kerosine, white spirit, do	680	898	Netherlands 525; Belgium-Luxembourg 130; Yugoslavia 60.
Distillate fuel oil, do	19,522	19,914	Netherlands 9,851; Italy 2,993; U.S.S.R. 1,961.
Residual fuel oil, do	3,456	4,302	Netherlands 1,985; France 922; Belgium-Luxembourg 397.
Lubricants, do	198	226	United Kingdom 56; Netherlands 42; United States 35.
Mineral jelly and wax, do	87	98	United States 52; Netherlands 31.
Other, do	4,144	4,763	Netherlands 3,001; United States 611; France 385.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals, do	630	633	Netherlands 286; Belgium-Luxembourg 123; United States 40.

r Revised. NA Not available.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Reduction in vehicle and machinery manufacture resulted in a slowdown of aluminum production and consumption compared with the 1971 growth rate. However, alumina production from bauxite was up 11% from 1971 to 916,000 tons. Overall, aluminum production and consumption still showed increases but were below expectations. The indicated aluminum balance for 1972, compared with 1971, was as follows, in thousand metric tons:

	1971	1972
Production of primary aluminum	427.5	444.7
Production of secondary aluminum	275.7	294.0
Total	703.2	738.7
Imports (ingot) [1]	329.1	362.0
Exports (ingot) [1]	−63.1	−82.0
Stock change [1]	−19.7	−21.0
Apparent consumption	949.5	997.7

[1] Escherich, R. Federal Republic of Germany. Aluminium (Düsseldorf), v. 49, No. 1, January 1973, p. 51.

The 5% increase in total aluminum production was essentially the same as the increase in apparent consumption. Production capacity for primary metal was 575,000 tons at the beginning of the year and 562,000 at yearend, with average utilization of about 78%. The largest plants were the Rheinwerke Norf, of Vereinigte Aluminium-Werke A.G. (VAW), with a capacity of 140,000 tons, and the Essen plant of Leichtmetall G.m.b.H., with a capacity of 126,000 tons. The latter was owned by Metallgesellschaft A.G., 50% and Alusuisse, 50%.

Keen international competition in aluminum due to worldwide buildup, together with the currency revaluation, combined to weaken competitiveness of German production. Primary aluminum, as a dollar-quoted commodity and marketed under identical conditions on the international market, resulted in German market losses because of the DM-US$ relationship changes in 1972. Prices were unfavorable compared with rising costs, especially for products involving high labor costs, which were not compensated for.

The foundry industry, largely because of reduced production in automotive and machinery industries, had lower rates than in previous years and the earnings of the manufacturing industry declined further.

Data on the aluminum fabricating industries, compared with 1971, were as follows, in thousand metric tons:

	1971	1972
Production of semiproducts	606.8	645
Aluminum castings	227.4	222
Miscellaneous	84.1	86
Total	918.3	953

Copper.—Production of refined copper, including secondary, decreased slightly to 399,000 tons compared with 400,000 tons in 1971. Mine production of 1,320 tons came from the Rammelsberg mine in the Hartz mountains, where it occurs in small amounts in lead-zinc ore and is recovered during processing.

West Germany's copper smelting capacity was unchanged from that of 1971. Copper refineries and capacities in metric tons were as follows: [3] Hüttenwerke Kayser Aktiengesellschaft, Lünen, 75,000; Norddeutsche Affinerie, Hamburg, 220,000; Zinnwerke Wilhelmsburg, Hamburg, taken over by Norddeutsche Affinerie and included in its total.

Iron Ore.—Iron ore production decreased 4% from that of 1971. Iron content, averaging 28.1%, was equivalent to 1.72 million tons. Worldwide competition has gradually forced the closing of German mines, and principal production is concentrated in only four. These are situated near steelmaking areas and because of low grades, require rationalization and mechanization to survive. Transportation also is a factor because the ore is used some distance from port locations. Domestic iron mining activities include the Salzgitter Erzbergbau A.G. and Stahlwerke Peine-Salzgitter A.G. operations, which from four mines produced approximately 80% of West Germany's total iron ore. Beneficiation was carried out at the company's mills in Lower Saxony. Major foreign suppliers of ore to West Germany were Liberia, Sweden, and Brazil. West Germany is Liberia's major customer, importing 7 million tons of ore in 1972.

[3] American Bureau of Metal Statistics of the Yearbook, 1972. June 1973, p. 29.

Iron and Steel.—Iron and steel production increased and held steady throughout most of the year, making a good recovery from the poor showing of 1971. Although the output level of 1970 was not reached, the economic situation pointed to continued future steel growth in line with that of the European Community.

Pig iron production, including blast furnace ferroalloys, totaled 32.0 million tons, and raw steel, 43.7 million tons. Raw steel production was approximately 7% of the world's production, the same percentage as in 1971. Overall shipments by West German steel mills increased by 9%.

List prices of German steel sold in the home market increased by an average of 24%. World prices in terms of U.S. dollars were higher, but competition and currency realinement resulted in an average export price increase for West German producers of only 1.8%. Thus, German iron and steel producers in general showed operating losses, or at best only modest profits. There were doubts within the industry that German steel mills would be able to maintain previous levels of export shipment in view of the U.S. dollar decline, although the home market for steel was expected to expand about 5%. Beginning January 1, 1973, labor rates were up 8.5%, and fuel and other raw material costs were also expected to rise.

The German steel industry did not have an organized system of control or planning, and the inflation of 1971–72 was claimed to have raised the break-even point of its steel mills to a raw steel capacity utilization of 85% to 90%, with 1972 averaging much below this. The industry has been centered in the Ruhr, with almost two-thirds of the total German steel production coming from this region. Other producing areas were the Saar, Lower Saxony, and Bremen. The major advantages enjoyed in the past, coal and ore in the vicinity of the blast furnaces, are now problems which the Government and industry are trying to resolve; the steelworks cannot afford to subsidize German coal at world market prices, or continue to use low-grade German iron ore and compete with the more efficient producing countries utilizing modern coastal plants and high-grade ores.

Technology and mergers have accomplished much to increase efficiency. Mergers have been largely within the country. One merger of considerable importance accomplished in 1972 was that of Hoesch A.G. and Koninklijke Nederlandsche Hoogovens en Staalfrabrieken N.V. (KNHS) to form a new company, ESTEL NV. Two holding companies, Hoogovens IJmuiden B.V. and Hoesch Werke A.G., were formed by the original companies. Each held 50% of the issued share capital. KNHS retained also an original holding of 14.5% in Hoesch A.G. The merger forms a major steel-producing group, with plant facilities on the coast for future development. This is considered important because the belief of the new group is that eventually there will be room for only eight or 10 major steelmakers in Western Europe. Raw steel production for ESTEL in 1972 totaled 11.1 million tons, 6 million tons at Dortmund and 5.1 million tons at IJmuiden. Expansion in ingot production can be expected to be at IJmuiden to supply finishing facilities as added to in Germany by the group.

The August-Thyssen steel group had a raw steel capacity exceeding 12 million tons, and remained Western Europe's largest producer, after the British Steel Corp., which would operate as part of the European Coal and Steel Community in 1973. Thyssen completed a new blast furnace at Duisburg-Huckingen and had a new company, Thyssen Purofer G.m.b.H., set up to promote its direct-reduction process. Thyssen also proceeded with plans for steel mill projects in Brazil. There was some speculation on Brazilian raw steel being produced in the future for finishing in West Germany.

The Peine-Salzgitter group operated in Lower Saxony with a 4.5-million-ton capacity in plants at Peine and Salzgitter. No plans for expansion were announced.

The Krupp organization continued as a leading steel producer. The Friedrick Krupp Hüttenwerke A.G. steelworks had a capacity of approximately 4.5 million tons per year and was installing at Rheinhausen a second continuous slabcaster, a 300-ton oxygen converter, and a new degassing facility. Krupp underwent a change in management in 1972, and a change toward reducing the importance of steelmaking was expected. The Krupp mineral processing and engineering division, Krupp Rohstoffe, extended its activities to Australia and was in the process of setting up a marketing consortium in West Germany to handle Austra-

lian mineral products. It would also offer expertise to Australian mining firms and evaluate joint venture projects. Minerals of interest included iron ore, coal, fluorspar, and beach sands.[4]

The Klöckner steel complex at Bremen has been the only German steelworkers near the coast. The company had a new blast furnace, expected to be completed in 1973, and was expected to operate with a steel capacity of about 5 million tons per year.

Mannesmann A.G. produced steel mainly for its own use in pipe production. Capacity was 3 to 4 million tons per year. The second continuous tube mill of Mannesmannröhren-Werk was inaugurated in December at the company's Mülheim works and was expected to turn the tide of tube imports into the country due to the new mill's cost advantages.[5] Mannesmann also had interests in a steel plant in Brazil and tube mills in Canada and Turkey.

Korf Stahl A.G., a small independent producer, operated Germany's first direct reduction steelmaking plant, the Hamburger Stahlwerke (HSW) at Hamburg, with a capacity of approximately one-half million tons raw steel per year. Korf, together with the state-owned Salzgitter A.G., signed an agreement with the Soviet Metallurgimport and was to start construction on a 3-million-ton integrated steel plant near Kursk in central Russia, 280 miles south of Moscow. The cost, approximately $300 million, would be met by credit from German banks for about two-thirds of the amount. Repayment would be by sponge iron pellets, to begin after 1975.[6] Direct reduction technology licensed to Korf by Midland-Ross Corp. would be employed in the complex.

Klöckner-Werke Aktiengesellschaft was reported as planning to take a minority stake in HSW and possibly in Korf Engineering, the Korf group steelworks plant contractor. HSW's raw steel capacity would be increased by 200,000 tons per year under the proposed agreement.

Wuppermann G.m.b.H. planned to install a small steelworks having two 100-ton electric furnaces. The plant, to include two continuous-casting strands, would be in operation in 1974 with a capacity of 500,000 tons per year. The plant would initially use scrap as a raw furnace charge, and could change to prereduced iron material. Based on past needs of the company, the mini-mill would provide about three-fourths of its rolling mill production requirements.

Foreign trade in iron and steel for principal categories in million tons was as follows:

	1971	1972
Exports:		
Ferrous scrap	2.1	2.1
Pig iron and ferroalloys	.8	.9
Semifinished steel, including coils	2.5	2.5
Finished rolled and forged steel	9.7	10.4
Imports:		
Ferrous scrap	1.0	1.2
Pig iron and ferroalloys	r .3	.3
Semifinished steel, including coils	1.5	2.0
Finished rolled and forged steel	7.8	8.7

r Revised.

Source: U.S. Embassy, Düsseldorf, West Germany. State Department Airgram A-60, May 30, 1973.

Iron and steel trade with the United States in thousand tons was as follows:

	1971	1972
Exports to United States:		
Pig iron, ferroalloys, scrap	14.0	9.0
Ingots and semifinished steel	1.0	1.0
Coils	513.0	405.0
Finished hot-rolled and forged steel	1,693.0	1,613.0
Imports from United States:		
Pig iron, ferroalloys, scrap	19.0	16.0
Ingots and semifinished steel	.9	.1
Coils	2.5	24.7
Finished hot-rolled and forged steel	33.5	66.6

Source: U.S. Embassy, Düsseldorf, West Germany. State Department Airgram A-60, May 30, 1973.

Lead-Zinc.—Production of lead on mine basis totaled 38,000 tons in 1972, a 7.3% decrease from the 41,000 tons of 1971. Zinc ore production on a zinc content basis decreased 7.6% to 122,000 tons compared with 132,000 tons in 1971. Smelter production of lead from primary and secondary sources totaled 273,600 tons, a 9.2% decrease from the 301,200 tons of lead smelter production in 1971. Production of zinc metal totaled 358,700 tons in all forms (including secondary) in 1972 compared with 262,600 tons in 1971, a 36.5% increase.

[4] Engineering and Mining Journal. West German Firm Eying Australian Minerals. V. 173, No. 7, July 1972, p. 126.

[5] Metal Bulletin. Mannesmann's New Mill. No. 5761, Dec. 22, 1972, p. 30.

[6] German International. West German Steel Plant in Russia. V. 16, No. 12, December 1972, p. 24.

Table 5.—Federal Republic of Germany: Scrap supply and consumption

(Thousand metric tons)

	1970	1971	1972
Supply:			
Iron and steel plants	10,096	8,856	9,149
Foundries	2,857	2,579	2,456
Purchases:			
Domestic	8,269	r 7,634	8,740
Imported	1,384	r 969	1,187
Other, including variation in stock estimates	3,329	3,279	2,787
Total new supply	25,935	23,317	24,319
Consumption:			
Iron and steel plants	18,439	16,427	18,196
Iron and steel foundries	5,233	4,744	4,510
Consigned for export	2,149	2,032	1,939
Stocks at yearend	2,049	2,164	1,838

r Revised.

Table 6.—Federal Republic of Germany: Salient statistics of the iron and steel industry

(Thousand metric tons unless otherwise specified)

	1970	1971	1972
PIG IRON			
Producing plants—number	24	23	NA
Blast furnaces available—do	104	98	89
Blast furnaces in operation at yearend—do	80	71	78
Maximum production capacity	36,510	36,480	35,328
Production:			
Thomas	13,729	11,819	11,802
Open hearth	17,391	16,122	18,331
Foundry	324	280	206
Spiegeleisen and blast furnace ferromanganese	251	210	210
Other	1,932	1,559	1,454
Total	33,627	29,990	32,003
Blast furnace charge:			
Iron ore:			
Domestic	1,258	953	748
Iron content	443	365	277
Imported	18,062	14,425	14,226
Iron content	10,882	8,668	8,632
Sinter and briquets	34,858	32,662	35,942
Iron content	19,349	18,157	20,012
Manganese ore	508	421	431
Iron content	65	46	49
Other iron-bearing materials:			
Slag, scale, cinder, dust	3,485	3,209	3,003
Scrap	533	543	699
Limestone	1,209	919	868
Phosphate rock	184	123	177
Coke:			
Total	18,787	15,638	15,598
Kilograms per ton of iron produced	558	520	486
STEEL			
Converters:			
Basic bessemer:			
Total—number	18	18	14
In operation at end of year—do	18	18	14
Oxygen:			
Total—do	43	r 43	44
In operation at end of year—do	31	29	33
Furnaces:			
Open hearth:			
Total—do	114	89	85
In operation at end of year—do	79	46	54
Electric:			
Total—do	176	176	179
In operation at end of year—do	151	159	160
Maximum production capacity (all furnaces)	53,100	57,875	59,070

See footnotes at end of table.

Table 6.—Federal Republic of Germany: Salient statistics of the iron and steel industry—Continued

(Thousand metric tons unless otherwise specified)

	1970	1971	1972
STEEL—Continued			
Production of crude steel:			
Basic bessemer	3,640	2,831	2,662
Oxygen	25,137	24,908	28,230
Open hearth	11,819	8,537	8,331
Electric	4,436	4,030	4,479
Other	9	7	4
Total	45,041	40,313	43,706
Ingots	44,315	r 39,654	43,154
Liquid steel for castings	725	659	552
Furnace feed for ingot steel:			
Pig iron:			
Total	30,469	27,446	29,705
Kilograms per ton crude steel	(688)	(692)	(688)
Scrap:			
Total	17,882	15,874	17,493
Kilograms per ton crude steel	(404)	(400)	(405)
Preblown Thomas and other presmelted steels	137	15	6
Ferroalloys and alloying metals	435	356	433
Other iron-bearing materials	1,152	1,116	1,039
Iron and manganese ores	879	597	680
Total iron-bearing materials	50,954	45,404	49,356
Limestone	3,326	2,822	3,009
CASTINGS			
Iron and steel foundries in operation—number	NA	NA	NA
Production of iron and steel castings	4,877	4,313	4,115
Consumption of raw materials:			
Pig iron	2,269	1,924	1,821
Scrap	5,233	4,744	4,510
Ferroalloys and other metals	102	92	85
Total	7,604	6,760	6,416
EMPLOYMENT			
In coking plants of smelters—persons	2,834	2,841	2,685
Blast furnace, steel mills, hammer and forge shops—do	374,428	354,590	339,525

r Revised. NA Not available.

Table 7.—Federal Republic of Germany: Raw materials consumed in the production of pig iron

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972
Iron ore:			
Domestic	5,752	4,900	5,145
Imported	43,732	39,261	42,144
Total	49,484	44,161	47,289
Manganese ore	702	562	570
Pyrite cinder	3,663	2,893	2,243
Slags and plant scale	6,130	5,543	5,754
Blast furnace dust	1,635	1,429	1,534
Scrap	533	543	699
Total metallic raw materials, gross weight	62,147	55,131	58,089
Iron content of total metallic raw materials:			
Iron ore:			
Domestic	1,820	1,575	1,641
Imported	25,205	22,635	24,496
Manganese ore	75	r 53	56
Pyrite cinder	1,789	1,427	1,090
Slags and plant scale	2,687	2,409	2,620
Blast furnace dust	621	525	575
Scrap	421	438	565
Total iron content	32,618	r 29,062	31,043
Limestone	3,844	3,505	4,059
Phosphate	184	123	177
Total metallic raw materials, limestone, and phosphate, gross weight	r 66,205	r 58,791	62,325
Coke	18,787	15,638	15,598

r Revised.

Table 8.—Federal Republic of Germany: Production of sinter and consumption of raw materials

(Thousand metric tons unless otherwise specified)

	1970	1971	1972
Production:			
Gross weight	35,008	32,805	36,175
Iron content	19,459	18,313	20,215
Consumption of raw materials:			
Iron ore	30,394	28,925	32,454
Cinder	3,624	2,853	2,207
Slags and scale	2,684	2,374	2,788
Blast furnace dust	1,635	1,429	1,534
Limestone	2,634	2,586	3,191
Iron content of materials consumed:			
Iron ore	15,710	15,184	17,236
Cinder	1,781	1,419	1,082
Slags and scale	1,487	1,315	1,516
Blast furnace dust	621	525	575
Total	19,599	18,443	20,409

Table 9.—Federal Republic of Germany: Production of finished steel

(Thousand metric tons)

	1970	1971	1972
Wire rods	3,520	3,293	3,780
Bars and rods	6,315	4,923	5,335
Angles, shapes, sections (excluding rails)	2,519	2,012	2,224
Universal plates	524	402	409
Other heavy plates and sheets (more than 4.75 millimeters thick)	4,786	4,233	4,582
Medium plates and sheets (3 to 4.75 millimeters)	533	429	458
Thin plates and sheets (less than 3 millimeters)	6,860	6,562	7,025
Hot-rolled strip including skelp	2,793	2,483	2,676
Hot-rolled wide strip	2,121	2,336	2,718
Rails and railway track material	511	450	409
Seamless steel tubes	1,810	1,594	1,576
Total finished steel	[1] 32,291	28,717	31,192
Selected semimanufactures:			
Tin plate	749	[r] 780	756
Galvanized and terneplate	1,004	1,147	1,320
Steel pipe, welded	1,584	1,830	2,059
Extrusions and forgings	688	565	526
Steel castings	391	343	284

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

Consumption of lead in 1972 amounted to 288,000 tons, a slight increase over the revised figure of 286,500 tons consumed in 1971. Zinc consumption totaled 405,000 tons in 1972, a 4.5% increase from the revised figure of 387,500 tons of 1971.

Although total lead production decreased in 1972, zinc metal output increased sharply. The increase in zinc production was generally attributed to the output from the new zinc electrolysis plant of Preussag-Weser-Zink G.m.b.H. at Nordenham. In 1972 lead smelters produced only one-third of the smelted lead from ore. Two-thirds was derived from old material, slag, and previously worked lead. In the case of zinc output, about one-third was obtained from German ore.

Production of pyrite ore at the Meggen mine of Sachtleben Mining Company G.m.b.H., Lennestadt, totaled 819,500 tons in 1972, compared with 866,000 tons in 1971. The crude ore yielded a flotation product of 405,100 tons of pyrite, 101,155 tons of zinc concentrate, and 7,300 tons of lead concentrate in 1972. This compared with 442,700 tons of pyrite, 109,500 tons of zinc concentrate, and 8,900 tons of lead concentrate in 1971.

During 1972, employment in lead and zinc mines of West Germany averaged 2,972 laborers and staff personnel, compared with 3,031 laborers and staff in 1971.

Five mines operated to produce lead and zinc ores. Preussag A.G. Metall's mines at Grund and Rammelsberg supplied about two-thirds of the country's lead ore and two-fifths of its zinc ore. The Sachtleben

A.G. für Bergbau und Chemische Industrie operations in Southern Westphalia, the Ramsbeck and Meggen mines, supplied about one-half the native zinc and a small amount of lead concentrate. The fifth mine, owned by a Belgian company, A.G. des Altenbergs für Bergbau und Zinkhüttenbetrieb, was in operation at Lüderich in the Rhineland, and produced lead-zinc ore.

Lead smelting and refining works and capacities in metric tons at the end of 1972 were: "Berzelius" Metallhütten G.m.b.H., Duisburg-Wanheim, 35,000 (smelter only); Braubach, 70,000; and Binsfeldhamer, 80,000; Norddeutsche Affinerie, Hamburg, 44,000; Preussag A.G. Metall, Nordenham, 117,000; and Oker (Harz), 50,000.

Electrolytic zinc plants and estimated annual capacity in metric tons for slab zinc at the end of 1972 were Ruhr-Zink G.m.b.H., Datteln, 130,000, and Preussag-Weser-Zink G.m.b.H., Nordenham, 130,000.

Zinc smelters and estimated annual capacity in metric tons for zinc production were "Berzelius" Metallhütten G.m.b.H., Duisburg-Wanheim, 180,000; Duisburger Kuperhutte, Duisburg, 20,000; Preussag A.G. Metall, Harlingerode (Oker), 94,000.

Uranium.—West Germany's program for atomic energy includes continuation of its sponsored exploration to obtain about 60% of its uranium needs to 1980 from this effort. The remainder would be bought on the world market. However, the ability to accomplish this is in doubt. Two main companies, Urangesellschaft G.m.b.H. (UG), and Uranerzbergbau G.m.b.H (UB), receive government support for exploration.

A small amount of work has been done in Bavaria and Austria, but most activity was centered in Niger, Togo, Canada, Australia, and the United States. Government support was withdrawn for prospecting in the Territory of South-West Africa.

UG had an 8.5% capital stake in a Franco-Italian-Niger undertaking, and the Niger area was regarded as the most promising. Production began in 1971, with West Germany to receive 150 tons per year starting in 1974. An option could increase the share to 300 tons at a later date. Prospecting rights were held by UB for the whole of Togo and exploration was continuing.

The quickest and best returns were expected from Canada. The Rabbit Lake project in Saskatchewan was expected to provide UB with approximately 2,000 tons per year of oxide material with an average uranium content of 0.35% beginning in 1975. Participants in this venture were Gulf Mineral Canada Ltd. and Gulf Oil Canada. A prospecting venture with British Newfoundland Exploration Co. in Labrador was temporarily suspended for economic reasons. Finds in Saskatchewan and Australia are still considered good possibilities.

Work on Europe's first fast breeder reactor was to begin at Kalkar in the northwest corner of North Rhine-Westphalia. Work would be done by an international consortium of construction firms. Schnellbruter Kernkraftgesellschaft G.m.b.H. of Essen would operate the plant, and the German utility firm Rheinisch-Westfälische Elektrizitäts-Werke A.G., would have a 70% interest. Dutch and Belgian firms would have 15% each. The three governments would subsidize the project to the extent of $336 million.

Gulf Energy Environmental Systems, a division of Gulf Oil Co., reached agreement with Nukem of Hanau to supply its high-temperature gas-cooled reactor (HTGR) nuclear fuel technology for designing and building reactors in West Germany. Nukem is a leading nuclear fuel manufacturer in Europe. The agreement included an option for Gulf to take 49% ownership in Hobeg, Nukem's new (HTGR) fuel subsidy.

NONMETALS

Cement.—Hydraulic cement production, 43.1 million tons, was up 5.2% over 1971, in line with increasing activity in the construction industry. The housing sector represented over 43% of the total building volume and rose 9%, while industrial and public works construction were off slightly. According to estimates of the German Building Industry Association, construction increased by 10% in value to $45 billion.

The Breisgauer Portland-Cementfabrik G.m.b.H. operated plants at Kleinkems and Geisingen with combined capacity of 880,000 tons. The Geisingen plant, representing approximately one-half the production, was in its first full year of operation.

A merger between the Breitenburger Portland-Cement-Fabrik and the Alsen-Breitenburg Zement- und Kalkwerke G.m.b.H. became effective in January. The new concern started a series of capital expendi-

tures, and in 1972 had completed construction of a cement mill with a capacity of 220 tons per hour.

Nordcement A.G., Hannover, set a new company record by shipping 1.39 million tons in 1972. Also a new construction project, expansion of the Alemannia works at Höver, proceeded and was expected to be complete early in 1973.

Fertilizers.—Production of potash (K_2O equivalent of marketable crude) was up slightly from 1971, and sales increased by 4.5% over that of 1971. Crude potash mined was 23,023,000 tons and capacity utilization was 82%.

Potassium chloride (muriate) with 60% minimum K_2O equivalent accounted for 53% of domestic potash production. Exports to the United States declined further, from 25,000 tons K_2O equivalent in 1971 to 11,000 tons in 1972. Imports were insignificant.

Prices of potash increased in May by 7% over the Government fixed price schedule, but were considered insufficient to absorb cost increases.

Kali und Salz A.G. (K&S), accounted for about 90% of total West Germany potash output. K&S operated Great Salt Lake Minerals & Chemicals Corp. (GSL) potash deposit in the U.S. but found it expedient, due to poor business operations, to incorporate Salzdetfurth, GSL's original parent company, into K&S. K&S also operated Alwinsal Potash of Canada Ltd. at Regina, Saskatchewan.

Nitrogenous fertilizer production dropped about 1%, owing to continued decline in exports and increase in imports. Consumption was up, and the trend toward increased usage was expected to continue. Demand increased for both imported urea and calcium ammonium nitrate, but there was a reduced demand for other mixed nitrogenous fertilizers, and ammonium nitrate.

A 340,000-ton-per-year urea plant was completed by Badische Analin und Soda-Fabrik A.F. (BASF) at Ludwigshafen. Production would be based on the Mitsui-Taatsu process. An expansion of the nitric acid plant of Erdolchemie G.m.b.H. at Dormagen was to be completed during the year. Capacity would be increased by 132,000 tons per year.

Fluorspar.—Fluorspar production dropped from 84,687 tons in 1971 to 84,070 tons. Consumption amounts to about 350,000 tons per year, and imports were from France, Spain, Mexico, the Republic of South Africa, and Italy. Sizable imports were expected to begin also from Thailand.

Domestic production was mostly acid-grade material used by the captive owners, Farbenfabriken Bayer and Kali-Chemie Aktiengesellschaft, and the state-owned aluminum producer, VAW. An estimated 10,000 tons of metallurgical-grade fluorspar was also produced by Friedrich Krupp. Producing deposits were located in the Black Forest region of Baden and the Oberpfalz-Stulln District of Bavaria. Increased expansion in mining of this material was not considered likely.

Sulfur.—Sulfur recovered, and obtained by chemical processes, increased by 19% to 219,000 tons. Planned expansion in plants for sulfur recovery from natural gas and crude oil was expected to raise recovered sulfur output to 600,000 tons per year within a few years.

The sulfuric acid producer, Ruhr-Schwefelsäure G.m.b.M., announced late in 1972 that operations would be discontinued at its 165,000-ton-per-year plant at Bochum-Riemke. The plant started operations in 1970 and was designed to utilize Soviet pyrites as raw material.[7] West Germany has been Europe's largest pyrite importer, and in 1972 imported 430,500 tons from Norway.

MINERAL FUELS

Coal.—Coal production declined by 7.5% from 1971, and yearend stocks increased by 3.37 million tons to 7.66 million tons. Lower demand made it necessary to cut back on work shifts. However, productivity increased, reaching over 4,000 kilograms of output per man-shift in the underground mines.

Lignite increased by 5.7% to 110.4 million tons, reflecting increased demand for this low-cost fuel in generation of electric power. Its use, after conversion to briquets, for household heating and small industry use continued to decline in favor of heating oil and natural gas.

Ruhrkohle A.G., the largest coal producer, had an output of approximately 77 million tons. The firm operated mines and coke-oven plants in the Ruhr District, with a total employment of approximately

[7] Sulfur (London). West Germany. No. 104, January–February 1973, p. 10.

Table 10.—Federal Republic of Germany: Coal and lignite industry
(Production, productivity, and employment)

	1970	1971	1972
BITUMINOUS AND ANTHRACITE			
Production:[1]			
Ruhr, million tons	91.1	90.7	83.3
Saar, do	10.6	10.7	10.4
Aachen, do	6.9	6.6	6.2
Lower Saxony, do	2.8	2.8	2.5
Total, do	r[2] 111.3	110.8	[2] 102.5
Output per man-shift:			
Ruhr:			
Underground, kilograms	3,843	3,893	4,081
Total mining, do	3,068	3,239	3,401
Federal Republic average:			
Underground, do	3,755	3,828	4,015
Total mining, do	3,001	3,158	3,308
Employment:			
Ruhr:			
Underground, thousand persons	109.2	107.9	100.4
Mine surface, do	31.5	23.9	21.0
Cleaning, do	12.8	10.7	11.1
Total including other workers and salaried employees, do	198.9	197.8	182.7
Federal Republic total:			
Underground, do	137.7	135.2	125.5
Mine surface, do	38.5	31.0	27.7
Cleaning, do	16.8	14.8	14.1
Total including other workers and salaried employees, do	249.7	247.8	229.7
LIGNITE AND SUBBITUMINOUS			
Production:			
Rhineland, million tons	93.0	90.5	95.7
Helmstedt, Hesse, Bavaria, do	14.7	14.0	14.7
Total, do	[2] 107.8	104.5	110.4
Employment:			
Rhineland:			
Open pit, thousand persons	4.7	4.6	4.4
All other, do	11.4	11.3	7.4
Total, do	16.1	15.9	11.8
Helmstedt, Hesse, Bavaria, do	7.0	6.8	6.6
Total, do	23.1	22.7	18.4
PECH COAL			
Production, million tons	.7	.07	--
Employment, thousand persons	1.4	.3	.06

r Revised.
[1] Excludes small mines and leases.
[2] Data may not add to total shown because of independent rounding.

Source: Statistik Der Kohlenwirtschaft e.V., Zahlen zur Kohlenwirtschaft, No. 96, February 1973.

183,000. Saarbergwerke A.G. with mines in the Saar District, produced about 10 million tons, and the Eschweiler Bergwerks-Verein with mines in the Aachen area, produced approximately 6 million tons.

Coal continued as a crisis industry, and Ruhrkohle reported losing over $200 million. Closing of the mines was not considered desirable by the Government because of the large labor force dependent on coal mining and the possibility of future needs to supply energy requirements of the country. It was expected that the Bonn Government would inevitably have to assist by subsidies. The industry has been subsidized to some extent by the steel industry, by paying higher prices for coal and coke than these fuels would cost elsewhere.

The Federal Commissioner for the coal industry expected coal to remain as the second largest source of energy and to increase in output for this purpose. Estimates for 1975 were that coal would supply 28% of total energy demand, compared with oil at 56%. He also stated that public funds could provide a guarantee for the financing of coal stockpiles to the extent of approximately $225 million, of which 85% would go to Ruhrkohle.

Ruhrkohle A.G. had stockpiled 3.6 million tons of coal and 6.6 million tons of coke, which, according to the chairman of the company, tied up $375 million.

The German Ministry for Economic Affairs announced plans for the construction of new coal-fired power stations having a total rating of 6,000 megawatts. These would be built near the West German coal deposits and would be supported by the Federal and state governments with grants

of $700 million. Nordrhein-Westfalen would receive one-third of the capacity, and consumption of coal was expected to be maintained above 20 million tons per year. This program would aid the coal-mining industry and modify an increasing dependence on crude oil from outside the country.

A 650-megawatt coal-fired complex also was to be erected in the vicinity of the Fenne Power stations by Saarbergwerke A.G. This would mean long-term use of the Saar bituminous coal and continued employment of a large number of men.

Petroleum and Natural Gas.—Crude oil production totaled about 7.1 million tons, 4% lower than in 1971. Refining capacity increased 5.3%, and a total refining capacity of 130 million tons per year was reached. Throughput of 109.8 million tons indicated a use factor of 84.5%. Crude imports amounted to approximately 103 million tons, of which 41.7% was from Middle East countries, 51.5% from Africa, 3.6% from Venezuela, 2.8% from the U.S.S.R., and 0.4% from Norway. A total of 38.1 million tons of finished petroleum products were also imported.

Oil reserves were down to 551 million barrels, and West Germany looked on its offshore North Sea waters as a promising prospecting area. Rights were held on 5,400 square miles by the German North Sea Consortium, under the leadership of Gewerkschaft Elwerath and Gewerkshaft Brigitta, both owned by Shell and Esso. There were nine other members of the consortium, and extensive seismic work was being done. Activities were extended in the non-German part of the North Sea again in 1972 as concessions were acquired from the Netherlands and the United Kingdom Governments by several groups with German participants.

Deminex, a Government-supported group of eight German oil firms, was active in other world areas, acquiring concessions in Canada and Guyana, and negotiating with Iraq, Venezuela, and the Arab Republic of Egypt. However, the group's drilling efforts offshore Trinidad and Nigeria did not result in reported discoveries of commercial oil or gas.

Drilling in West Germany totaled 156,431 meters. Of the 48 completed wells in 1972, 26 resulted in oil or gas production, somewhat better than in 1971. Four German and four foreign companies were active in oil and natural gas production. The German firms were Wintershall A.G., Preussag A.G., Deutsche Schacht-und Tiefbohregesellshaft G.m.b.H., and C. Deilmann A.G. International firms were Texaco, Royal Dutch Shell, Standard Oil, and Mobil Oil.

Natural gas continued to increase as a primary energy source. Its 1972 share of 8.6% was forecast to increase further to 12% in 1980. Indigenous sources provided 65% of the requirements for 1972, and with natural gas being produced at about 16,000 million cubic meters per year, special attention was focused on new sources of supply. Official estimates of German reserves were 360,000 million cubic meters in 1972. Arrangements were made for Norwegian offshore gas to be transported through a 400-kilometer underwater pipeline to Emden on the North Sea, pending Norwegian Government approval. A second agreement was arranged by three firms to receive liquefied gas from Algeria beginning in 1977. A third would provide for delivery from a Dutch offshore concession beginning in 1975. Delivery of natural gas from the U.S.S.R. was to begin in early 1973 at the rate of 7,000 million cubic meters per year over a 20-year period in return for large-diameter line pipe to be produced in West Germany.

Oil refining capacity increased 5% as the result of expansions, and no new refineries came onstream. Total capacity reached was 130 million tons per year with a throughput of 109.8 million tons. Expansion of the refinery capacity from 2,678 million barrels per day in 1972 to 3,644 million barrels per day in 1975 was planned. New refinery projects were undertaken by Texaco in Schwaig/Bavaria, Mobil Oil in Wilhelmshaven, and BP in Germersheim. Inland consumption of mineral oil products were estimated as follows, in thousand metric tons:

	1971	1972	Growth rate (%)
Motor gasoline	17,200	18,200	5.8
Automotive gas oil	9,700	10,300	6.2
Light fuel oil	46,100	48,000	4.1
Heavy fuel oil	26,300	28,800	9.5
Bitumen	4,700	4,800	2.1
Others	15,000	15,800	5.3
Total	119,000	125,900	XX

XX Not applicable.

Source: World Petroleum Report 1973. V. 19, 1973, p. 32.

Total refinery output of finished products was 2.9% above the output for 1971. Product breakdown in metric tons was as follows:

Product	1971	1972
Refinery, heating, and town gas [1]	4,828,625	4,413,059
Ethylene, propylene, butadiene, butylene	965,035	1,334,691
Other LPG	1,623,188	1,677,295
Motor gasoline (including aviation)	13,305,669	13,623,431
Naphtha and spirit	4,781,177	5,250,514
Kerosine and jet fuel	1,289,854	1,246,240
Diesel oil	9,336,713	9,978,398
Fuel oil, light [1]	29,755,887	30,557,364
Lubricating oil, grease	987,365	948,228
Fuel oil, heavy [1]	32,081,378	33,066,435
Paraffin, wax	135,868	134,158
Bitumen	4,703,707	4,673,072
Petroleum coke [1]	650,234	730,528
Sulfur	65,332	72,900
Other products	1,080,370	1,038,265
Total	105,590,902	108,744,578

[1] Includes refineries' own consumption.

Source: Erdoel-Informationsdienst, Hamburg.

Crude oil imports were distributed by country of origin in thousand metric tons as follows:

Country	1971	1972
Libya	29,940	28,482
Saudi Arabia	16,845	18,997
Algeria	11,327	11,430
Nigeria	9,511	10,890
Iran	8,517	9,808
Abu Dhabi	5,861	6,394
Kuwait	r 4,293	4,344
Iraq	4,168	1,896
U.S.S.R.	3,318	2,845
Venezuela	2,838	3,727
Tunisia	1,254	1,036
Qatar	952	1,147
Egypt, Arab Republic of	738	--
Syria	300	368
Gabon	283	460
Norway	78	448
Other	--	183
Total [1]	100,230	102,526

r Revised.

[1] Data may not add to totals shown because of independent rounding.

Source: Bundesamt für Gewerbliche Wirtschaft, Aussenstelle Hamburg.

Table 11.—Federal Republic of Germany: Petroleum and natural gas production by area

Area	1970	1971	1972
PETROLEUM (THOUSAND TONS)			
North of Elbe (Schleswig-Holstein)	800	799	737
Between Elbe and Weser	2,247	2,184	2,053
Between Weser and Ems	1,891	1,942	1,885
Ems Estuary	2	2	3
West of Ems (Emsland)	2,002	1,941	1,883
Upper Rhine Valley	199	198	177
Alpine Foreland (Bavaria)	393	353	361
Total [1]	7,535	7,420	7,098
NATURAL GAS (MILLION CUBIC METERS)			
Between Elbe and Weser (Hannover)	69	74	99
Between Weser and Ems (Hannover)	5,906	7,186	9,808
Ems Estuary	3,611	4,614	4,102
West of Ems (Emsland)	1,280	1,598	1,551
Upper Rhine Valley	26	25	16
Alpine Foreland (Bavaria)	1,084	1,292	1,585
Total	[1] 11,977	14,789	17,161

[1] Data may not add to totals shown because of independent rounding.

Table 12.—Federal Republic of Germany: Shipments of petroleum products

(Thousand metric tons)

Commodity	1970	1971	1972
Domestic sales:			
Gasoline, all kinds	19,548	21,783	23,107
Kerosine, including jet fuel	1,781	1,892	2,057
Diesel oil	9,640	9,712	10,151
Fuel oils	69,983	72,467	76,654
Liquefied petroleum gas	2,203	2,329	2,605
Lube oil and greases	1,087	1,092	1,078
Petroleum coke	973	603	1,692
Bitumen	4,730	4,661	4,896
Refinery gases	2,571	2,402	1,866
Other products	2,040	1,592	1,933
Total	114,556	118,533	126,039
Consumption by refineries:			
Fuel oil	4,544	4,175	4,115
Refinery gas	2,896	3,266	3,513
Petroleum coke	230	238	239
Total	[1] 7,671	7,679	7,867
Bunker deliveries:			
Gas and diesel oil	846	794	829
Fuel oil	2,882	2,932	3,122
Lubricants	44	16	49
Total	[1] 3,773	3,742	4,000
Exports	8,453	8,374	7,775
Other shipments	1,624	1,628	2,372
Changes in refinery stock	+335	+394	+191
Balancing factor [2]	+656	+270	−10
Total products available	137,068	140,620	148,234

[1] Data may not add to total shown because of independent rounding.
[2] Apparently changes in nonrefinery stocks.

The Mineral Industry of Ghana

By Henry E. Stipp [1]

Ghana's mineral industry in 1972 was highlighted by the Government's action in acquiring a 55% share in Ashanti Goldfield's Corp. Ltd. and Consolidated African Selection Trust Ltd. (CAST). The companies were reorganized as the Ashanti Goldfields (Ghana) Corp. Ltd. and Ghana Consolidated Diamonds Ltd. to conduct the operations of the former Ashanti Corp. and CAST. In December the Mining Operations Decree was published, which stated the Government's policy of effective participation in the mining industry and also defined the role of foreign private participation in the mining industry. Negotiations were being conducted with several other mining firms for the Government to acquire similar shareholdings in these companies.

In May the Government organized a five-member Aluminum Industry Commission. The commission was designated to negotiate with private organizations for the exploitation of bauxite and to promote, organize, and develop the aluminum industry.

A Decree NRC D32, 1972, was published that prohibited any person other than the Diamond Marketing Corp. from selling or disposing of diamonds. Any person finding diamonds is required to sell them to the Diamond Marketing Corp. within a 4-week period. The corporation was given the sole right to export diamonds. Another decree issued by the Government stated that any person found guilty of smuggling gold or diamonds out of the country would be punished by death.

Reportedly the Government of Ghana planned to extend mineral industry operations to provide for the processing of crude minerals mined in Ghana, into finished or semifinished products. This would increase employment and tax revenue.

A license to start exploration of the bauxite deposits located around Kibi, was issued to the Bauxite Alumina Study Co. Ltd. (BASCOL). The study will evaluate the bauxite reserves and determine their commercial viability. BASCOL is a consortium of Kaiser Aluminum & Chemical Corp. of the United States and the Aluminum Resources Development Co. Ltd. of Japan.

Negotiations were being conducted between the Government and an Iranian group for financing to establish a $24 million [2] cement clinker plant at Nauli, near a 400-million-ton limestone deposit. The clinker would be utilized in the cement factories at Tema and Takoradi. These factories are supplied with imported clinker at the present time.

Ghana and Togolese officials were discussing exploitation of limestone deposits located in Togo. The talks covered a preliminary study of the project and Ghana's role in it.

The Ghana Supply Commission announced that Nigeria would ship 20,000 tons of coal valued at $546,000 to Ghana. Reportedly, Ghana will import between 10,000 tons and 15,000 tons of coal annually for the next 4 years. The coal shipments were resumed after a 7-year interruption.

The Bank of Ghana reported that all shipments of manganese ore, bauxite, and other nonferrous base metals from Ghana will be supervised by the General Superintendence Co. Ltd. The company also has been given authority to inspect ore shipments at the seaport. Ore exporters were

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from the new Ghana cedi (N¢) to U.S. dollars at the rate of 1 N¢ = US$0.78.

required to give the company copies of ore sales contracts, shipping contracts, and shipments details.[3]

A protocol agreement was signed in September by the Governments of Ghana and Bulgaria calling for preliminary studies on projects to be conducted in Ghana by Bulgarian specialists in geology and several other fields.

The Government of Ghana reportedly will adopt a metric system of weights and measures on September 1, 1974.

PRODUCTION

Ghana's production of mineral commodities (excluding petroleum products) increased in value to an estimated $141.2 million in 1972, compared with an estimated $133.7 million in 1971. The increased output of gold and its higher value on world markets was the main reason for the increase in total value of Ghana's mineral production. The increase was offset to some extent by a decrease in the value of cement, diamond, and manganese. Future gold and diamond production could be disturbed by changes brought about by the Ghanaian Government's acquisition of 55% equity in the largest gold and diamond mining companies. However, the Government has indicated that it wants the former majority owners to provide management and technical services.

Figures on quantity of minerals produced are shown in table 1.

Table 1.—Ghana: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Aluminum:				
Bauxite, gross weight		[r] 342,002	329,608	340,321
Metal, smelter production, primary		113,039	111,125	144,070
Gold	thousand troy ounces	[r] 715	698	724
Manganese ore and concentrate, gross weight		[r] 405,367	598,562	498,340
NONMETALS				
Cement, hydraulic	thousand tons	[r] 442	531	415
Diamond:				
Gem [e]	thousand carats	255	256	266
Industrial [e]	do.	2,295	2,306	2,393
Total	do.	2,550	2,562	2,659
Salt		[r] 38,000	47,261	[e] 50,000
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	1,349	1,684	1,669
Jet fuel	do.	--	166	279
Kerosine	do.	550	601	689
Distillate fuel oil	do.	1,819	1,985	1,919
Residual fuel oil	do.	1,982	2,165	2,459
Other	do.	50	69	55
Refinery fuel and losses	do.	200	347	385
Total	do.	5,950	7,017	7,455

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

[1] In addition to the commodities listed, a variety of crude construction materials (clays, sand and gravel, and stone) is produced, but production data are not reported and available general information is inadequate for the formulation of reliable estimates of output levels.

TRADE

Ghana had a substantially improved trade balance in 1972, brought about largely by reduced imports and sharply improved prices for gold and cocoa. Gold normally accounts for about 10% of export earnings. However, inventories were depleted, and an increased level of commercial imports will

[3] Mining Journal (London). Ghana. V. 279, No. 7143, pp. 23–25.

be necessary to keep the economy operating at current levels.

Exports and imports of mineral commodities are shown in tables 2 and 3.

Table 2.—Ghana: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	339,099	353,733	United Kingdom 250,861; United States 37,137; Canada 32,204.
Metal, including alloys, unwrought	99,067	88,781	United States 30,910; Japan 20,399; United Kingdom 16,497.
Gold, bullion—thousand troy ounces	r 697	697	All to United Kingdom.
Iron and steel:			
Metal:			
Scrap	--	518	All to Italy.
Ferromanganese	3,475	--	
Semimanufactures	370	559	All to Ivory Coast.
Manganese ore and concentrate	403,345	418,843	Norway 168,879; Spain 72,040; United States 56,715.
Silver and platinum ores, including waste and sweepings—thousand troy ounces	1,503	--	
Other nonferrous metal, scrap, n.e.s	2,722	5,516	Italy 3,594; Spain 951; United Kingdom 480.
NONMETALS			
Cement	2	--	
Clay products, refractory	2	--	
Diamond, all grades—thousand carats	2,872	2,367	United Kingdom 1,655; Belgium-Luxembourg 407; Netherlands 305.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	(1)	--	
Refinery products:			
Gasoline—do	--	36	Togo 24; Dahomey 12.
Kerosine and jet fuel—do	--	29	Togo 18; Dahomey 11.
Distillate fuel oil—do	14	173	Nigeria 98; United Kingdom 47.
Residual fuel oil—do	r 605	1,247	Italy 697; United States 243; Greece 185.

r Revised.
1 Less than ½ unit.

Table 3.—Ghana: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	r 217,082	184,522
Metal:		
Unwrought	797	514
Semimanufactures	2,264	3,225
Copper metal, including alloys, all forms	739	1,227
Iron and steel:		
Metal:		
Scrap	4,798	7,567
Pig iron, ferroalloys, etc	2,008	1,682
Steel, primary forms	179	2,316
Semimanufactures	51,487	104,277
Lead metal, including alloys, all forms	164	532
Magnesium and beryllium metal, all forms	45	--
Nickel metal, including alloys, all forms	2	2
Silver, platinum-group metals—troy ounces	10,769	4,731
Tin metal, all forms—long tons	225	176
Zinc metal, including alloys, all forms	959	1,224
Other, n.e.s.:		
Ore and concentrate	9	19,173
Scrap	--	4
Metal, including alloys	261	377
NONMETALS		
Abrasives, natural:		
Pumice, emery, natural corundum	5	--
Grinding and polishing wheels and stones	556	86
Asbestos	51	681
Cement:		
Clinker	389,409	426,302
Portland	2,474	6,496

See footnotes at end of table.

Table 3.—Ghana: Imports of selected mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Chalk		25	14
Clays and clay products (including refractory):			
Clays, n.e.s		1,732	1,124
Products		6,936	7,275
Diatomite and other infusorial earths	value, thousands	r $4,179	$5,256
Fertilizers and materials:			
Crude		r 146	203
Manufactured		5,269	6,679
Ammonia		88	100
Gypsum and plasters		12,058	19,353
Lime		3,062	3,222
Salt and brines		2,571	135
Sodium and potassium compounds, caustic soda		7,408	9,873
Stone, sand and gravel		980	1,622
Sulfur:			
Sulfur and unroasted iron pyrites		1	92
Sulfuric acid		1,438	1,768
Talc, steatite, and pyrophyllite		1,010	676
Other nonmetals [1]		102	965
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural		101	321
Coal and coke, including briquets	thousand tons	32	11
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	r 6,218	5,095
Refinery products:			
Gasoline	do	6	12
Kerosine and jet fuel	do	r 254	144
Distillate fuel oil	do	19	--
Lubricants	do	136	151
Gas, natural and manufactured	value, thousands	r $6,103	$6,186
Mineral jelly and wax	thousand 42-gallon barrels	r 19	39
Other	do	r 355	375
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	value, thousands	r $7,655	$1,980

r Revised.
[1] Includes mica, meerschaum, amber, and jet.

COMMODITY REVIEW

METALS

Aluminum.—The construction of an electricity transmission line from the powerplant at Akosombo Dam to the Volta Aluminum Co. Ltd. (VALCO) smelter in Tema was completed in December.[4] Two additional generators were installed in the Akosombo plant, bringing total generating capacity to 912 megawatts of electricity.

Bauxite.—Shipments of bauxite from Takoradi in 1972 totaled 387,736 tons compared with shipments of 323,400 tons in 1971. In April difficulties in shipping bauxite were experienced because of the lack of spare parts for machinery. Imports of machinery parts are controlled by government licenses.

Preliminary results of studies conducted by BASCOL to determine the feasibility of mining and refining bauxite at Kibi reportedly were encouraging.[5] Test pitting and sinking of 100 drill holes to a depth of 40 feet into the deposit was nearly completed at yearend.

A combined bauxite and alumina complex based upon the Kibi deposits would cost from $130 million to $150 million. The alumina plant would have a capacity of 600,000 tons per year.[6] Negotiations were conducted in April by the Government and Engineers International Corp. (Ghana) Ltd. for an evaluation survey of bauxite deposits at Nyinahin.

A paper was published that gave the history of Ghana's aluminum industry and explained the rationale behind development of the bauxite deposits and the establishment of an alumina plant in Ghana.[7]

Gold.—A 5-year exploration and exploitation program costing about $5.85 million will be initiated by Tarkwa Goldfields, a subsidiary of the State Gold Mining Corp.[8]

[4] Standard Bank Review (London). Ghana. February 1973, p. 19.
[5] Page 17 of work cited in footnote 4.
[6] Standard Bank Review (London). Ghana. April 1972, p. 16.
[7] Standard Bank Review (London). Ghana's Bauxite Deposits. December 1972, pp. 2–4.
[8] Barclays International Review (London). Ghana. September 1972, pp. 15–16.

The Bibiani Gold mine, Western Region, was to be reopened, owing to the discovery of about 47,000 tons of gold ore in the northern section of the mine. The mine has been closed since 1966.

The Tarkwa gold refinery project, abandoned in 1966, was scheduled for reactivation in 1972.

Prestea Goldfields, a subsidiary of the State Gold Mining Corp., discovered additional deposits of gold ore in the northern section of the mines belt.[9] The company planned a $390,000 program for purchase of new equipment and material to exploit the recently discovered deposits.

The State Gold Mining Corp. planned a $7.02 million program to purchase machinery and equipment to rehabilitate the facilities of all its subsidiary mining firms.

Iron Ore.—Two deposits of iron ore occur in Ghana at Shieni in the north and Opon Mansi in the Western Region.[10] Proven reserves at Shieni are about 270 million tons; the Opon Mansi deposits are roughly estimated at 150 million tons.

Manganese.—Shipments of manganese ore from the port of Takoradi in 1972 totaled 517,127 tons, compared with 418,843 tons in 1971.

NONMETALS

Cement.—The cement factories at Takoradi and Tema stopped producing during May and June owing to a shortage of clinker. In mid-June the companies received the necessary import licenses, and they resumed full production of 1 million bags per month at the end of June. There was local shortages of cement in Ghana at midyear.

Clays.—A new ceramic factory located at Saltpond was scheduled to begin experimental production in December.[11] The largest part of the material and equipment necessary for the venture has arrived and was being installed rapidly. In its initial production period, the factory will produce annually 1,500 tons of tile and 600 tons of sanitary articles. Employment at the factory will be 200 persons initially.

Sand and Gravel.—The Glass Manufacturing Corp. factory at Aboso was scheduled for a $2.34 million expansion. Annual production of bottles will be increased to 24 million, and sheet glass manufacture for window panes will be initiated.[12]

MINERAL FUELS

Petroleum.—Oxoco Offshore Exploration Oil Co. of the United States was granted a prospecting license to explore for petroleum in a 1,180-square-mile area of Ghanaian territorial waters. The company expected to conduct preliminary surveys and exploratory drilling studies over a 2-year period.[13] The petroleum discovered offshore from Saltpond in July 1970 was still being evaluated at yearend to determine its commercial viability.

The Ghanaian Government announced that it would acquire Agip Ghana Ltd., a petroleum distribution company. This action was an extension of an agreement between the Ghanaian Government and Ente Nazionale Idrocarburi (ENI), the Italian national oil corporation. ENI built the Ghana-Italian Petroleum Co. Ltd. refinery located at Tema and owned a substantial share of Agip Ghana.

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[9] Standard Bank Review (London). Ghana. November 1972, p. 9.
[10] Work cited in footnote 6.
[11] Industries et Travaux d'Outremer (Paris). Ghana. No. 227, October 1972, p. 929.
[12] Barclays International Review (London). Ghana. June 1972, p. 21.
[13] Barclays International Review (London). Ghana. May 1972, p. 20.

The Mineral Industry of Greece

By John D. Corrick [1]

The Greek economy in 1972 was characterized by rapid growth and a buildup of inflationary pressures. Growth of the gross national product (GNP) was estimated to be 10.5%. If in fact this growth rate was achieved, then the average growth rate of the GNP during the 5-year period 1968–72 would exceed 8%, the goal set for the current 5-year economic development plan. An average annual GNP rise of 7% was forecast for the recently announced, long-range 15-year development plan.

The Greek Government's efforts to control prices during 1972 were being put to a severe test by mounting inflationary pressures. The pressures included general wage and salary increases and a high level of overall bank deposits. Nevertheless, Greece experienced only relatively moderate inflation. Government policy in controlling inflation was directed toward price control, reliance on imports to satisfy potentially inflationary demand, productive use of private bank deposits, and development of a capital market. Although an increase in reserve requirements by Greek banks could have been used to draw off excess monetary funds, the Government was reluctant to interfere with the expanding economy. However, the Government introduced anti-inflationary measures at yearend. Government actions were aimed at reducing monetary reserves through large cuts in the highly expansionary 1973 budget, placing curbs on residential construction, ceilings on credit, and increasing compulsory reserves and treasury bill holdings of commercial banks.

Strong domestic demand and improved import prospects were instrumental in maintaining Greek industrial activity at high levels throughout 1972. Rising residential construction and government spending continued to be the economy's principal stimulators. The consumer price index increased 4.3% and the wholesale price index increased 6.3% compared with 1971 indexes. The average index of industrial production increased 12.8% in 1972 compared with a 9.4% increase in 1971. The fastest growing manufacturing sectors were: basic metals, up 21% (a result of heavy foreign demand for aluminum, iron, and nickel); rubber and plastic articles, up 27.3%; chemicals, up 17.9%; petroleum products, up 18.4%; electrical machinery and appliances, up 26.3%; and textiles, up 24%.

A tightening labor market in 1972 emerged as a new and potentially serious problem facing the Greek economy. Wage increases of 10% to 17% in some sectors and limited though growing use of foreign labor in local industry reflected the scarce labor situation. In order to avoid future labor shortages, the Greek Government expanded and accelerated its work training programs and established bonus and tax incentives to encourage higher birthrates.

The balance of payments during the first 6 months of 1972 was favorable. Imports rose by 18%, while exports grew by 45%. European currency revaluations with their lower export financing cost and the economic upturn in Europe provided the major impetus. Invisible earnings continued their steady rise, resulting in the current accounts defict declining 15% from the 1971 midyear level. Sharp increases in foreign exchange deposits, supplier credits and public borrowing increased official assets of gold and foreign exchange to a record $711 million at midyear.

The Thessaloniki industrial zone was formally inaugurated on March 17, 1972. The area was to serve as a focal point for new industries locating in Thessaloniki and smaller local enterprises relocating from antiquated sites within the city. Firms were locating in the new industrial zone as a result of government incentives for industrial

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

development outside the Athens-Pireaus area and the overall growth of northern Greek economy. Construction began late in 1972 on the Steyr-Hellans heavy truck, tractor, and engine complex, which was to be the largest factory in the zone. Mitsubishi Metal Mining Co., Ltd. of Japan expressed interest in constructing a large magnesite processing plant in the industrial complex.

Late in 1972 the deputy minister of National Economy for Industry established a committee to organize a computerized register for the country's mineral resources. The register was to be used for supplying information to various public agencies and private enterprises. The information will assist officials in evolving policies for proper development and exploitation of the nation's mineral resources. The committee was to (1) identify areas of the country valuable in terms of mineral and stone resources; (2) gather related data on all measured, probable, and possible deposits of mineral and stone in specific areas; and (3) recommend mineral prospecting activities and propose agencies or enterprises qualified to undertake such activities.

PRODUCTION

Segments of the Greek mineral industry that recorded appreciable gains in 1972 were aluminum (9%), pig iron (17%), nickel (8%), and hydraulic cement (14%). Those segments showing significant decreases were manganese concentrates (13%), crude magnesite (2%), crude perlite (20%), pyrite (40%), and dimension stone (7%).

Table 1.—Greece: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum:			
Bauxite, gross weight thousand tons	2,292	2,861	2,408
Alumina, gross weight do	313	464	476
Metal, primary	[r] 90,725	120,603	131,277
Antimony, mine output, metal content	1	NA	3
Chromium, chromite:			
Crude ore, gross weight	56,782	46,446	56,666
Concentrates	27,440	24,276	22,130
Iron and steel:			
Iron ore and concentrate, gross weight	873	--	--
Pig iron and ferroalloys	300,000	291,633	340,000
Crude steel	435,000	476,572	500,000
Steel semimanufactures [2]	[r] 679,374	661,580	[e] 700,000
Lead:			
Mine output metal content	9,227	10,469	15,973
Smelter (refined): [3]			
Primary	[r] 15,444	19,457	26,919
Secondary	NA	NA	17,330
Manganese:			
Crude ore, gross weight	31,865	NA	24,353
Concentrate, gross weight	6,590	6,127	5,305
Nickel:			
Mine output metal content	9,526	10,700	[4] 19,702
Metal, content in alloy	8,642	10,573	11,270
Silver, smelter or refinery output thousand troy ounces	420	456	315
Zinc, mine output metal content	[r] 9,279	14,210	17,718
NONMETALS			
Abrasives, natural, emery	7,000	7,000	7,000
Barite:			
Crude ore	103,664	138,899	127,683
Concentrate	54,091	84,944	88,149
Cement, hydraulic thousand tons	[r] 4,933	5,533	6,300
Clays:			
Bentonite:			
Crude	192,941	212,740	375,413
Processed	10,542	15,560	20,115
Kaolin:			
Crude	48,274	54,855	70,965
Processed	14,569	14,029	11,977

See footnotes at end of table.

Table 1.—Greece: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
NONMETALS—Continued				
Fertilizers, manufactured, gross weight:				
Nitrogenous	thousand tons	379	353	NA
Phosphatic	do.	617	642	NA
Potassic	do.	NA	NA	5
Gypsum and anhydrite		308,553	325,154	399,751
Magnesite:				
Crude		755,176	952,523	931,658
Dead burned		219,366	274,832	250,791
Caustic calcined		57,338	37,735	52,891
Perlite:				
Crude		168,508	155,374	123,816
Screened		106,729	94,824	90,800
Pozzolan (santorin earth)		585,542	612,387	657,263
Pumice		450,774	419,081	533,632
Pyrite:				
Gross weight		[r] 308,287	383,370	230,666
Sulfur content		[r] 138,729	172,517	103,800
Salt, all types	thousand tons	[r] 113	114	115
Stone, dimension, marble	cubic meters	59,000	63,000	58,380
Talc		2,744	4,000	5,441
MINERAL FUELS AND RELATED MATERIALS				
Coal, lignite	thousand tons	7,858	10,963	11,579
Coke, gashouse	do.	15	14	[e] 12
Fuel briquets (lignite briquets)	do.	81	88	[e] 90
Gas, manufactured:				
Gasworks	million cubic feet	388	388	388
Blast furnaces	do.	5,792	4,238	NA
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	4,947	5,542	5,653
Jet fuel	do.	2,424	2,952	2,688
Kerosine	do.	775	581	1,225
Distillate fuel oil	do.	12,227	12,749	14,562
Residual fuel oil	do.	11,668	12,940	17,922
Lubricants	do.	119	112	105
Other	do.	3,327	3,099	4,431
Refinery fuel and losses	do.	1,503	1,488	2,223
Total	do.	36,990	39,463	48,809

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

[1] In addition to the commodities listed, other types of crude construction materials such as clays, sand, gravel and stone are produced, but output is unreported and available information is inadequate to make reliable estimates of output levels.

[2] Black sheet, galvanized sheet and reinforcing bars only.

[3] Including antimonial lead and hard lead.

[4] Nickel plus cobalt contained.

TRADE

Preliminary data indicated that Greece's balance of payments improved significantly in 1972 compared with that of 1971. In the first 6 months of 1972 the value of exports reached $399 million or an increase of 45% over exports during the corresponding 1971 period. Increased exports occurred in most major categories and specifically in the following: Raw materials and processed products (21.8%); oil products (391.0%); food stuffs (23.4%); and tobacco (48%). Exports of industrial and handicraft products increased by nearly 70% during the first 6 months of 1972. Commodities showing exceptional export activity were textiles (107%), cement (112%), chemicals and pharmaceuticals (103%), aluminum (42%), iron sheet (106%), and electrical apparatus (114%). Nickel exports which had dwindled to nearly zero in 1971 reached approximately $4 million in value during the first 6 months of 1972.

The value of imports (payments and trade credits) reached $1,094 million during the first 6 months of 1972, an increase of 18% over the value imported during the corresponding 6-month period in 1971. An indication of the healthy climate that pervaded Greek trade was the fact that the value of imported capital equipment and raw materials reached $608 million in the first 6 months of 1972. Favorable develop-

ments in the country's trade and invisible resource transactions resulted in a decrease in the current balance of payment's deficit of $43 million (−18%) during the first 6 months of 1972. Balance of payments data for 1972 showed a trade deficit of $1,572 million and a current accounts deficit of $405 million. The relationship between mineral trade and total commodity trade in recent years follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1969	110.0	553.6
1970	184.3	642.5
1971	150.6	662.5
Imports:		
1969	270.9	1,594.2
1970	310.8	1,958.3
1971	330.5	2,098.1

Table 2.—Greece: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	1,235	952	U.S.S.R. 516; France 114; Netherlands 78.
Oxide and hydroxide do	170	218	United States 115; France 61; Romania 26.
Metal, including alloys:			
Unwrought	60,012	87,004	France 44,609; Belgium-Luxembourg 22,285; Italy 16,040.
Semimanufactures	9,277	4,782	France 1,124; Italy 1,076; West Germany 440.
Chromite	24,976	26,805	Norway 10,700; West Germany 9,669; Yugoslavia 3,387.
Copper, metal, including alloys:			
Scrap	152	--	
Semimanufactures	1,493	1,250	France 578; West Germany 219; United States 189.
Iron and steel:			
Roasted pyrite	74,841	104,216	United Kingdom 63,587; West Germany 30,119.
Metal:			
Ferroalloys (excludes ferro-manganese)	15,640	3,662	Netherlands 3,540; Austria 111.
Steel, primary forms	19,147	28,899	United States 17,902; Syrian Arab Republic 8,996; Republic of South Africa 2,001.
Semimanufactures:			
Bars and rods, other than wire rod	27,016	12,752	Yugoslavia 12,578.
Universals, plates and sheets	131,936	78,084	Yugoslavia 51,290; United States 16,656; West Germany 2,650.
Tubes, pipes, and fittings	1,980	5,617	Libya 2,243; Cyprus 2,081; West Germany 319.
Lead, ore and concentrate	13,750	11,790	Italy 8,690; France 3,100.
Manganese, ore and concentrate	4,004	6,847	France 2,731; West Germany 2,658; United Kingdom 1,448.
Nickel, ore and concentrate	--	9,300	All to U.S.S.R.
Silver:			
Waste and sweepings value, thousand	--	$97	Belgium-Luxembourg $61.
Metal, including alloys do	$172	$68	France $66.
Zinc, ore and concentrate	21,612	25,820	France 14,350; Italy 11,470.
Other:			
Ore and concentrate of base metals, n.e.s.	--	142	NA.
Ash and residue containing non-ferrous metals	2,333	1,017	Belgium-Luxembourg 496; Spain 302.
NONMETALS			
Abrasives, natural, n.e.s., pumice, emery, natural corundum, etc	237,734	254,567	United States 234,428; France 3,872.
Barite and witherite	46,828	120,568	United States 64,420; Nigeria 28,625; West Germany 9,690.
Cement	371,165	648,969	Libya 474,196; Yugoslavia 84,115; Algeria 30,281.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	157,867	215,450	Canada 74,124; Nigeria 55,623; France 26,411.
Products:			
Refractory (including nonclay bricks)	79	16	NA.
Nonrefractory	3,537	33,218	Yugoslavia 30,662; Cyprus 1,047.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Fertilizer materials, manufactured:			
Phosphatic	43,601	15,150	All to Bulgaria.
Other	72,393	38,957	Italy 24,127; Cyprus 12,499; Syrian Arab Republic 2,326.
Lime	--	9,162	Libya 4,028.
Magnesite	296,940	288,987	West Germany 105,696; United States 64,928; United Kngdom 34,227.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked, calcareous	r 32,973	35,049	West Germany 12,679; Italy 11,434; Netherlands 4,247.
Worked	--	721	Libya 218.
Sulfur:			
Elemental, other than colloidal	9,542	3,175	Cyprus 1,877; Egypt 1,000.
Sulfuric acid, oleum	5,031	25,067	Italy 9,223; Turkey 6,191; Israel 5,131.
Other nonmetals, n.e.s.:			
Crude	126,134	127,906	France 46,081; United Kingdom 26,287; West Germany 24,910.
Slag, dross and similar waste, not metal bearing	11,037	5,702	Spain 399; Belgium-Luxembourg 345.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	31,947	32,224	Yugoslavia 14,603; Hungary 11,036; Libya 4,538.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, refinery products:			
Gasoline (including natural) thousand 42-gallon barrels	152	139	Cyprus 69; Italy 40; Finland 23.
Kerosine and jet fuel do.	r 1,125	1,126	Lebanon 156; Italy 152; Switzerland 138.
Distillate fuel oil do.	371	142	Cyprus 46; Italy 24; Finland 18.
Residual fuel oil do.	358	150	United Kingdom 60; Liberia 56.
Lubricants do.	7	7	Bulgaria 2.
Other, bituminous mixtures, n.e.s do.	--	4	Mainly to Libya.

r Revised. NA Not available.

Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	1,543	1,525
Metal, including alloys:		
Scrap	--	481
Unwrought	454	534
Semimanufactures	1,817	1,377
Chromium oxide and hydroxide	177	210
Copper:		
Metal, including alloys:		
Scrap	90	182
Unwrought	11,791	12,884
Semimanufactures	556	569
Iron and steel:		
Ore and concentrate	r 552,752	432,148
Metal:		
Scrap	11,636	14,292
Pig iron, including cast iron	22,397	19,670
Sponge iron, powder and shot	518	417
Ferroalloys	4,686	3,140
Steel, primary forms	135,719	197,770
Semimanufactures:		
Bars, rods, angles, shapes, sections	211,813	189,774
Universals, plates and sheets	129,538	128,656
Hoop and strip	23,560	27,772
Rails and accessories	3,848	7,958
Wire	10,788	12,639
Tubes, pipes, and fittings	18,975	23,939
Castings and forgings, rough	1,704	1,879
Lead:		
Ore and concentrate	16,362	20,475
Oxides	165	1,280
Metal, including alloys:		
Unwrought	8,530	8,720
Semimanufactures	r 120	154

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Magnesium metal, including alloys, all forms [1]	193	154
Manganese, ore and concentrates	5,585	4,031
Mercury, 76-pound flasks	87	--
Nickel, metal, including alloys, all forms	r 62	85
Platinum-group metals and silver, including alloys:		
Platinum group, value, thousands	$67	$112
Silver, do	$734	$1,260
Tin, metal, including alloys, all forms, long tons	r 241	254
Titanium oxides	3,565	4,196
Tungsten, metal, including alloys, all forms	4	1
Zinc:		
Oxide	445	511
Metal, including alloys:		
Unwrought	8,315	7,436
Semimanufactures	437	116
Other:		
Ores and concentrates of nonferrous base metals, n.e.s	3,715	3,052
Oxides, hydroxides and peroxides of metals, n.e.s	55	70
Metals, including alloys, all forms:		
Metalloids	172	156
Alkali, alkaline earth and rare earth metals	1,559	4,210
Base metals, including alloys, all forms, n.e.s	48	38
NONMETALS		
Abrasives, natural, n.e.s.:		
Dust and powder of precious and semiprecious stones, value, thousands	$81	$268
Grinding and polishing wheels and stones	321	374
Asbestos	17,811	16,100
Boron materials, crude natural borates	1,240	1,087
Cement	1,334	1,188
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	54,350	59,556
Products:		
Refractory (including nonclay bricks)	55,654	33,441
Nonrefractory	6,429	4,676
Diatomite and other infusorial earths	1,051	--
Feldspar and fluorspar	3,498	5,200
Fertilizer materials:		
Crude:		
Phosphatic	178,741	295,780
Other	670	151
Manufactured:		
Nitrogenous	74,448	124,403
Potassic	22,900	22,328
Other, including mixed	3,280	2,188
Ammonia	13,287	3,546
Graphite, natural	--	318
Gypsum and plasters	1,015	--
Magnesite	875	1,761
Pigments, mineral, including processed iron oxides	1,190	1,310
Precious and semiprecious stone, except diamond, value, thousands	$58	$98
Pyrite (gross weight)	12,971	80,368
Salt	57,959	35,576
Sodium and potassium compounds, n.e.s	14,505	46,406
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	--	397
Worked	1,074	167
Dolomite, chiefly refractory grade	862	727
Gravel and crushed rock	4,717	4,191
Sand, excluding metal bearing	76,933	73,712
Sulfur:		
Elemental, all forms	43,986	104,467
Sulfuric acid, oleum	--	4,964
Talc, steatite, soapstone, and pyrophyllite	3,915	2,967
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal bearing	--	1,047
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,051	765
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	1,851	2,950
Coal and briquets:		
Anthracite and bituminous coal	161,679	335,457
Briquets of coal	--	8,349
Coke and semicoke	286,466	54,177
Hydrogen and rare gases	156	173

See footnotes at end of table.

Table 3.—Greece: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1071
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	r 35,011	35,122
Refinery products:			
Gasoline (including natural)	do	786	787
Kerosine and jet fuel	do	r624	514
Distillate fuel oil	do	2,140	2,525
Residual fuel oil	do	5,545	6,886
Lubricants	do	r 517	561
Mineral jelly and wax	do	5	6
Other:			
Nonlubricating oils, n.e.s	do	6	9
Liquefied petroleum gas	do	156	75
Pitch and petroleum coke	do	313	328
Bitumen and other residues	do	--	50
Bituminous mixtures, n.e.s	do	2	15
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		4,913	4,789

r Revised.
1 May include small quantities of beryllium.

COMMODITY REVIEW

METALS

Aluminum.—Production of bauxite in 1972 totaled 2,408,000 tons compared with 2,861,000 tons in 1971. The major producer of bauxite in Greece, Parnassos Bauxite, S.A., started up a new beneficiation plant, part of the company's $6 million investment program, at Itea in June 1972. The plant, the first of its kind in Greece, was to extract limestone and clay impurities from low-grade bauxite ore. The new plant, which incorporated $200,000 worth of U.S. equipment, was expected to increase output of marketable bauxite and bring about development of large-scale underground mining operations. The overall investment program was planned to raise the company's production and ore loading capacities to 2 million tons per year by 1975. Officials of Parnassos estimated Greek reserves of bauxite at 500 million tons.

Aluminium de Grèce, S.A. (ADG) enlarged its holdings of Greek bauxite deposits in 1972. ADG bought Bauxitai Distomou, S.A., and negotiated for part interest in Earlos Barlos Bauxitai Hellas, S.A. Reportedly Bauxitai possessed extensive bauxite deposits in Greece. ADG, which controlled Bauxitai Delfon, S.A., obtained the major portion of its bauxite requirements from Parnassos Bauxite. The Aluminum Co. of America (Alcoa) concluded a geological survey of the Parnassos Bauxite deposits from which it expected to obtain raw material should it implement its bauxite-alumina-aluminum project in Greece. Reportedly, there were 200 separate bauxite deposits known in the Parnassos region of Greece in 1972.

The Greek Ministry of Commerce lowered the bauxite export quota from 1.295 million tons in 1971 to 1.275 million tons in 1972. Export quotas for bauxite in 1972 by country of destination were European Community (EC), 420,000 tons; U.S.S.R. 450,000 tons; Great Britain, 100,000 tons; United States, 75,000 tons; Norway, 10,000 tons; Japan, 20,000 tons; Czechoslovakia, 20,000 tons; Sweden, 70,000 tons; Spain, 60,000 tons; Yugoslavia, 15,000 tons; Romania, 25,000 tons; and Finland, 10,000 tons.

Greece's only alumina-aluminum plant, owned by ADG, produced 476,000 tons of alumina and 131,000 tons of aluminum in 1972. The comparable 1971 figures were 464,000 tons of alumina and 121,000 tons of aluminum. Alumina production in 1972 was at plant capacity of about 475,000 tons per year. Of the tonnage produced, 250,000 tons was consumed in the production of aluminum, the remainder was exported to various European and North African countries. The 1972 aluminum production showed an increase of 9% compared with that of 1971. At yearend, nearly 100,000 tons of metal had been exported compared with 87,000 tons exported in 1971.

Greek consumption of aluminum in 1972 was estimated at 26,000 tons compared with 21,500 tons in 1971. Increased consumption of aluminum was in line with the sustained growth of the Greek economy during 1972.

Most aluminum end use categories showed increased consumption in 1972 compared with those of 1971. The exception was aluminum conductor cables. The principal aluminum end use markets were in the electrical and building industries. Air-conditioning manufacturers were considered a significant potential market. The Greek aluminum industry, in attempting to penetrate export markets, have improved markedly the quality and expanded the variety of products manufactured.

At yearend, the Greek Government was considering four separate proposals for the construction of alumina-aluminum plants. Reynolds International proposed to build a $150 million to $200 million, 500,000- to 600,000-ton-per-year capacity alumina plant in conjunction with the Greek company Parnassos Bauxite. Alcoa proposed to build a $300 million complex to produce 300,000 tons per year of alumina and 130,000- to 150,000-tons-per-year of aluminum. The U.S.S.R., through Chalkis Cement Co. of Greece, offered to build a $120 million 500,000-ton-per-year alumina plant to be 100% Greek owned. The Soviet Union would take the entire output for the first 7 years. Kaiser Aluminum and Chemical Corp. of America proposed to build a plant to produce 60,000 to 70,000 tons of aluminum per year using either imported or Greek alumina.

Reportedly, Péchiney-Ugine Kuhlmann which controlled ADG filed a proposal to establish a 1-million-ton-per-year alumina production facility in addition to its present operation in Greece. The plant's output was to be exclusively for export. ADG obtained the Greek Government's approval to invest $5.6 million in its alumina-aluminum smelter at Distomon Bay in order to modernize and complete plant equipment, streamline production, and increase the plant's safety features. This project was to supplement the company's 1970–72 investment program providing for expansion of production capacity from 250,000 tons of alumina and 85,000 tons of aluminum to 475,000 to 500,000 tons and 145,000 to 150,000 tons, respectively. Improvements to ADG's smelter represented an investment of approximately $20 million. In 1972 ADG announced its intention to go public. Initially the company was to float a $15 million bond issue, part of which was to be in convertible debentures at 7% interest while the balance was to be nonconvertible at 8% per year. Corporate stock was to be listed on the Athens stock exchange at a later date.

Copper.—Hellenic Chemical products and Fertilizer Co. operated a chalcopyrite (3% copper) mine at Ermioni, Peloponnesus, which produced 50,000 tons of copper per year. The Roberts Construction Co. Ltd. of the Republic of South Africa sank a shaft in 1972 in a deposit of mixed sulfides (reportedly 2% to 8% copper content) at the Kassandra mines discovered and owned by Hellenic. By midyear, the shaft had reached a depth of 300 meters. Mining stopes were to be driven in 1973. Hellenic expected to complete a $2.6 million copper flotation plant being constructed on Chalkidike Peninsula by yearend 1972.

Reportedly Compagnie Péchiney dropped its option in 1972 to develop the Skounes copper mine on the Chalkidike Peninsula. Nevertheless, the mines codeveloper, Placer Development Co. of Canada, obtained an extension through yearend on its contractual obligation to invest $15 million in development of the Skounes mine. Placer owned 60% of Skounes mine through the Greek corporation, Macedonian Copper Mines Co.

Iron and Steel.—The Halyvourgiki, S.A., number two blast furnace at Elevsís, with a capacity of 500,000 tons per year, which has been inactive for almost 2 years, was brought back into operation. The Halyvourgiki plant was the country's first complete vertically integrated iron and steel complex. It has a capacity to produce about 1 million tons of finished steel per year. Halyvourgiki started up a continuous slab casting machine and completed installation of new coking facilities. The new facilities increased coke capacity to the 500,000 tons per year needed to feed the company's second blast furnace. At yearend the Halyvourgiki works consisted of port facilities able to accommodate vessels up to 50,000 dead weight tons; two blast furnaces; and a steel plant consisting of two top blown basic oxygen furnaces, an oxygen plant, and two rolling mills. The rolling mills were capable of producing flat products, steel bars, and cold-rolled flat and wire products. The company was building its own electric generating plant with completion expected in 1973.

The Steelworkers of Northern Greece (formerly Viohalco Sanitas, S.A.) commissioned a Schloemann combined narrow

strip wire rod mill at its Thessaloniki works. The mill was capable of producing continuous strip, ranging from 60 to 180 millimeters in width and 1.25 to 2.6 millimeters in thickness. The wire rod facilities, designed for two-strand rolling, were capable of producing rounds from 6 to 12.5 millimeters in diameter and included modern finishing facilities. The company continued work on its expansion scheme to raise steel capacity at Thessaloniki to 400,000 tons per year. Reportedly a 250,000-ton-per-year direct reduction plant was to be set up in Greece and was expected to be operating within a 5-year period. The cost of the proposed plant located outside the greater Athens area was estimated at $23.2 million, of which $18 million was to come from sources outside the country.

The Greek Government approved plans by Metallourgiki Athinon, S.A., to build electric steelmaking and hot-rolling facilities at a cost of $12 million. The planned facilities were to be located in the Volos area or at nearby Stilis and were expected to be commissioned within 3 years. Hellenic Steel Co.'s plans to expand the capacity of its cold-rolling facilities in Thessaloniki from 350,000 to 1 million tons annually were being considered by the Government at yearend. Hellenic Steel had proposed several alternatives to the Government for a contractual commitment to develop the present cold-rolling mills into an integrated steel plant. Reportedly the alternatives were (1) expanding the present works in order to produce sections and coils and (2) increasing the output of manufactured products and exports with a subsequent effort toward integration.

Late in 1972 the Greek Government established a "Steel Board." The Board will have representatives from integrated iron and steel producers, dependent steel product industries, steel construction firms, iron and steel merchants, and the Ministry of National Economy. The Board's duties were to (1) assist the steel industry in drawing up a uniform policy for the acquisition of raw materials; (2) plan efficient works at lowest cost; (3) develop scientific research; (4) establish contacts with international bodies connected with the iron and steel industry, particularly the EC; (5) advise on international market research, and; (6) deal in general with matters of interest to the steel industry.

Officials of the Greek Government and representatives from the Brazilian Embassy discussed the possibility of using Brazilian iron ore in Greece. Brazilian companies reportedly have been interested in establishing cooperative ventures in Greece for concentrating Brazilian ores and in establishing a free transit area in Greece for distributing Brazilian goods to European, African, and Asian markets.

Nickel.—Nickel ore production in Greece increased from 10,700 tons of recoverable nickel in 1971 to 19,702 tons in 1972. Greece's only nickel producer, Société Minière et Métallurgique de Larymna, S.A. (LARCO), operated a smelter at Larymna in 1972 and produced ferronickel with a nickel content of 11,270 tons compared with 10,573 tons nickel content in 1971. LARCO's exports of ferronickel, which were nil in 1971, increased dramatically in 1972 as a result of improved world market conditions. LARCO was able to reduce the arsenic level of its ferronickel from 0.3 to 0.5% to 0.15%. Arsenic reduction was brought about by blending arsenic-free ore from LARCO's newly opened Euboea mine with ore from Larymna. During 1972, LARCO continued a $16 million expansion program. The company hoped to complete expansion work by 1973, increasing production to 1,600 tons per month of nickel compared with 1,000 tons per month produced in 1971. LARCO's annual ore production would then increase to 2 million tons. The company was considering production of 500,000 annual tons of steel billets from iron slag produced at its Larymna plant. LARCO expected to increase nickel ore production to 5 million tons annually in the next 10 years, coupled with parallel expansions to the metallurgical processing facilities. In March 1972, the company took delivery of the 1,200-ton vessel "Ilion" in Rotterdam, the Netherlands. The Ilion was obtained to carry ore from the firm's mines on Euboea to its plant at Larymna.

Elevsís Bauxite, S.A., a member of the Skalistiris Group, estimated its proven nickel laterite deposits in central Euboea to be 70 million tons. Elevsís and Lurgi Consultants of Frankfurt, West Germany, were conducting studies on methods for beneficiation and metallurgical processing of the ore.

Uranium.—An agreement was signed on March 1, 1972, by the Greek Atomic

Energy Commission and the International Atomic Energy Agency (IAEA) for the supply of enriched uranium for the Democritos Research and Isotope Production Reactor (GRR–1). Uranium was to come from United States under a 1959 agreement with the IAEA. The agreement related to the transfer of approximately $15,425 worth of enriched uranium to the Greek Atomic Energy Commission as part of a U.S. gift of $50,000 worth of special nuclear material to the IAEA for 1971.

The IAEA project to explore for uranium in central and eastern Macedonia and Thrace was extended an additional year in 1972. The project originally was scheduled for completion by yearend 1972 but was extended to compensate for delays in the initial stage. Reportedly, findings were promising enough to warrant a second phase, aimed at a more detailed drilling and exploration program to determine the economic feasibility of exploiting some of the deposits.

NONMETALS

Asbestos.—Asbestos Mines of Northern Greece Mining, S.A. (MABEM), obtained approval from the Greek Government to extend until December 31, 1972, its option to lease and commercially develop the Zindanion asbestos mines. The U.S. Cerro Corp. of New York which held a 90% interest in the Greek company was considering plans to double its investment in the asbestos fiber factory project to $30 million. The increased investment would not affect the 1975 date for beginning factory operations. The Hellenic Industrial Development Bank, S.A.., in 1972 reportedly secured financing for the project valued at $30 million. Cerro continued operating a pilot plant at the mine to determine grades and rates of recovering fibers from ore. Asbestos fiber samples from the Zindanion operation were tested by Cerro in the United States. Although fiber strength was below Canadian specifications, its filtration property exceeded these specifications. The deposit was prospected initially by the Hellenic subsidiary of the General Mineral Exploration and Mining Development Corp.

Cement.—Greek cement production in 1972 was 6.3 million tons, compared with 5.5 million tons in 1971. Production capacity of the Greek cement industry proved inadequate to supply both local and foreign demand in 1972 and resulted in a shortage of cement in local markets. The cement industry's total annual capacity in April 1972 was 6.9 million tons and was expected to rise to 8.9 million tons by yearend 1973 as a result of expansion programs under way in 1972. The Ministry of National Economy's forecasts of local production and consumption of cement during the 1972–80 were as follows (in million of tons):

Year	Production	Consumption
1972	6.3	5.4
1973	6.7	6.1
1975	10.2	7.4
1977	10.2	9.0
1980	11.0	12.0

In May 1972, Titan Cement Co. commissioned a 3,000-ton-capacity distribution terminal at Heráklcion, Crete. Titan's overall productive cement capacity was rated at 2,350,000 tons per year. Titan expected to commission in 1972 two new grinding mills at Elevsís and thereby complete its $10.7 million investment program. Chalkis Cement Co., S.A., had a $16 million investment program underway at its third cement producing unit at Mikro Vathy, Avlis. Most of the work was to be completed by yearend 1972, raising the firm's annual capacity from 650,000 to 1.5 million tons. In February 1972, the company employed the British firm, John Brown Constructor Ltd., to begin assembly of electrical-mechanical equipment at the new unit. Chalkis also employed the British firm GEC-Elliot Mechanical Handling Ltd. in May 1972 for the supply and installation, by yearend 1973, of a $1.8 million system to sack cement in 50-kilogram bags and load them on ships at the rate of 5,000 bags per hour.

At the beginning of 1972, General Cement Company's (AGET) new 850,000-ton-per-year cement production unit at the Olympos works in Volos became operational. The new unit raised the Olympos' works annual capacity to 2 million tons and the firm's overall capacity to 3 million tons. The firm expected to finish constructing port facilities at Volos by late summer 1972, thereby completing a $20 million expansion program which started in 1969 and included improvements to three of AGET's five distribution terminals. AGET announced plans to establish a third cement plant at Methana in eastern Peloponnesus near the Saronic Gulf. The plant would have a daily capacity of 4,000 tons of

clinker. The new plant's annual capacity reportedly was 1.2 to 1.3 million tons of cement. It was scheduled to be in production within 3 to 4 years.

In May 1972, Aget, Titan, Halyps, S.A., and Chalkis established the Greek Concrete Co. to produce and distribute concrete ready for use in prefabricated elements. The new company planned to establish four or five concrete mixing units in the Athens and Thessaloniki areas as well as other regions of the country. It had placed an order at midyear for 50 special trucks to transport concrete.

Fertilizer Materials.—Expansions of the Hellenic Chemical Products and Fertilizer Co., Ltd., complex fertilizer plant at Drapetsona were to be completed by yearend 1972. Coppée-Rust S.A. of Belgium was the principal contractor. In order to provide the expanded complex fertilizer plant with sufficient phosphoric acid, Hellenic Chemical Co. awarded Coppée-Rust a second contract to build an acid plant at the Drapetsona site. The Belgium company was to provide the design, engineering, and equipment for the plant. Plant capacity was to be between 160 and 200 tons of phosphoric acid per day. The plant was designed to use the Prayon Convertible Process. Completion was expected by 1974.

The first stage of a two-stage expansion program by Nitrogenous Fertilizers Industry, S.A. (AEVAL), to its fertilizer plant at Ptolemaís was completed. The plant had a capacity of 440 tons of fertilizer per day and utilized lignite from the Ptolemaís area. The plant's process enabled ammonium nitrate to be prilled into nonporous, dust-free fertilizer having excellent storage and handling properties. Reportedly, the plant produced specification-grade products within 2 hours of commissioning and operated at designed output levels within 24 hours. AEVAL applied for a license in 1972 to add additional ammonium nitrate capacity to its plant at Ptolemaís. The proposed expansion would represent an investment of $20 million, complimenting present work.

The British constructor, John Brown Ltd., won a contract from the Hellenic Chemical Co., a member of the Bodosaki group, to construct a sulfuric acid plant at Drapetsona near Piraeus in 1972.

Greece's increased production capacity for nitrogenous fertilizers in 1972 permitted the country to export fertilizer for the first time. Industries Chimiques du Nord de la Grèce, S.A. (SICNG), obtained a contract in 1972 for the delivery of 15,500 tons of 15-15-12 fertilizer to the People's Republic of China. The order, valued at $850,000, was the first SICNG had obtained from China and followed orders already secured in 1972 from Turkey, Italy, and Cyprus. At yearend, SICNG had secured a second order to deliver an additional 20,000 tons of fertilizer to China.

Magnesite.—Production of magnesite in Greece had risen significantly in the past decade in response to worldwide demand for higher purity natural magnesite. Greece was one of the world's leading producers of dead-burned magnesite in 1972, with a capacity of more than 300,000 tons per year. The largest producer of magnesite in Greece was the Scalistiri group of companies which mined and processed magnesite through its subsidiaries Société Financière de Grèce, S.A., at Mantoudi, Euboea, and Macedonian Magnesite, S.A., at Ormylia, Chalkidiki. Société Financière operated two dressing plants and four rotary kilns on the island of Euboea. Macedonian Magnesite was constructing a magnesite processing plant at Ormylia with an annual capacity of 120,000 tons of dressed ore. The plant's rotary kilns were to produce dead burned magnesite at an annual rate of 40,000 tons. The company had a second rotary kiln of 70,000 tons capacity per year under construction at Mantoudi. Macedonian completed a new loading jetty at Mantoudi in northern Euboea in 1972. The new facilities were capable of loading magnesite at a rate of 1,000 tons per hour. Other additions included a new silo and belt conveyor system to be installed by Pollig Hegel Bleichert of West Germany. Total cost of the company's improvements were $1.5 million. Macedonian's $5 million magnesite refractories brick factory with an annual capacity of 40,000 tons was scheduled to be commissioned at the end of 1972.

Perlite.—Greece was the world's second leading producer of perlite in 1972. Greek production of crude perlite increased from about 91,445 tons in 1965 to approximately 124,000 tons in 1972. A major portion of the output was marketed in Western Europe, particularly the United Kingdom, where large tonnages were used in the manufacture of filter aids. Silver and Baryte

Ores Mining Co. was responsible for producing over 50% of the perlite mined in Greece. The company mined most of its perlite from large deposits on the Greek island of Milos where reserves were estimated at over 100 million tons. Opencast mining methods were used. Silver and Baryte maintained a perlite expansion plant on the Greek mainland to supply domestic needs. One of the major advantages of Greek perlite was its high degree of gas retention, which meant that little or no preheating was required for the expansion process and that fewer fines were generated.

MINERAL FUELS

Lignite and Peat.—Lignite remained Greece's principal mineral fuel in 1972. The Public Power Corp. (PPC) mined and used lignite to fire thermal power stations at Aliveri (40% lignite fired) on the island of Euboea, Ptolemaís (100% lignite fired) in northern Greece, and Megalopolis (100% lignite fired) on the island Peloponnesus. The mines at Aliveri were underground while those at Ptolemaís and Megalopolis were opencast. Production of lignite totaled 11,579,000 tons in 1972 compared with 10,963,000 tons in 1971. Greek use of lignite to generate electric power was attributed to politico-economic reasons rather than to the caloric value of the lignite. The Greek Government desired development of indigenous lignite resources as an alternative to importing foreign fuel oil. A direct result of Greece's rapid development of its lignite coalfields was the doubling of electrical output from 5,444 million kilowatt hours in 1966 to 12,000 million kilowatt hours in 1972.

PPC signed a $120 million contract in mid-1971 with a consortium of West and East European local manufacturing and technical firms headed by Kraftwerke Union of West Germany to supply and install a 300,000-kilowatt thermal electric unit at Megalopolis and extend mining operations in the lignite fields of the area. Construction work on the project began in April 1972. The generating unit was to be operational by May 1975, making a total of three lignite-burning units operating in the Megalopolis area. Annual consumption of lignite from this area was expected to double from 4.4 million tons in 1972 to 9 million tons in 1975. Megalopolis' known reserves of lignite were sufficient to supply the three units for at least 40 years at their present operating levels.

Lignite reserves in the Ptolemaís area were estimated at 900 million tons. The Ptolemaís area can be divided into three separate fields; the main, the south, and Kardia. Work continued during 1972 on installation of the fourth lignited fired unit in the main field. This unit, was to have an electrical output capacity of 300,000 kilowatt hours and was to be commissioned by yearend 1972. Preparatory work on the lignite mines in the Kardia field was also to be completed by yearend. In May 1972, PPC signed a $15 million contract with the East German firm, Maschinen-Export, to supply and install three stacker-reclaimer units for transporting lignite in the Kardia field. Two of the units were to be operational by September 1974 and the third by yearend 1976. In September 1972 ground-breaking ceremonies were held for two lignite-fired steam turbine power stations at Kardia. These turbines have combined generating capacity of 600 megawatts. PPC has programmed three additional 300,000 kilowatt units for the Kardia and south field areas of Ptolemaís by 1980. The south field is the largest and richest of the lignite deposits in the Ptolemaís area with proven reserves of over 480 million tons. Projected annual production capacity of the south field was 10 million tons.

Peat deposits located in northern Greece were estimated to contain 4 billion cubic meters. In November 1972 a preliminary agreement was signed between PPC and the Soviet Energomas Export Corp. to supply and install three peat-burning steam generators at a cost of $89 million. Each generator was to have a capacity of 125 megawatts. They would be built at Philippi in the Kavalla area of Greece.

Petroleum.—Since 1968 the Greek Government has signed 17 agreements (four in 1972), with U.S. firms for petroleum exploration and development work. Thirteen were in effect in 1972. They involved an exploration area of 66,640 square kilometers, principally offshore, and called for 50 deep wells to be drilled during the next 5 years at a total investment of $67,970,000. During the year two wildcat wells were drilled, one offshore and one onshore. Ancar Oil Co. of Boston spudded a well on

its block five concession on Zakhyntos Island, 7 kilometers west of the town of Zanthe. It was abandoned after reaching 1,324 meters; however, the company's portable rig was left at the site to spud a replacement well early in 1973. Better success was obtained with an offshore wildcat well spudded by the Oceanic Group in the northwest Aegean Sea. Drilling began during October 1972 and reached a total depth of 2,035 meters by the end of November. Significant gas shows were encountered at about 1,700 meters; however, the lower part of the hole had to be abandoned. The well was rerouted at 1,230 meters. A depth of 1,753 meters had been reached at the end of December 1972. Production tests were carried out between the 1,700 and 1,740 meter levels. The final test showed a flow of 10 million cubic feet of gas in 24 hours through a 1-inch choke with a pressure of 1,300 pounds per square inch at the well head. For each million cubic feet of gas produced during the test, 35 barrels of high-grade condensate were recovered. A second wildcat well was expected to be drilled approximately 2 kilometers away early in 1973. The operator for the Oceanic Group was Colorado Greece Oil Corp., a subsidiary of Colorado Interstate Group. Oceanic Exploration of Denver held a 50% interest; the remainder was held equally by White Shield Greece Oil Corp., Hellenic Oil Co. Inc. (a subsidiary of Fluor Drilling Services Inc.), and Fundamental Oil Corp. of San Francisco.

Surface exploration for oil and gas continued in Greece in 1972. Anschutz Overseas Corp. of Denver mapped the geology around the Gulf of Salonika and conducted seismic surveys on its concessions in the area. Texaco and Chevron both abandoned all their Greek concessions offshore near Thrace during 1972. One of Texaco's abandoned concessions attracted Oceanic and Anschultz, two groups already operating in the region. Late in November 1972, LVO Corp. of Tulsa announced signing a concession agreement with the Greek Government covering 1.25 million acres in the northern part of the Aegean Sea west of the Island of Lesbos. Officials of the company stated that seismographic surveys were underway and that pending results of the surveys drilling would take place in the second year.

Greece's two petroleum refineries were entirely dependent upon imported crude for their supply in 1972. The refineries, Aspropyros (owned by the Government and Stavros Niarchos) located near Athens and Esso-Pappas located near Thessaloniki, processed a total of 6,530,000 tons of crude in 1972 compared with 5,363,000 tons in 1971. A $2 million modernization and expansion program to the Niarchos Aspropyrgos refinery was completed in 1972. Under the program, the processing capacity of the refinery was increased from 1.8 million to 5 million tons of crude annually. In December 1972, the refinery began operating at its new capacity. A full range of petroleum products were produced including improved grades of regular (91 octane) and super (98 octane) gasoline. Niarchos announced plans in 1972 to establish a distribution network for the refinery's products.

Two new export-oriented refineries began operations in 1972. Shipowner John Latsis commissioned his 1.2-million-ton annual capacty Petrola Hellas refinery at Elevsís only 8 months from the start of construction. Motor Oil Hellas, S.A., controlled by shipowner Nicholas Vardinoyannis, inaugurated a $15 million lubricating oil refinery near Corinth in 1972. The refinery's crude petroleum processing capacity was 1.5 to 2 million tons per year and was to be increased to 5 million tons, involving an investment of $90 million by 1975.

The Greek Government in 1972 resolved the question of who would build and operate the country's third domestic-oriented refinery. The so-called "third refinery" was actually in the form of two separate refineries. Deputy Prime Minister Nicholas Makarezos announced the contract awards for a 6-million-ton capacity refinery to Professor Stratis Andreadis and a 3.5-million-ton capacity refinery to shipowner Ioannis Latsis. These refineries were to replace the proposed 7.5 to 10-million-ton capacity refinery provided for under the now defunct Government of Greece—Onassis agreement. The Andreadis refinery was to be built at Jaji, 45 kilometers west of Athens, and was to become operational in January 1975. Its initial production capacity of 3 million tons per year was to be gradually raised to 6 million tons and involve an investment of $76 million. The Latsis refinery was to be established at Elevsís, 25 kilometers west of Athens at a

site adjacent to his present topping plant. Initial capacity of the Latsis refinery was to be 2.5 million tons per year and was to be operational by 1973. This capacity was to be raised to 3.5 million tons by 1974 and involves an investment of $45 million. Their respective contracts called for processing 68 million tons of crude by the Andreadis refinery and 38 million tons of crude by the Latsis refinery. Refining fees were fixed at $5.00 per ton of crude with possible readjustments upward to $5.15 per ton.

The Mineral Industry of Hungary

By Joseph B. Huvos [1]

Bauxite continued to be Hungary's most important mineral product from the viewpoint of world standards in 1972, with output representing about 4% of the world's estimated total. Hungarian output of mineral fuels and iron and steel, although constituting smaller shares of world production than Hungarian bauxite, were most important to the domestic economy. Large-scale imports were needed to satisfy the expanding demand for many mineral commodities.

Hungary's total gross national product (GNP) in 1972 was estimated at 303.5 billion forints,[2] an increase of 9.4% over that of 1971.

Investments in 1972 totaled 103 billion forints, an increase of 3% over the previous year's level.

In 1972, the mineral and related industries' planned production and plan fulfillment were as follows, in percent of 1971 figures:

Industry sector	Plan	Fulfillment
Mining	100	96
Energy industry	107	108
Metallurgy	104	102
Chemical industry	111	112
Building materials	107	104
All industries average	105–106	106

Source: Magyar Hirlap. Jan. 26, 1973, p. 1.

Some of the more important mineral industry developments in the news were partial commissioning of the Halimba No. 3 bauxite mines, continued construction of the Ajka alumina plant, shakedown runs at the Csepel steel wire mills, continued construction of the Ózd continuous casting plant, and commissioning of the Beremend cement plant. Other developments were continued construction of the Pétfürdö ammonia plant, commissioning of a new Szolnok sulfuric acid plant, commissioning of the Friendship petroleum pipeline, construction in Leninváros of olefine plants, and construction of two natural gas treating plants in Szeged.

PRODUCTION

Production of coal, Hungary's most important domestic mineral commodity, decreased again in 1972, with output of brown and bituminous coal decreasing and lignite production increasing. This was in accordance with planned rationalizing of the coal mining industry and utilizing Hungary's lignite resources for power generation.

Production of bauxite, Hungary's most important export mineral, increased substantially as investments in this area began bearing fruit.

Nitrogenous fertilizer production decreased slightly, and phosphatic fertilizer production increased slightly. Iron ore production increased marginally, and iron and steel increased at a moderate rate. Cement production increased substantially as did that of other building materials. Crude petroleum production showed a slight gain, and natural gas increased moderately.

[1] Foreign mineral specialist, Division of Fossil Fuels—Mineral Supply.

[2] Values have not been converted from Hungarian currency units (forints) to U.S. dollars owing to the wide variation between the official exchange rate for forints against U.S. dollars and those actually used for some transactions, and also because of variations in the forints exchange rate against dollars during the year.

Table 1.—Hungary: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum:			
Bauxite ---thousand tons--	2,022	2,090	2,358
Alumina ---do---	441	467	520
Metal, including secondary	66,029	67,037	68,183
Copper:			
Mine output, metal content [e]	1,000	1,200	1,200
Metal: [e]			
Smelter, primary	1,000	1,200	1,200
Refined, including secondary	11,200	12,000	17,000
Gold, mine output [e] ---troy ounces--	320	320	320
Iron and steel:			
Iron ore ---thousand tons--	629	687	695
Pig iron:			
Pig iron for steel ---do---	1,798	1,890	1,964
Pig iron for foundries ---do---	24	80	80
Total ---do---	1,822	1,970	2,044
Ferroalloys ---do---	[r] 16	14	26
Crude steel ---do---	[r] 3,108	3,111	3,273
Steel semimanufactures, rolled only ---do---	2,038	2,063	2,220
Lead: [e]			
Mine output, metal content	1,735	1,735	2,368
Metal, refined, secondary	720	720	457
Manganese ore [2] ---thousand tons--	169	227	187
Silver [e] ---thousand troy ounces--	6	6	42
Zinc:			
Mine output, metal content [e]	4,800	4,800	4,800
Smelter, secondary	740	NA	733
NONMETALS			
Cement, hydraulic ---thousand tons--	2,771	2,712	2,969
Clays:			
Bentonite ---do---	65	71	79
Kaolin, crude and washed ---do---	[r] 72	65	67
Fertilizer materials, manufactured:			
Nitrogenous:			
Gross weight ---do---	1,709	1,841	1,824
Nitrogen content ---do---	350	377	374
Phosphatic:			
Gross weight ---do---	900	922	951
Phosphorus pentoxide content ---do---	167	174	181
Lime, calcined ---do---	[r] 652	610	637
Perlite	NA	40	85
Pyrite: [e]			
Gross weight	6,500	[r] 6,500	7,000
Sulfur content	2,600	2,800	2,800
Refractory materials, n.e.s.:			
Chamotte products ---thousand tons--	179	179	169
Chrome magnesite products ---do---	56	55	45
Sand and gravel:			
Gravel ---thousand cubic meters--	8,812	9,983	10,207
Sand, common ---do---	354	360	360
Sand, moulding ---thousand tons--	555	603	NA
Stone:			
Dimension, all types ---do---	6	3	4
Other:			
Dolomite ---do---	699	819	805
Limestone ---do---	5,621	5,754	6,186
Quartzite ---do---	14	29	32
Sulfur:			
Elemental, byproduct	3,233	3,370	[e] 3,400
Sulfuric acid ---thousand tons--	457	468	566
Talc	16,149	16,000	[e] 16,000
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	4,151	[e] 4,200	[e] 4,200
Coal:			
Bituminous ---thousand tons--	[r] 3,381	3,941	3,671
Brown ---do---	19,008	17,757	15,534
Lignite ---do---	4,671	5,726	6,636
Total ---do---	[r] 27,060	27,424	25,841
Coke:			
Coke oven coke ---do---	776	782	777
Gas coke ---do---	399	378	363
Total ---do---	1,175	1,160	1,140

See footnotes at end of table.

Table 1.—Hungary: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued			
Fuel briquets ---thousand tons	1,463	1,308	1,080
Gas:			
Manufactured ---million cubic feet	23,166	24,226	24,508
Natural, marketed ---do	122,506	131,123	144,295
Natural gas liquids:			
Natural gasoline ---thousand 42-gallon barrels	466	NA	NA
Liquefied petroleum gas ---do	854	NA	NA
Petroleum:			
Crude:			
As reported ---thousand tons	1,937	1,955	1,977
Converted ---thousand 42-gallon barrels	14,780	14,917	15,085
Refinery products: [3]			
Gasoline, including naphtha ---do	8,415	8,874	10,319
Kerosine ---do	8	31	4
Distillate fuel oil ---do	[r] 12,839	16,337	18,367
Residual fuel oil ---do	15,158	15,611	18,541
Lubricants ---do	1,169	1,267	1,204
Liquefied petroleum gas ---do	[r] 696	[e] 740	[e] 740
Asphalt and bitumen ---do	2,836	3,218	2,763
Paraffin and petroleum ---do	221	259	275
Total ---do	[r] 41,342	46,337	52,213

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, gypsum and other crude construction materials, such as common clay and sand, and gravel, are produced but available information is inadequate to make reliable estimates of output levels.
[2] Ore contains less than 25% manganese.
[3] Excludes refinery fuel and losses.

TRADE

In 1971, the reference year for the trade tables in this chapter, the pattern of Hungary's foreign trade in mineral commodities did not change substantially. The main mineral industry export items, most shipped in larger quantities than in 1970 were bauxite, alumina, aluminum, manganese ore, and various semimanufactured products. The country continued to import most of its mineral requirements in steadily increasing quantities. Imports consisted mainly of nonferrous metals, iron ore, phosphates, potassium salts, rock salt, high-rank coal, coke, and crude oil.

Hungary's total commodity trade, (exports plus imports), was valued at 64.5 billion devisa forints.[3] The total trade balance for 1971 was in deficit by 5.7 billion devisa forints. Hungary's major trade partners in 1971 were in the U.S.S.R. and other Communist countries, as shown in the following tabulation in million devisa forints and percent of Hungary's total trade:

Country	Exports		Imports	
	Million devisa forints	% of total	Million devisa forints	% of total
U.S.S.R	11,983.5	40.82	10,249.2	29.20
East Germany	3,813.0	12.99	2,842.3	8.10
Czechoslovakia	2,945.1	10.03	2,327.5	6.63
Poland	1,796.6	6.12	2,209.1	6.29
West Germany	2,196.5	7.48	1,612.5	4.60
Italy	1,365.3	4.65	1,656.1	4.72
Austria	1,126.0	3.84	748.9	2.13
Other	4,128.7	14.07	13,452.8	38.33
Total	29,354.7	100.00	35,098.4	100.00

In 1971, Hungary's trade in mineral-industries-related products was as follows, in million devisa forints:

Commodity	Exports	Imports
Fuels and electric power	232.3	2,545.2
Raw and basic materials:		
Mine products	144.9	755.7
Metallurgical products	1,229.9	1,935.8
Chemical products	215.8	1,312.0

[3] Devisa forints are values converted from other currencies to forints at the official Hungarian exchange rates.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite[2] ——thousand tons	660	700	Poland 103; West Germany 7.
Oxide and hydroxide[2]	415,283	423,000	U.S.S.R. 160,800; Austria 85,500.
Metal and alloys:			
Scrap	2,327	9,878	West Germany 4,247; Italy 3,143; Austria 2,184.
Unwrought[2]	52,579	62,514	Italy 3,452; Austria 3,177; Finland 3,067.
Semimanufactures[2]	6,267	12,486	West Germany 1,818.
Chromium oxide and hydroxide	83	150	All to Yugoslavia.
Copper metal and alloys:			
Scrap	2,109	1,767	West Germany 1,487.
Unwrought and semimanufactures	2,165	1,854	West Germany 1,266; Austria 375.
Iron and steel:[3]			
Scrap ——thousand tons	7	26	NA.
Pig iron and ferroalloys ——do	54	133	Italy 61; Austria 14.
Steel, primary forms ——do	215	237	Austria 50; Italy 39; Switzerland 11.
Semimanufactures ——do	703	721	West Germany 26; Italy 17; Yugoslavia 15; Norway 13.
Lead:			
Ore and concentrate	--	1,160	All to Belgium-Luxembourg.
Metal and alloys, all forms	1,560	4,953	Austria 2,272; Italy 1,953; Yugoslavia 728.
Manganese ore and concentrate	--	19,304	All to West Germany.
Nickel metal and alloys, all forms	186	511	West Germany 335; Austria 131.
Platinum-group metals and silver metal, all forms ——value, thousands	$118	$1,197	All to West Germany.
Tin metal including alloys ——long tons	--	24	All to Denmark.
Zinc:			
Ore and concentrate	7,241	6,652	All to Poland.
Metal and alloys, all forms	1,821	33,460	United Kingdom 19,100; Italy 5,078; France 3,735.
Other:			
Ash and residues containing unspecified nonferrous metals	14,723	15,939	Italy 8,145; Belgium-Luxembourg 3,422; West Germany 2,475.
Nonferrous metals, not further described	731	1	All to Belgium-Luxembourg.
NONMETALS			
Cement, hydraulic[2]	37,248	17,000	NA.
Clays and products:			
Crude, bentonite	24,824	25,118	NA.
Products:			
Refractory, fire brick[2]	21,722	27,044	NA.
Nonrefractory	9,717	735	All to Yugoslavia.
Diamond, gem and industrial ——value, thousands	--	$332	All to Belgium-Luxembourg.
Diatomite and related materials	--	1,769	All to Austria.
Fertilizer materials, manufactured, all types[2]	67,536	130,000	West Germany 38,090; Yugoslavia 5,352.
Sodium compounds, n.e.s., caustic soda	14,476	--	
Stone, sand and gravel:			
Dolomite ——value, thousands	--	$32	NA.
Gravel and crushed rock	--	139,076	All to Yugoslavia.
Limestone	23,628	10,079	Do.
Sand, excluding metal-bearing	18,064	27,145	Do.
Sulfur, elemental	2,600	--	
Other, crude nonmetals, n.e.s	[4] 18,534	22,666	West Germany 18,446; Austria 2,920.
MINERAL FUELS AND RELATED MATERIALS			
Coal, brown[2]	91,346	104,936	NA.
Coke from bituminous coal[2]	1,202	--	
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	184	--	
Refinery products:[5]			
Gasoline[2] ——do	2,747	1,964	Austria 525.
Distillate fuel oil[2] ——do	[6] 1,384	560	West Germany 336.
Residual fuel oil[2] ——do	1,980	87	All to Austria.
Lubricants[2] ——do	185	229	Yugoslavia 100; Austria 81.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products—Continued			
Other:			
Mineral jelly and wax thousand 42-gallon barrels	145	47	Italy 18; Austria 13; Yugoslavia 7.
Nonlubricating oils, n.e.s ..do	1	2	All to Switzerland.
Crude chemicals from coal, oil or gas distillation	[7] 7,528	1,037	All to Yugoslavia.

NA Not available.
[1] Compiled from official Hungarian trade returns and import data of selected trading partner countries.
[2] Official Hungarian export statistics.
[3] Data from United Nations Economic Commission for Europe. Quarterly Bulletin of Steel Statistics for Europe. V. 23, No. 4, New York 1973, p. c11.
[4] Partial figure, valued at US$237,000; an additional unreported quantity valued at US$199,000 was exported to the United Kingdom.
[5] In addition to information given on destinations by individual product, Poland reportedly received approximately 1,120,000 barrels of products in 1970 and 966,000 barrels in 1971 (distribution by product not reported).
[6] Individual trading partners reported a total of 4,178,857 barrels imported from Hungary, with Belgium-Luxembourg, alone reporting 1,025,966 barrels from Hungary.
[7] Partial figure, valued at US$541,000; an additional unreported quantity valued at US$272,000 was exported to the United States and the United Kingdom.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	[2] 20,086	54,190	All from United States.
Metal including alloys, all forms [3]	91,969	123,778	U.S.S.R. 65,800.
Chromite	13,000	21,000	All from U.S.S.R.
Copper metal including alloys, all forms [3]	24,722	17,905	U.S.S.R. 16,100; Belgium-Luxembourg 1,003.
Iron and steel: [4]			
Iron ore thousand tons	3,119	3,156	Mainly from U.S.S.R.
Pig iron, ferroalloys and similar materials ..do	266	235	[5].
Steel, primary forms ..do	347	267	U.S.S.R. 121.
Semimanufactures ..do	560	757	U.S.S.R. 382.
Lead:			
Oxide	1,672	--	
Metal including alloys, all forms [3]	15,557	14,875	U.S.S.R. 11,200.
Magnesium metal, unwrought	300	458	U.S.S.R. 301; Canada 157.
Mercury 76-pound flasks	406	--	
Molybdenum metal including alloys, all forms	10	13	Austria 7; United Kingdom 4.
Nickel metal including alloys, all forms	180	539	Canada 348; West Germany 91; Switzerland 57.
Platinum-group metals including alloys value, thousands	$1,088	$1,158	West Germany $1,131.
Silver metal including alloys ..do	$754	$1,292	United Kingdom $1,201; West Germany $71.
Tin metal including alloys [3] long tons	1,827	1,528	United Kingdom 754; Denmark 373.
Titanium oxides	2,943	2,931	Italy 2,660; West Germany 271.
Zinc:			
Oxide	922	330	All from Yugoslavia.
Metal, all forms [3]	17,823	22,957	U.S.S.R. 7,346; France 771; Netherlands 685.
Other:			
Ores and concentrates of ferroalloying metals [3] [6]	55,074	60,365	NA.
Metals including alloys:			
Metalloids	162	130	All from Yugoslavia.
Base metals, n.e.s	41	71	Belgium-Luxembourg 49; France 22.
NONMETALS			
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	325	656	Austria 301; West Germany 124; France 124.
Asbestos	14,118	16,944	Mainly from U.S.S.R.
Barite, witherite	14,700	17,448	Yugoslavia 15,488; West Germany 1,140.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Cement, hydraulic [3] ——thousand tons	1,239	1,478	U.S.S.R. 569.
Clays and products:			
Fire [3]	76,477	63,833	NA.
Kaolin [3]	13,243	19,249	NA.
Crude, n.e.s [3]	71,976	55,795	NA.
Products	36,838	14,388	Mainly from Italy.
Diamond, gem and industrial value, thousands	$351	$472	Mainly from Belgium-Luxembourg.
Feldspar and fluorspar	5,153	7,020	Yugoslavia 4,849; Norway 1,570; Italy 601.
Fluorspar and cryolite	1,032	1,039	All from U.S.S.R.
Fertilizer materials:			
Crude phosphatic [3] ——thousand tons	604	638	U.S.S.R. 370.
Manufactured: [3]			
Nitrogenous ——do	404	253	U.S.S.R. 199.
Phosphatic ——do	372	308	U.S.S.R. 181.
Potassic ——do	605	739	U.S.S.R. 369.
Graphite, natural	1,621	125	All from West Germany.
Magnesite, calcined [3]	84,377	91,356	Austria 8,941.
Mica, worked	16	19	Switzerland 14; Austria 3.
Pigments, mineral, iron oxides and hydroxides	2,515	2,085	All from West Germany.
Precious and semiprecious stones, except diamond ——value, thousands	$131	$215	Switzerland $127; Austria $42; West Germany $38.
Pyrite, gross weight [3] ——thousand tons	r 176	135	U.S.S.R. 111.
Salt ——do	62	74	All from U.S.S.R.
Sand, industrial [3]	46,931	57,067	NA.
Sodium compounds, caustic soda	42,563	50,565	Mainly from West Germany.
Sulfur [3]			
Elemental	127,638	110,000	Mainly from U.S.S.R.
Sulfuric acid	72,835	53,637	Do.
Talc and natural steatite	1,556	2,282	All from Austria.
Other nonmetals, n.e.s.:			
Crude, other than meerschaum	897	862	West Germany 732; United Kingdom 130.
Oxides and hydroxides of magnesium, strontium and barium	130	273	France 191; United Kingdom 82.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black [3]	7,136	[7] 6,624	West Germany 1,466; Italy 804.
Coal, anthracite and bituminous [3] thousand tons	[8] 1,986	1,911	U.S.S.R. 346.
Coal briquets [3] ——do	[8] 445	532	NA.
Coke, all types [3] ——do	[8] 1,254	1,307	U.S.S.R. 628.
Gas, natural [3] ——million cubic feet	7,063	7,063	All from Romania.
Petroleum, crude thousand 42-gallon barrels	[3] 29,044	[8] 37,154	All from U.S.S.R.
Refinery products:			
Gasoline [3] ——do	895	1,258	NA.
Kerosine [3] ——do	1,050	938	NA.
Distillate fuel oil [3] ——do	2,219	1,835	NA.
Residual fuel oil [3] ——do	2,586	1,485	NA.
Lubricants [3] ——do	90	96	NA.
Other ——do	8	54	Yugoslavia 40; Austria 5.
Crude chemicals from coal, petroleum or gas distillation	15,363	17,628	Mainly from U.S.S.R.

r Revised. NA Not available.

[1] Compiled from official Hungarian trade returns and from export data of selected trading partner countries.

[2] Import of 485 tons from Yugoslavia consists entirely of artificial corundum.

[3] Official Hungarian import statistics.

[4] Data from United Nations Economic Commission for Europe, Quarterly Bulletin of Steel Statistics for Europe. V. 23, No. 4, New York 1973, p. c11.

[5] Official U.S.S.R. trade statistics report 241,000 tons exported to Hungary.

[6] Figures may duplicate data on chromite ore from export statistics of trading partner countries presented elsewhere in this table.

[7] Official U.S.S.R. trade statistics report 9,135 tons exported to Hungary.

[8] Official U.S.S.R. trade statistics.

COMMODITY REVIEW

METALS

Aluminum.—In 1972, there was a 12% increase in bauxite production ranking Hungary as the world's ninth largest producer accounting for about 3.6% of world output. Bauxite is the only nonferrous metal ore that could be exported from Hungary in significant quantities.

Bauxite production will reach 3 million tons per year by 1975, the end of the current 5-year plan. According to the development program approved by the Hungarian Government in its 1970 resolution, the Hungarian aluminum industry has developed beyond the stage of large-scale expansion of raw material production. The quality of Hungarian bauxite deposits makes significant further expansion of mining operations impossible. Individual bauxite deposits are becoming progressively smaller, deeper, and most them are below Karst-water levels. The quality is average at best. The average silicon dioxide content of Hungarian bauxite is 7% to 8%.[4]

Among Hungarian bauxite mines the Halimba No. 3 was said to be the largest and deepest bauxite mine in Europe with 300,000 tons of production in 1972[5] and a 600,000-ton-per-year capacity thereafter.

New bauxite mines were being opened up in the Bakony mountains and Fejér county, where the five new deposits being developed included the Rákhegy No. 2, which is to be in full production by 1974.[6]

New bauxite deposits were being explored in the south-east area of the Berecse mountains, near Nagyegyháza, Csordakút, and Mány.[7]

The Hungarian Aluminum Industrial Trust reported that experiments aimed at introduction of longwall coal mining methods into bauxite mines were abandoned. The reason given was the irregularity of the deposits.[8]

Alumina production increased 11.3% in 1972, 8.3% short of the production plan for the year. The increase in production was due to the commissioning of new capacities.

Construction continued on new units of the Ajka alumina plant. The oldest (No. 1) unit has a 145,000-ton-per-year capacity. Unit No. 2 was readied by the end of 1972, in which year it produced about 60,000 tons, and is scheduled to reach a capacity of 240,000 tons of alumina by 1975. Investment for this plan was 2.2 billion forints. Unit No. 3 will also have a 240,000-ton-per-year capacity.[9]

Fifteen percent of the alumina in Hungary was used for purposes other than producing metal. Seventy-seven percent of this amount went for artificial corundum; the rest, mainly for firebrick and glass.

Aluminum ingot production increased 1.7% during the year. No significant increase in ingot production is expected in the near future, only a more efficient use of existing smelters.[10] The Inota aluminum smelter has been equipped with machinery to produce semimanufactures such as heat-treated narrow strip.[11] Aluminum consumption in Hungary rose to 10.3 kilograms per capita in 1971.[12]

Copper.—Construction of the Troulli copper mine on Cyprus continued with production expected during 1973. The Hungarian State Mining Corp. is operating the mine.[13] Hungary will import 4,000 tons of copper per year from Chile for a period of 3 years. Deliveries started during 1972.[14]

Iron and Steel.—In 1972, ferrous metallurgy remained the most important branch of Hungary's metal industry. Efforts were continued to update the industry's facilities. Although the production plan for the year prescribed a 4% increase, growth

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[4] Zámbó, J. Problems in Aluminum Industry (Hungarian). Magyar Tudomány (Budapest), No. 2, February 1973, pp. 96–99.

[5] Largest Bauxite Mine (Hungarian). Figyelö (Budapest). V. 16, No. 44, November 1, 1972, p. 23.

[6] New Bauxite Mines Opened (Hungarian). Népszabadság (Budapest). V. 31, No. 7. Jan. 9, 1973, p. 5.

[7] Soki, I., Bauxite Occurrences. Bányászati és Kohászati Lapok-Bányászat (Budapest). V. 106, No. 2. 1973, pp. 119–123.

[8] Use of Longwall Method Discontinued in Bauxite Mines (Hungarian). Népszabadság (Budapest). V. 30, No. 173, July 25, 1972, p. 9.

[9] Népszabadság (Budapest). Good Work, Delayed Test Runs. Oct. 24, 1972, p. 5. Construction of the Aika Alumina Plant Continued (Hungarian). Nov. 26, 1972, p. 3.

[10] Gy. Kaptay: Use of Alumina in Other Industries (Hungarian). Magyar Aluminium (Budapest). V. 9, No. 10, October 1972, pp. 301–302.

[11] Aluminum Products (Hungarian). Népszabadság (Budapest). V. 31, No. 57, Mar. 9, 1972, p. 5.

[12] Nagy, A. and S. Fülöp, Hungary's Aluminum Consumption in 1971 (Hungarian). Magyar Aluminum (Budapest). V. 9, Nos. 3–4, 1972, p. 65.

[13] Népszabadság (Budapest). V. 31, No. 45, Feb. 23, 1973, p. 4.

[14] Foreign News: Hungarian-Chilean Copper Agreement (Hungarian). Bányászati és Kohászati Lapok-Bányászat (Budapest). V. 105, No. 11, November 1972, p. 770.

during the year for the whole of the metallurgical industry amounted only to 2%. In particular, pig iron production increased 3.8%; crude steel, 5.2%; and semimanufactures, 7.6%. Domestic iron ore production increased 1.2%.

Hungarian pig iron production depends almost entirely on imported materials, mainly from the U.S.S.R. with minor amounts from India. Seventy-five percent of all ferrous metallurgical exports go to western markets in exchange for hard currencies. Hungarian steel consumption amounted to 300 kilograms per capita in 1972.

The current 1971-75 5-year plan for ferrous metallurgy calls for domestic steel production to increase to 3.6 million tons by the end of the plan period.

Future plans are to build a high-alloy-steel plant in Diósgyör, a rod and wire mill at Ózd, and to reconstruct the sheet mill at the Danube Iron Works to accommodate increased output of the new continuous casting facility. The Danube Iron Works plant will produce also sheet, spiral welded pipe, and structural steel; the Ózd metallurgical works will produce mainly wire and thin rods; the Lenin metallurgical works will make medium-size rods and profiles and high-alloy steel and forgings; the Csepel metallurgical works will make rolled and welded pipes and supply its machine building shops.

In 1971, pig iron production increased by 148,000 tons, and steel production increased only by 3,000 tons. Therefore, expansion of the Borsod ore dressing plant and intensification of pig iron production has created surplus pig iron capacity not matched yet by steelmaking. Shortage of steel makes it seem necessary to create at Ózd a steelmaking capacity of 120,000 to 200,000 tons by 1975.[15]

Production of cold-formed products will increase in the future, as indicated in the following tabulation:

Cold-formed products	Production (thousand tons)		Percent increase
	1968	1985	
Sheet	270	900	233
Strip	65	125	92
Rod	40	155	288
Wire	130	165	27
Total	505	1,345	166

Source: Mándoki A. Cold-forming in Hungary's Iron and Steel Industry (Hungarian). Bányászati és Kohászati Lapok-Kohászat. V. 105, No. 5, 1972, pp. 193-196.

Shakedown runs have started at the new 450 million forints, 80,000-ton-per-year automated steel wire mill at the Csepel Iron and Steel Works. Full capacity will be reached by mid-1973.[16] Shakedown runs also reportedly will start by mid-1973 on the new continuous casting steel plant at the plus 1 billion forints Duna steel mills.[17] In 1973, construction is scheduled to be completed on the 356 billion forints, 325,000-ton-per-year continuous casting plant at the Ózd metallurgical works.[18]

Construction continued on the new 2.7 billion forints alloyed steel rolling mill. Equipment was imported from East Germany, with commissioning scheduled for 1975.

Uranium.—The No. 1 mine of the Mecsek Ore Mining Enterprise was closed down because the ore reserve has been exhausted. The mine has been in service, for almost 20 years. Workers were transferred to the new Petöfi No. 4 mine, located near Petöc. Open since 1971, the mine, for which drilling started in 1960, with exploration following in 1964, has modern wet-drilling equipment. The mine is 1,146 meters deep, and its 113°F temperature is lowered to 75°F by ventilation.[19]

NONMETALS

Hungary was essentially self-sufficient in lime, kaolin, bentonite, diatomite, and sand and gravel. A number of nonmetallic minerals such as asbestos, cryolite, graphite, crude phosphates, rock salt, sulfur, and pyrites had to be imported to meet most or all of the requirements.

Aluminum Sulfate.—Aluminum sulfate was produced at the 30,000-ton-per-year Magyaróvári Timföld és Mükorundgyár (Motim plant), with 11,000 tons available for export in 1972. Plans were made to an

[15] Figyelö (Budapest). Prospects and Problems in the Metallurgical Industry (Hungarian). Dec. 13, 1973, p. 5.

[16] Népzszabadság (Budapest). New Wire Mill in Csepel (Hungarian). V. 31, No. 59, Mar. 11, 1973, p. 1.

[17] Steel Plant Built (Hungarian). Népszabadság (Budapest). V. 31, No. 21, Jan. 26, 1973, p. 5. Concast Plant Built (Hungarian). V. 31, No. 5, Mar. 7, 1973, p. 1.

[18] Ózd Concast Plant (Hungarian). Népszabadság (Budapest). V. 30, No. 138, June 10, 1972, p. 5.

[19] First Uranium Mine Closed (Hungarian). Népszabadság (Budapest). V. 30, No. 172. July 20, 1972, p. 8.

unspecified increase in the production capacity.[20]

Cement.—Hungarian cement output in 1972 increased 9.5% over the 1971 level. The reason for this was partial commissioning of the 1.1-million-ton capacity, 3 billion forints, Beremend cement plant, adding 400,000 tons of cement to the production of the country in 1972.[21]

Fertilizer Materials.—In 1972, Hungary's nitrogenous fertilizer output decreased 1%, and phosphatic fertilizer production increased 3.1%. Imports of nitrogenous fertilizers increased 45% reaching 360,000 tons in 1972.

Construction continued at different nitrogenous fertilizer plant projects. At Pétfürdö, a 1,000-ton-per-day ammonia plant was under construction with completion scheduled during 1974, contractor being the Kellogg Co. A 600-ton-per-day urea unit has Koppée Rust S.A. as contractor, with a cost of $4.6 million.[22] At Kazincbarcika the old nitrogen fertilizer plant was completely reconstructed and will have its' capacity increased by 30,000 tons ammonia per year. Reconstruction took 2 years at a cost of 140 million forints.[23] A new 130-million-forint nitric acid plant was commissioned at the Tisza Chemical Combyne (TVK), which will increase fertilizer production by 40,000 tons per year.[24] Phosphatic fertilizer production, mainly superphosphate, increased 3.1%. In 1972 Hungary imported most of its phosphatic materials, mainly from the U.S.S.R., from the Kola phosphate mines, although some 59,000 tons were also imported from Algeria.

Potassic materials are imported mainly from the U.S.S.R. and East Germany.

Perlite.—In 1971 the Pálháza perlite mine was producing at the rate of 30,000 tons per year. Shipments went mainly to West Germany (50%), and the rest, to Yugoslavia, Czechoslovakia, Austria, Switzerland, Belgium, and France. The ore is shipped untreated.[25] For 1972, plans were to produce 50,000 tons.

Sulfuric Acid.—The new 200,000-ton-per-year sulfuric acid plant at the Szolnok Tisza chemical works went onstream, raising output to 550,000 tons per year, accounting for 90% of Hungary's total production.[26]

MINERAL FUELS

Hungary's total estimated energy production in 1972 amounted to 18.9 million tons in standard coal equivalent and was comprised of brown coal (32.9%), bituminous coal (13.0%), lignite (11.7%), natural gas (28.7%), crude oil (13.6%), and other (0.1%).

Estimated primary energy consumption in 1972 in thousand metric tons of coal equivalent and percent are shown in the following tabulation:

Commodity	Quantity	Standard coal equivalent	Percent of total
Bituminous coal and coke	6,503	5,175	17.8
Brown coal	15,534	6,183	21.2
Lignite	6,634	2,210	7.6
Crude oil and products	7,577	9,758	33.6
Natural gas ---million cubic meters	4,286	5,708	19.7
Other (hydroelectric, etc.)	XX	11	.1
Total	XX	29,045	100.0

XX Not applicable.

1972, the share of Hungary's energy supplied by solid fuels continued to decline, reaching 46.6%, and natural gas, crude oil, and products increased their share to 53.3%. It is expected that hydrocarbons are to account for an even greater share of the energy supply in the future.

The U.S.S.R. was Hungary's major crude oil supplier in 1972 and is also to supply Hungary with natural gas. Imports of energy, which accounted for 34% of the demand in 1972, are also expected to increase in the future.

[20] Harrach W., Aluminum Sulfate Production in Hungary (Hungarian). Bányászati és Kohászait Lapok-Kohászat (Budapest). V. 105, No. 11, November 1972, pp. 510–518.
[21] Test Run at BCM (Hungarian). Figyelö (Budapest). V. 15, No. 27, June 7, 1972, p. 28.
[22] Petrochemicals—World-wide Construction, Hungary. Oil and Gas Journal. V. 71, No. 13, Mar. 26, 1973, p. 118.
[23] Operation Start at Kazzincbarcika's New Nitrogen Plant (Hungarian). Népszabadság, (Budapest). V. 30, No. 244, Oct. 13, 1972, p. 1.
[24] Two New Plants Commissioned at the TVK (Hungarian). Népszabadság (Budapest). V. 30, No. 282, Nov. 29, 1972, p. 4.
[25] World Minerals and Metals. Expanding Perlite Exports. No. 7, May–June 1972, p. 24.
[26] Figyelö (Budapest). Polish Equipment (Hungarian). V. 14, No. 29, July 19, 1972, p. 7.

Primary electric energy accounted for less than 0.1% of Hungary's generating capacity in 1972. Total electric power generated increased 8.7% to 16.3 billion kilowatt-hours during the year. Of that amount, 12.0 billion kilowatt-hours was distributed to industries, 0.8 billion kilowatt-hours to railways, and 2.3 billion kilowatt-hours to households.

Coal and Lignite.—Hungary's coal output declined 5.8% in 1972 in accordance with the plan for rationalizing the industry and for closing submarginal mines. Bituminous coal output decreased 6.9%; brown coal decreased 12.5%; and lignite production increased 15.9%.

Increased lignite production originated from the Visonta open pit mines near the Mátra mountains. Lignite mined there was used in the recently commissioned 800-megawatt mine-mouth powerplant.

In 1972, coal was produced largely by underground mines; only 5% of the Hungarian coal output was surface-mined.[27]

Hungary's main coal mining areas and the calorific value of coal and lignite are presented in the following tabulation:

Area	Coal and lignite (calorific value)
Mecsek Area	Bituminous coal with a calorific value of about 6,000 kilocalories per kilogram.
Tatabánya, Kisgyón, Várpalota Ajka, Brennberg, Esztergom, and Pilis Areas in the Dunántul (Trausdanubian) Area. Salgótarján in the north.	Brown coal with a calorific value of +4,000 kilocalories per kilogram.
The Borsod Area	Medium-grade brown coal with an average calorific value of 3,500 kilocalories per kilogram.
Mátra-Bükk Area	Lignite with a calorific value of 2,100 to 2,500 kilocalories per kilogram.

Hungary supplemented its bituminous coal and coke requirements in 1972 by imports of 1.7 million tons of bituminous coal and 1.1 million tons of coke.

In 1972, the Hungarian consumption of all coal and lignite, in thousand metric tons, was as follows:

Industry	21,881
Electric power industrial	15,331
Railways	1,169
Household use	3,015

Natural Gas.—In 1972, Hungary's gross natural gas production, including deliveries, in-plant use, and amounts reinjected into the formation, showed a 1.2% increase over that of the previous year.

Reserves of natural gas including associated gas at the beginning of 1971, according to the most recent data available, included 3,577,959 million cubic feet of proved recoverable reserves and 7,491,653 million cubic feet of possible reserves.

Hungary's natural gas originates from the Szeged-Algyö Area (associated gas), the Zala county Area (associated gas), and the Hajdúszoboszló Area (dry gas). The Szeged-Algyö Area associated gas is processed at Szánk in a 141-million-cubic-foot-per-day, 300-million-forint plant and fed into the national network. Work is underway to double the capacity of this plant to 782 million cubic feet per day. The plant also produces gasoline, propane-butane, isobutane, and isopentane totaling 4.1 million barrels per year.

In 1972 as in previous years, Hungary was a net importer of natural gas, with imports of 7 billion cubic feet. All gas imported came from Romania. The U.S.S.R. is expected to deliver up to 35 billion cubic feet of natural gas per year by 1975.

In 1971, the last year for which data were available, Hungary's gas supplies included 2.4 billion cubic feet of manufactured gas prepared from crude oil.

An agreement signed by the U.S.S.R. and the Hungarian Government provides for the 1975 commissioning of a new pipeline to supply up to 35 billion cubic feet of Soviet gas annually. In a second phase after 1975, the pipeline is to be extended from Leninváros to Budapest. An underground storage facility is also to be built near Hajdúszoboszló.

Petroleum.—Crude oil output of Hungary increased 1.1% in 1972 compared with that of 1971. It is not expected that crude oil production will increase significantly in the near future. Hungary's main petroleum-producing areas are the Szeged Algyö Region (Great Plains) and the Zala Region (Dunántúl).

Although exploratory drilling continued at a reduced rate because of reduced funds, the 1972 plans called for drilling 160,000 meters in the Szeged-Great Plains Region

[27] Braunkohle (Düsseldorf). V. 24, No. 6, June 1972, p. 182.

and 100,000 meters in the Dunántúl Region. That is 100,000 to 150,000 meters less than the average of recent years. Cutbacks in the programs will reduce by eight the number of operating drilling rigs compared with that of last year.[28]

Although petroleum reserve figures were not released, published data indicated that at present production rates Hungary's oil and natural gas resources will last for 20 to 70 years, with investments of 30 to 80 billion forints.[29]

In 1969, the latest year for which data were available, 1,014 oil wells were operatting in Hungary, of which 450 were in the Szeged Region.[30]

In 1972, Hungary was a net importer of crude oil and petroleum products. The U.S.S.R. supplied the bulk of the 6.1 million tons of crude oil imported. Hungary is planning to purchase additional supplies of crude oil from Middle Eastern countries.

Hungary's apparent consumtpion of crude oil and petroleum products increased by an estimated 12.5% during 1972. Crude oil was used as a feedstock for the petrochemical industry and for generating electric power.

Hungary's petroleum-refining capacity was about 7.7 millions tons per year[31] in 1972, distributed among six refineries as follows:

Refinery	*Annual capacity (million tons)*
Százhalombatta	3.2
Leninváros	1.0
Szöny	2.0
Zalaegerszeg, Pét, Nirbogdány	1.5

Expansion of several oil refineries was underway; Százhalombatta was being expanded to 6 million tons per year, with tentative completion by yearend 1972; the Leninváros refinery was to be expanded by 3 million tons per year by 1977.[32]

Hungary's pipeline network was further expanded with the commissioning of the Friendship No. 2 pipeline, which together with the previously built line will carry 10 million tons per year from the U.S.S.R. to Hungary.

A contract was initialed for construction of the Adria crude oil line for the movement of 17 to 33 million tons per year from Bakar, Yugoslavia, to refineries in Yugoslavia (10 million tons per year), Hungary (5 million tons per year), and Czechoslovakia (5 million tons per year). The 150-mile pipeline section crossing Hungary is partly financed by Czechoslovakia. Completion is scheduled for 1975.[33]

Petrochemical development work continued[34] with construction of the following processing capacities:

	Tons per year
Leninváros, ethylene	250,000
Leninváros, propylene	400
Kazincbarcika, polyvinyl chloride (PVC)	1,200
Budapest, tetrachlor-benzene	1,200

[28] Magyar Nemzet (Budapest). Prospects, Costs of Hydrocarbon Exploration Noted. June 25, 1972, p. 5.
[29] Work cited in footnote 28.
[30] Kazakhastanskaya Pravda. July 15, 1972, p. 3.
[31] Neues Deutschland (East Berlin). V. 28, No. 94, Apr. 4, 1973, p. 6.
[32] Oil and Gas Journal. V. 70, No. 14, Apr. 3, 1972.
[33] Oil and Gas Journal. V. 71, No. 13, Mar. 26, 1973.
[34] Népszabadság (Budapest). V. 30, No. 23, Sept. 30, 1972, p. 1.

The Mineral Industry of India

By Harold A. Taylor, Jr. [1] and Charles W. Sweetwood [2]

According to most measures of quantity and value, the Indian mineral industry grew modestly in 1972. The value of crude mineral output was $673 million [3] in 1972, compared wih $640 million (revised) in 1971. The increase in total value resulted primarily from an increase in value of bituminous coal production and the increase in unit value of petroleum from $1.85 per barrel in 1971 to $2.06 in 1972. Exports of minerals, metals, and ores were valued at $360 million in 1972, compared with $377 million in 1971. Imports of minerals, metals, ores, and crude petroleum had a total value of $713 million in 1972, compared with $667 million in 1971. The preceding totals conceal however a few dramatic changes, such as declines in ferrorchromium production and exports, a decline in bauxite exports, declines in iron and steel and pig iron exports, and a decline in aluminum imports.

Mining accounted for about 0.9% of India's $63.6 billion gross national product (GNP), for the year ending March 31, 1973. The inclusion of mineral processing would multiply by several times the contribution of the mineral industry to the total GNP.

Although official employment figures for 1972 are not available yet, it appears that the Indian metals and minerals industry employed 1.40 million people, 0.64 million of these in mines and quarries, 0.29 million in the basic metal industries (mostly in the iron and steel industry), 0.26 in the nonmetallic mineral product industries, and 0.21 in the metal product industries. In addition, the petroleum industry directly employed 59,736 people, 25,898 of these in exploration and production, 19,415 in marketing, 11,346 in refining, and the balance in other activities. About half of those employed in mines and quarries, and most of those employed in the rest of the mineral and petroleum industries, were union members. The coal mining industry reportedly lost 475,230 man-days in 1972, compared with 603,786 in 1971. The work week for coal miners in 1972 averaged 48 hours, and the weekly wage averaged $7.83. These averages were typical for the mining industry.

On March 31, 1972, the Government's total public sector investment was $7.30 billion, of which $2.40 billion was invested in the steel industry, $0.67 billion was invested in the metals and minerals industry, $0.57 billion was invested in the petroleum and petrochemical industries, and the balance was invested in other (nonmineral) enterprises.

Because of a number of major nationalizations and changes in the last several years, a summary of the ownership status of the Indian mineral industry would be helpful. Government-owned firms now account for over 70% of India's crude mineral output by value, and control the entire domestic mine production of coal, lignite, ilmenite, copper, lead, zinc, and gold. Government-owned firms are heavily predominant in the production and refining of petroleum, and in the production of iron and steel. Private firms are heavily predominant in the production of aluminum and bauxite, iron ore, manganese, mica, and salt. However, several sizable government-owned aluminum plants are planned or under construction. The Government also monopolizes all exports of iron ore and manganese ore, except for Goan iron ore. Although mica exports are officially under government control, private mica traders actually are allowed a substantial role. Private firms have a sizable role in cement production, but a govern-

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[3] Where necessary, values have been converted from Indian Rupees (Rs) to U.S. dollars at the rate of Rs1 = US$0.133.

ment agency sets the price allowed the producer, the charges for transportation, and the cost to the consumer.

The Government of India has been stepping up its foreign activities to procure minerals. The Government received its initiation in this area several years ago when it obtained a 17% interest in Iranian Marine International Oil Co., a supplier of crude oil to India. Next, India discussed with Iran the construction of a joint-venture ammonia plant in Iran which would supply India with ammonia. Now that this venture with Iran has fallen through, India is discussing a similar ammonia venture with Iraq. Iraq has agreed in principle to supply India with significant quantities of crude oil over a 10-year period beginning in 1976. At yearend, India had also entered into final negotiations with the state-owned Iraq National Oil Co. for an oil and gas exploration service contract covering an area near the North Rumaila field. India could in turn supply Iraq with industrial equipment and such minerals as iron ore. The Government is reversing its offshore oil policy, and will now allow foreign companies to explore anywhere offshore except the Bombay High. India will probably implement its new offshore exploration policy by offering production-sharing contracts through its Oil and Natural Gas Commission. The Government has also recently signed a long-term supply contract with Peru for electrolytic copper. As yet, the Government's increased foreign activities have not had an opportunity to produce much in the way of tangible results.

PRODUCTION

The following tabulation shows the change in value of crude mineral output for 1970 through 1972 broken down by commodity group:

Commodity group	Value (million dollars)		
	1970	1971	1972
Metallic minerals:			
Ferrous	61.28	r 68.32	67.48
Nonferrous	20.85	r 23.22	24.84
Total	82.13	r 91.54	92.32
Nonmetallic minerals [1]	83.50	r 89.12	89.81
Mineral fuels:			
Bituminous coal	350.57	r 339.62	357.00
Lignite	11.98	r 13.82	11.58
Petroleum, crude [2]	76.26	101.28	117.35
Gas, natural	[3] 4.06	4.85	[4] 5.05
Total	442.87	r 459.57	490.98
Grand total	608.50	r 640.23	673.11

r Revised.
[1] Does not include crude nonsalable china clay.
[2] Estimated, applying a value of $1.45 per barrel produced in 1970, $1.85 per barrel in 1971, and $2.06 per barrel in 1972.
[3] Estimated, applying a value of $0.17 per thousand cubic feet produced.
[4] Estimated on the basis of the 1971 value.

All of the individual commodities in the ferrous subgroup increased in value in 1972, except manganese ore. The decline in value of manganese ore was large enough to make the entire ferrous subgroup decline in value, even though iron ore comprised about 80% of the 1972 total. The slight increase in value of the nonferrous subgroup in 1972 paralleled the slight increases in value of gold and copper production, with gold accounting for 40% of the total value of the nonferrous subgroup and copper accounting for 30%. (Revised figures show copper accounting for 28% in 1971.) Although the total value of the nonmetallic minerals group increased slightly in 1972, some of the principal mineral commodities had large changes in value. Limestone accounted for 34% of the total value in 1972, compared with 36% in 1971 (revised). All forms of mica accounted for 28% of the total value in 1972, the same as in 1971 (revised). Salt accounted for 17% of the total value in 1972, compared with 14% in 1971 (revised). Bituminous coal increased both

in quantity and in value, and lignite declined both in quantity and in value. Crude petroleum increased both in quantity and in value per barrel. Natural gas increased a small amount in both quantity and value.

Table 1.—India: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum:			
Bauxite, gross weight—thousand tons	1,370	1,517	1,659
Alumina, gross weight [e]—do	327	362	363
Metal, primary only	161,081	178,256	179,103
Antimony metal, regulus	526	607	905
Beryl, gross weight [2]	[e] 1,300	NA	NA
Cadmium metal	34	29	31
Chromite, gross weight	273,679	273,060	281,025
Copper:			
Mine output metal content	10,262	10,766	12,744
Metal, refined primary only	9,311	9,678	9,735
Gold, smelter—troy ounces	104,198	118,572	105,776
Iron and steel:			
Iron ore and concentrate, gross weight—thousand tons	31,366	34,261	35,036
Pig iron—do	[r] 6,896	6,672	7,020
Ferroalloys:			
Ferrochrome	[r] 8,955	10,519	1,894
Ferromanganese	[r] 172,472	162,106	163,475
Ferrosilicon	27,590	25,629	35,676
Other	[r] 10,499	11,111	3,539
Steel ingots—thousand tons	[r] 6,234	6,215	6,842
Steel castings—do	NA	[3] 84	90
Steel semimanufactures:			
Angles, shapes, sections—do	970	791	879
Bars and rods—do	1,572	1,623	1,831
Plates and sheets:			
Uncoated—do	593	599	642
Galvanized—do	171	173	154
Tinplate—do	116	114	120
Hoop, strip and skelp—do	483	439	466
Rails and accessories—do	498	465	452
Wire—do	130	216	231
Special steels, form not specified—do	286	200	164
Total—do	4,819	4,620	4,939
Lead:			
Mine output metal content	1,862	1,556	2,641
Metal, primary only	1,862	1,549	2,646
Manganese ore and concentrate, gross weight—thousand tons	1,651	1,841	1,624
Rare-earth metals, monazite concentrates, gross weight [e]	2,600	3,882	4,086
Silver:			
Mine production—thousand troy ounces	50	121	142
Smelter output—do	50	133	128
Titanium:			
Ilmenite concentrate, gross weight	79,000	66,000	71,463
Rutile concentrate, gross weight	2,500	2,912	3,065
Tungsten, mine output metal content	18	15	17
Zinc:			
Mine output metal content	8,246	10,273	11,382
Metal	23,410	21,267	25,227
NONMETALS			
Abrasives, natural, n.e.s.:			
Corundum, natural	407	318	383
Garnet	986	1,391	3,156
Asbestos	10,056	13,581	12,272
Barite	74,843	58,695	46,113
Cement, hydraulic—thousand tons	13,543	14,894	15,700
Chalk	47,609	48,840	59,910
Clays:			
Ball clay	8,472	12,620	17,118
Diaspore	6,172	4,881	5,298
Fire clay	632,448	612,000	659,000
Kaolin (china clay) [4]	546,654	567,000	629,000
Diamond:			
Gem [e]—thousand carats	17	16	17
Industrial [e]—do	3	3	3
Total—do	20	19	20

See footnotes at end of table.

Table 1.—India: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
NONMETALS—Continued			
Diatomite	--	77	NA
Feldspar	29,625	44,236	49,887
Fertilizer materials:			
Crude phosphatic:			
Apatite	15,997	11,307	11,513
Phosphate rock	149,544	232,170	228,622
Manufactured:			
Nitrogenous, nitrogen content [5] thousand tons	623	745	907
Phosphatic, P_2O_5 content [6] do	103	102	124
Fluorspar, all grades	4,647	3,107	3,527
Gem stones, excluding diamond:			
Agate (including chalcedony pebble)	743	728	699
Emerald, crude carats	11,625	22,520	20,220
Garnet kilograms	5,268	2,962	268
Gypsum thousand tons	921	1,088	1,078
Kyanite and related materials:			
Kyanite	118,998	63,482	68,479
Sillimanite	4,562	4,326	4,073
Lime	461,672	535,000	338,000
Magnesite	354,291	296,000	273,000
Mica:			
Crude (reported output total, actual production exceeds this quantity)	15,300	14,400	13,200
Processed: [7]			
Blocks	1,630	1,301	1,484
Splittings	6,313	7,465	7,179
Condenser film	122	92	159
Other	24,876	23,017	25,033
Total	32,941	31,875	33,855
Pigments, natural mineral, ocher	37,682	53,018	52,636
Pyrite:			
Gross weight	26,400	40,886	30,723
Sulfur content	9,770	15,130	11,370
Salt, all types thousand tons	5,588	5,430	6,500
Stone, sand and gravel:			
Calcite	16,839	20,425	24,300
Dolomite thousand tons	1,148	1,320	1,322
Limestone do	23,801	25,073	25,544
Quartz and silica do	266	336	316
Sand, calcareous do	996	1,028	960
Sand, other do	738	1,473	1,300
Slate	632	725	1,006
Talc and related materials:			
Pyrophyllite	13,725	11,780	15,773
Steatite (soapstone)	154,686	177,000	174,000
Vermiculite	727	537	1,337
Wollastonite	563	2,042	2,290
MINERAL FUELS AND RELATED MATERIALS			
Carbon, black	36,287	e 38,000	e 40,000
Coal:			
Bituminous thousand tons	73,694	71,499	74,771
Lignite do	3,545	3,660	3,067
Total do	77,239	75,159	77,838
Coke:			
Coke oven and beehive do	r 8,958	8,975	e 9,191
Gashouse do	73	80	e 80
Other, soft do	r 3,914	3,494	e 3,486
Total do	r 12,945	12,549	e 12,757
Gas, natural:			
Gross production million cubic feet	50,288	52,972	e 55,100
Marketable production do	23,873	25,921	e 27,000
Petroleum:			
Crude oil thousand 42-gallon barrels	52,596	54,748	56,965
Refinery products: [8]			
Gasoline:			
Aviation do	106	r e 14,400	e 13,600
Other do	13,880		
Jet fuel do	5,767	r e 30,400	e 27,200
Kerosine do	24,268		

See footnotes at end of table.

Table 1.—India: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products—Continued				
Distillate fuel oil	thousand 42-gallon barrels	36,074	[r e] 40,900	[e] 40,300
Residual fuel oil	do	20,841	[r e] 27,200	[e] 23,200
Lubricants	do	3,083	[r e] 2,800	[e] 3,500
Other	do	27,598	[r e] 23,409	[e] 24,653
Refinery fuel and losses	do	6,882	[r e] 7,722	[e] 10,869
Total	do	138,499	[r] 146,831	143,322

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

[1] In addition to the commodities listed, India also produces bromine, other clays (bentonite, fuller's earth and common clay), other varieties of gem stones (aquamarine, ruby and spinel), uranium and natural graphite, but production data are not available.

[2] Apparently, production of industrial beryl has been terminated in India, with remaining output being confined to insignificant unreported quantities produced as a byproduct of mica production and relatively inconsequential output of gem quality material. The estimated output for 1970 may be considerably higher than actual output, inasmuch as no beryl has been reported among exports from India since 1967.

[3] Data incomplete, includes output for last 9 months only.

[4] Data given are total crude production; includes directly salable crude as follows in tons: 1970—204,117; 1971—184,000; 1972—218,000. Balance of output in each year is classified as "nonsalable crude"; material which requires beneficiation prior to sale. Processing of nonsalable crude resulted in the production of the following quantities of processed china clay in tons: 1970—99,296; 1971—106,000; 1972—115,000.

[5] Nitrogen content of ammonium sulfate, nitrophosphate and urea.

[6] P_2O_5 content of superphosphates only.

[7] Exports.

[8] Details on refinery production by product type are not available for 1971 and 1972; estimates supplied are based on available information on refinery facilities and previous years' performance of these facilities.

TRADE

India's total exports were worth $2.48 billion in 1972, 14.5% or $360 million of which were exports of ores, minerals, and metals. Iron ore was the most important export in this minerals group, accounting for 42.6% of the total value of ores, minerals, and metals exported in 1972, followed by diamond with 19.3% of the total, iron and steel with 10.2%, mica with 7.0%, and precious and semiprecious stones with 4.4% of the total. On the basis of only partial data, Japan was probably the most important destination for exports.

India's overall imports were valued at $2.20 billion in 1972, 32% or $713 million of which was spent on imports of ores, minerals, metals, and crude petroleum. Iron and steel was the most important import in the above grouping, accounting for 40.3% of the total value of ores, minerals, metals, and crude petroleum imported in 1972, followed by crude petroleum with 26.1% of the total, copper with 9.3%, gem diamond with 6.0%, and zinc with 3.8% of the total. Some of the important sources of India's imports were Iran (crude petroleum), the United Kingdom, Japan, the United States, and Zambia, not necessarily in that order.

Table 2.—India: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1971	1972
METALS		
Aluminum:		
Bauxite	61,288	9,340
Metal, including alloys, all forms	6,272	7,722
Chromite	95,765	62,218
Copper, metal including alloys, all forms	5,439	3,895
Iron and steel:		
Iron ore and concentrate—thousand tons	20,382	21,484
Pig iron and sponge iron—do	414	173
Ferroalloys:		
Ferrochrome	4,196	2,005
Ferromanganese	47,260	55,958
Ferrosilicon	--	2,470
Other	61	--
Iron and steel scrap—thousand tons	198	117
Steel ingots and semimanufactures—do	423	263
Lead, including alloys, all forms	31	44
Manganese ore and concentrate—thousand tons	1,285	812
Nickel	5	--
Tin, including alloys, all forms—long tons	160	18
Titanium, ore and concentrate (ilmenite)	54,049	56,463
Vanadium, ore and concentrate	400	736
Zinc, including alloys, all forms	32	30
NONMETALS		
Abrasives, natural, tripoli earth and emery	93	198
Asbestos	51	28
Barite	34,014	20,672
Cement	196,641	242,711
Chalk	10	31
Clays:		
Bentonite	2,725	4,894
Fire clay	4	12
Fuller's earth	4	--
Kaolin	121	297
Other	641	253
Feldspar	10,683	11,238
Graphite	77	225
Kyanite and related materials:		
Kyanite	45,553	24,740
Sillimanite	1,752	552
Lime	151	718
Magnesite	25,232	16,196
Mica, all grades	23,875	25,355
Mineral pigments	1,437	759
Salt—thousand tons	111	269
Stone, sand and gravel:		
Building stone, not further identified	18,293	51
Gravel	128	31,977
Limestone	--	2,214
Marble	85	65
Sand, including natural quartz	4,342	2,825
Talc and related materials, steatite	9,488	6,004
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen	589	7,141
Coal and coke—thousand tons	285	235
Petroleum refinery products:		
Gasoline and naphtha—thousand 42-gallon barrels	589	--
Distillate fuel oil—do	50	--
Asphalt—do	14	--
Total	653	--

Table 3.—India: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1971	1972
METALS		
Aluminum, metal, all forms	32,354	3,425
Antimony:		
Ore and concentrate	868	1,458
Metal, all forms	207	113
Arsenic, sulfides	9	NA
Copper, metal and alloys, all forms	56,253	55,713
Iron and steel:		
Iron ore	373	218
Pig iron, sponge iron and powder	--	353

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1971	1972
METALS—Continued			
Iron and steel—Continued			
Ferroalloys:			
Ferrochromium		16	--
Ferromolybdenum		263	139
Ferrophosphorus		121	124
Ferrosilicon		2,600	1,593
Ferrotungsten		75	18
Other		145	178
Total		3,220	2,052
Steel ingots and semimanufactures		1,020,348	1,301,064
Lead:			
Ore and concentrate		49	9
Metal including alloys, all forms		41,387	39,830
Magnesium metal, all forms		389	485
Manganese ore		3,346	5,288
Mercury	76-pound flasks	9,950	3,162
Nickel:			
Metal and alloys, all forms		3,558	2,343
Platinum, metal	troy ounces	11,574	7,009
Silver, metal	do.	31,636	49,030
Tin, metal and alloys, all forms	long tons	2,856	1,842
Tungsten ore concentrate		325	365
Zinc:			
Ore and concentrate		34,394	29,824
Metal including alloys, all forms		96,813	80,713
NONMETALS			
Abrasives, natural including tripoli earth		1,491	2,552
Asbestos		45,174	49,412
Boron materials (borax)		9,169	5,387
Clays:			
Ball clay		1,345	1,380
Bentonite		7	6
Fire clay		--	3
Fuller's earth		17	4
Kaolin		955	263
Other		769	118
Diamond:			
Gem	value, thousands	$28,044	$42,682
Industrial	do.	$1,266	$1,545
Diatomaceous earth (kieselguhr and infusorial earth)		5	1,386
Fertilizer materials, crude:			
Nitrogenous, sodium nitrate		3,015	998
Phosphate rock	thousand tons	697	855
Fluorspar and cryolite:			
Cryolite		765	2,260
Fluorspar		14,055	13,141
Graphite		921	1,577
Gypsum and plaster		5	2
Magnesite		52	51
Mineral pigments:			
Red oxide		1,413	1,154
Other (earth colors)		4	356
Precious and semiprecious stones, except diamond:			
Emerald	value, thousands	$6,032	$5,585
Other	do.	$828	$1,111
Salt		568	470
Stone, sand and gravel:			
Alabaster		84	15
Building stone, not further specified		--	8
Gravel		--	2
Limestone		4	10
Marble		8	23
Sand, all types		7	4
Sulfur		441,270	623,991
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural		499	334
Coal, anthracite		733	548
Coke		4,876	64
Petroleum:			
Crude oil	thousand 42-gallon barrels	92,667	90,225
Refinery products:			
Aviation gasoline	do.	450	475
Kerosine and jet fuel	do.	4,863	6,176
Distillate fuel oil	do.	2,142	3,897
Residual fuel oil	do.	6,036	12,320
Lubricants	do.	1,130	1,082
Total	do.	r14,621	23,950

NA Not available.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—The State Government of Tamil Nadu began to examine the possibility of nationalizing Madras Aluminium Co. Ltd., an Indian-Italian collaboration. Tamil Nadu cited two reasons for this action: To use national resources in the public interest, and to make metal more easily available to consumers. The Central Government took the position that an industry of this magnitude should be under its direct control, if under any government's control, and that the state did not have enough financing or expertise to operate such a large and sophisticated company. Although discussion continued, the matter remained unresolved.

Production of both aluminum metal and bauxite in 1972 increased over that of the previous year. Imports and exports of both aluminum and bauxite were negligible.

Indian bauxite production totaled 1,659,000 tons in 1972, 37% of which came from Bihar, 18% from Madhya Pradesh, 17% from Maharashtra, 16% from Gujarat, and the balance from other jurisdictions. The amount of bauxite consumed in the manufacture of alumina and aluminum metal was 1,073,600 tons, and the amount consumed in the manufacture of chemicals, refractories, abrasives, cement and steel was 576,060 tons. Bauxite exports made a dramatic decline to only 9,340 tons from 61,288 tons exported in 1971.

The Geological Survey of India lowered its reserve estimate to 155.6 million tons of economically recoverable open pit bauxite, 65.7 million tons of which ranged between 50% and 60% Al_2O_3, while the balance ranged between 30% and 50% Al_2O_3.

The following tabulation shows production and capacity of the Indian aluminum industry in thousand metric tons:

Company, plant, and location of plant	1972		1975 proposed capacity
	Output	Capacity	
Aluminium Corp. of India Ltd:			
Asansol, West Bengal	8	9	9
Bharat Aluminium Co. Ltd.:			
Koyna, Maharashtra	--	--	50
Korba, Madhya Pradesh	--	--	100
Hindustan Aluminium Corp. Ltd.:			
Renukoot, Uttar Pradesh	79	80	120
Indian Aluminium Co. Ltd.:			
Alwaye, Kerala	19	20	20
Belgaum, Mysore	39	40	60
Hirakud, Orissa	21	20	20
Madras Aluminium Co. Ltd.:			
Mettur, Tamil Nadu	14	20	20
Total	180	189	399

All aluminum production continued to be from private sector firms, since the government-owned Bharat Aluminium Co. Ltd. plants had not yet come onstream.

Apparent consumption of aluminum was 174,800 tons in 1972, down from the 204,300 tons of 1971. The Planning Commission estimated that demand for aluminum will be 240,000 tons in 1973, 300,000 tons in 1975, and 400,000 tons in 1978.

Chromite.—Production of chromite continued its upward trend in 1972, and again all the chromite exports went to Japan. Chromite reserves are presently thought to total 13.9 million tons, 3.9 million tons of this being metallurgical and chemical grades (48% to 56% Cr_2O_3).

Production of ferrochrome declined sharply during 1972 to only 1,894 tons because of unexpectedly poor markets, especially in the problem-plagued domestic iron and steel industry. The major producer, Ferroalloy Corp. Ltd., closed for the entire year, and the other producers were only in part-time production. Domestic consumption of ferrochrome totaled about 2,000 tons, and exports accounted for another 2,005 tons. The producers had operated in the expectation of an even poorer market than this, so the shortage had to be made up from stocks.

Copper.—The Government of India nationalized the nation's only producing copper mine and smelter at Ghatsila, owned by Indian Copper Corp. Ltd. (ICC), on March 10, 1972. The company

was well managed and profitable, had no known labor troubles, and had just completed a new flash smelter that gave it a total smelter capacity of 26,460 tons, all at Ghatsila. The Government simply stated that the takeover was "expedient in the public interest," and was hard pressed to answer charges of nationalization "for the sake of nationalization." The Government's Hindustan Copper Ltd. received the responsibility of managing ICC. Problems in utilizing this newly-acquired smelter capacity can be plausibly attributed to cuts in electric power and inability to adequately increase mine production.

India has made some progress in opening up new sources of copper. The Hindustan Copper Ltd. project at Khetri-Kolihan, under development since 1957, may be able to produce copper concentrate at a rate of about 9,900 tons per year by mid-1973. The concentrates will go to the presently operating Ghatsila smelter because the smelter at Khetri-Kolihan will not be operating for at least 3 years. Mysore State reported that its 6,000-ton-per-year copper concentrator near Chitaldrug will be completed in mid-1973; they also plan to ship their concentrates to the Ghatsila smelter.

The Ghatsila smelter of the former ICC was the only producer in 1972. The smelter's production could meet only a small part of the national demand of 110,000 tons. Most of the demand was met by imports of 54,274 tons of copper metal (95% as electrolytic wire bar) worth $62.6 million, of which 29,907 tons came from Zambia, 7,580 tons from Japan, 6,057 tons from Zaire, and the balance from other sources. The Planning Commission has estimated that demand for copper would total 145,000 tons in 1975.

Gold.—On April 1, 1972, the Government consolidated its two gold producers, the Kolar Gold Mining Undertaking and Hutti Gold Mines Co., into one organization titled Bharat Gold Mines, Ltd. The Government made the consolidation to cut costs and, hopefully, to make mine modernization possible.

Indian production of gold ore in 1972 increased in quantity and declined in grade from the previous year. In 1972, the mines at Kolar produced 400,609 tons of ore averaging 0.17 troy ounce of gold per ton, while the mines at Hutti produced 211,867 tons averaging 0.18 troy ounce per ton. While gold mining might continue at Kolar for another 15 years, problems with ventilation and water may not allow gold mining at Hutti for more than a few years.

Iron Ore.—New mine development fell somewhat behind schedule. While the Bailadila expansion program went well, that for Kiriburu was about 1 year behind schedule, mostly because of delayed equipment deliveries. After more than 2 years, the Kudremukh project was still awaiting government approval. If consummated as planned, the Government would hold a 51% interest in this 4.0-million-ton-capacity project, the slurried concentrate product of which would be exported to Japan for pelletizing and subsequent consumption. Tata Iron and Steel Company's (TISCO) new 1-million-ton iron ore pellet plant in Bihar went onstream in 1972, as did also the new expansion of the existing pellet plant in Goa belonging to Chowgule and Co. Capacity of the latter was brought to 2 million tons.

Indian iron ore production in 1972 increased by a negligible amount over that of 1971. The Union Territory of Goa accounted for 30.8% of the total production, Madhya Pradesh for 23.8%, Orissa for 18.4%, Bihar for 13.2%, Mysore for 11.6%, and other states for the balance. Production was reported at 227 mines in 1972, of which 24 mines were government-owned. Important mines in the private sector were Naomundi (in Bihar), Joda East (in Orissa), and Pale, Sanquelim, and Sonshi (all in Goa). Both of the country's iron ore pellet plants are in the private sector. Important government-owned mines included Bailadila (in Madhya Pradesh), Kiriburu (in Bihar), Dhalli Rajhara (in Madhya Pradesh), Barsua (in Orissa), Bolani (a former Indian Iron and Steel Company mine in Orissa), and Daitari (owned by the state of Orissa).

Domestic consumption of iron ore totaled 10.9 million tons in 1972. The Government Planning Commission estimated that domestic iron ore consumption will be 19.8 million tons and iron ore exports will be 32.0 million tons in 1975, while iron ore consumption will rise to 34.2 million tons and iron ore exports will rise to 47.0 million tons in 1981.

Iron ore exports in 1972 totaled 21.48 million tons worth $153 million, and were sent to the destinations shown in table 4. The government-owned Minerals and Metals Trading Corp. exported 11.1 million tons of the total, and private firms in Goa exported the balance.

Table 4.—India: Exports of iron ore
(Million metric tons)

Destination	1971	1972
Belgium	0.27	0.23
Czechoslovakia	.68	.73
Hungary	.10	.11
Japan	16.79	18.03
Poland	.38	.47
Romania	1.38	1.43
Yugoslavia	.20	.18
Other	.58	.30
Total	20.38	21.48

Iron and Steel.—On July 14, by presidential ordinance, the Government of India took over the management of the Indian Iron and Steel Co. (IISCO) for a period of 2 years. The Government stated that the major reasons for the action were the decline in steel production, the deteriorating plant conditions, and the growing financial problems that have occurred over the last several years. Knowledgeable people in industry feel that the takeover may last longer than 2 years, or may be a precursor to full nationalization.

The Government continued to make plans for additional steel capacity, and has set its sights on an installed capacity of 19.5 million tons of ingot by the end of the Fifth Plan in 1979. On October 3, the Prime Minister commissioned the first blast furnace at Bokaro. The rest of Bokaro's first stage is scheduled for completion in 1973, and a second stage, which will bring the plant to a capacity of 4.0 million tons, is scheduled for completion by 1976. TISCO, now the only private sector steelmaker (and that with 40% government participation), has asked Japan's Nippon Steel Corp. for technical assistance with a proposed new steel plant having a capacity of 2.0 to 2.5 million tons that would increase TISCO's capacity to 4.0 million tons or more. Government approval of TISCO's expansion seemed likely, assuming that the Government will be a joint participant in the new plant. While work continued on the expansion of the Government's plant at Bhilai, the prospects for the proposed new plants in southern India seemed more nebulous.

Production of both pig iron and steel increased in 1972, reversing the trend of the last several years. Steel ingot production by plant was as follows: Bhilai provided 30% of the total, TISCO provided 24%, Rourkela provided 17%, Durgapur provided 10%; IISCO provided 6%; and other plants provided the balance.

A moderate increase in imports combined with a drastic cut in exports, especially of iron and steel, made India an even heavier net importer of ferrous metals (in terms of value of iron, steel, scrap, and ferroalloys) in 1972. In that year, India was a net importer of $233.7 million worth of ferrous metals although in 1971 it was a net importer of only $141.3 million worth.

Ferroalloys.—Production of most ferroalloys declined; for example, production of ferromolybdenum dropped from 255 tons in 1971 to 236 tons in 1972.

Ferromanganese production at the seven plants operating in India averaged 83% of rated capacity, although the individual plants operated in a range from over 100% of capacity on down to 26% of rated capacity. Domestic consumption of ferromanganese in 1972 was about 81,000 tons. Ferromanganese exports totaled 55,958 tons worth $6.8 million, of which 29,917 tons went to the United States and 14,359 to Sweden.

Ferrosilicon was produced at four plants in 1972, the largest producer of which, the plant of Mysore Iron and Steel, Ltd., accounted for 58% of the total production. The two plants which were new producers accounted for less than 12% of the total production. Because ferrosilicon production increased greatly while more production setbacks occurred in the principal consuming industry (iron and steel) ferrosilicon stocks rose from 5,000 tons at the beginning of the year to 15,000 tons at the end of the year.

Scrap.—The Government of India increased its share of the ferrous scrap exporting Metal Scrap Trade Corp. Ltd. to 80%, putting the corporation firmly in the public sector. The additional government capital being brought in will be used to diversify into related activities, such as the import of scrap, shipbreaking, and the control of scrap collection and distribution. The changes were made because of the

expectation that scrap exports will decline as domestic demand from electric steelmakers increases.

The Indian ferrous scrap market was the subject of varied interpretations by the interested parties. According to the Iron and Steel Scrap Association of India (ISSAI), a decline in demand in 1972 by the electric steelmakers has left the scrap merchants with undesirably large inventories bought at high prices and left them under long-term contracts to accept even more scrap. ISSAI raised the specter of scrap merchants being forced out of business and of scrap collections dropping off. The electric steelmakers, on the other hand, claimed that all available scrap was used and that more could have been consumed if available. They recommended more scrap imports, additional scrap processing yards, and restrictions on scrap exports.

Lead and Zinc.—Any increases in the supply of lead and zinc from the mine and smelter expansion projects announced in recent years appear to lie at least several years in the future. India's only lead-zinc mine at Zawar produced 314,431 tons of ore containing 0.84% Pb and 3.62% Zn in 1972. Lead concentrate output was 4,518 tons in 1972, compared with 4,262 tons (revised) in 1971. Zinc concentrate output was 15,855 tons in 1972, compared with 17,055 tons (revised) in 1971.

The demand for both metals exceeded the supply from domestic production and imports. Demand for lead was 88,500 tons in 1972, for a deficit of 38,570 tons. About 7,500 tons of lead were supplied as scrap. Demand for zinc was 129,000 tons in 1972, for a deficit of about 23,000 tons.

Indian imports of lead metal totaled 39,830 tons worth $12.4 million, of which 13,857 tons came from Australia, 8,851 tons from Burma, 8,010 tons from the United Kingdom, 4,910 tons from Canada, and the balance from other sources. Indian imports of zinc concentrates totaled 29,824 tons worth $3.0 million, of which 20,627 tons came from Canada and 9,197 tons from Australia. Indian imports of zinc metal, 82% of this zinc or spelter, totaled 80,713 tons worth $27.0 million, of which 28,031 tons came from Australia, 17,257 tons from Japan, 8,668 tons from the U.S.S.R., and the balance from other sources.

Information from the Indian Lead Zinc Information Centre indicated that 35% of total lead consumption was used in batteries in 1971, 25% in cables, 20% in paints and pigments, and the balance in other uses. The same source indicated that 55% of total zinc consumption was used in galvanizing in 1971, 15% in brass, 12% in rolled zinc, and the balance in other uses.

Manganese.—Both production and exports of manganese ore in 1972 were lower than those in 1971, with production only dropping slightly and exports dropping by over one third. India is thus continuing to lose ground to other producing nations.

Table 5.—India: Exports of manganese ore by type and destination

(Thousand metric tons)

Type and destination	1971	1972
Types:		
Ore, 48% manganese or higher	NA	24
Ore, 35% to 48% manganese	NA	245
Ore, ferruginous, below 35% manganese	NA	541
Peroxide and other processed oxides	NA	2
Total, ores and similar materials	NA	812
Destinations (all types):		
Belgium	43	32
Canada	40	--
Czechoslovakia	34	61
France	15	14
Japan	1,081	647
Korea, South	19	6
Spain	29	--
United Kingdom	4	(1)
United States	17	16
Other	4	36
Total [2]	1,285	812

NA Not available.
[1] Less than ½ unit.
[2] Data may not add to total shown because of independent rounding.

The state of Orissa supplied 31% of India's 1972 manganese production, followed by Mysore with 26%, Madhya Pradesh with 14%, Maharashtra with 11%, and other jurisdictions with the remainder. Almost 58% of the ore produced contained less than 35% Mn, almost 41% contained between 35% and 48% Mn, with the balance being higher grades. About 313 manganese mines were active, of which only 20 were government-owned. The amount of production being exported was almost equal to the amount being consumed domestically, while about 27,000 tons of manganese ore was added to stocks. Table 5 shows the amount of ore exported by type and destination. Domestic manganese consumption was 790,000 tons in 1972, of which 395,000 tons was used in iron and

steel, 385,000 tons was used to make ferromanganese, and the remainder was mostly used in batteries.

Nickel.—The Government announced that it hopes to build a plant in Orissa which would recover about 4,800 tons of nickel powder per year (design capacity) from lateritic ores.[4] Indian sources estimated that 27% of total nickel consumption in India was used in plating in 1971, 23% was used in constructional alloy steels, 17% was used in stainless steel, 17% was used in coinage, and the balance was used elsewhere.

Uranium.—India's only uranium mine and ore concentration plant at Jaduguda ran at a level of about 800 tons of ore per day in 1972; the ore contained about 0.060% to 0.065% U_3O_8.

NONMETALS

Cement.—Cement production in 1972 was 15.70 million tons, while consumption was 15.75 million tons and yearend 1972 stocks were only 5,000 tons. The production increase in 1972 occurred in spite of freight car shortages, a nationwide strike, and some electric power shortages. Installed cement capacity at yearend 1972 was 19.0 million tons.

Cement is exported only by the Government's State Trading Corp.; the cement exports are also subsidized by the Government. Exports of cement totaled 242,711 tons, 106,357 tons of which went to Nepal, 101,828 tons to Bangladesh, and the balance to other neighboring countries.

The Cement Corp. of India, the Government agency responsible for cement, allowed a price of $13.33 per ton to the producer, while charging the consumer $33.33 per ton. The difference between these amounts is absorbed by transportation and taxes.

Diamond.—The Geological Survey of India announced the discovery of diamond-bearing pipes at two locations, one near Wajrakarur in Andra Pradesh, and the other near Panna in Madhya Pradesh. The only field now producing is also at Panna. The Wajrakarur discovery consists of four pipes, a bulk sample from one of which yielded 22.42 carats of diamond, while the Panna discovery consists of only one pipe.

In addition to being a producer, India is also an importer of both gem and industrial diamond. Gem diamond is imported for cutting and polishing, and then reexported. Industrial diamond is imported for incorporation into tools for grinding, cutting, and core drilling; most of these tools are used domestically. The Industrial Diamond Association of India estimated that about 500 thousand carats of industrial diamond are used in such tools each year.

Gypsum.—Production declined slightly in 1972 to 1.078 million tons worth $1.7 million, with 90% of this quantity coming from Rajasthan. Consumption also totaled 1.078 million tons. Of this quantity, 600,000 tons was used to make fertilizers at Sindri 460,000 tons was used by cement producers, and the balance was used by other industries.

Early in the year, the Government and many of the gypsum consumers were concerned about the producers' ability to meet the demand for gypsum. Complaints centered about erratic deliveries, railcar shortages, high freight rates, and unsatisfactory quality-control measures. The deposits are so variable in quality and often so interbedded with contaminants that selective mining is necessary to get a satisfactory product. The consumers are now looking into substitutes for gypsum or imports of gypsum. Thus, the outlook for Indian gypsum is uncertain, even though production apparently met most of the demand this year.

Kyanite and Sillimanite.—The Government nationalized the principal kyanite producer, the ICC, owner of the deposit at Lapsa Buru in Bihar, when it nationalized that firm's copper properties. The kyanite operation was placed under the control of Hindustan Copper Ltd. Indian kyanite production rose to 68,479 tons worth $1.8 million in 1972, of which 86% came from Bihar, 13% from Maharashtra, and 1% from Mysore. Of the 24,740 tons of kyanite exported, 6,487 tons went to Japan, 4,831 tons to West Germany, 3,825 tons to the United Kingdom, and the balance to other destinations.

Sillimanite production continued to decline; 4,073 tons worth $0.9 million was produced in 1972, 76% from Meghalaya, 13% from Kerala, and the balance from other states. Consumption totaled 3,521

[4] Mining Journal (London). Resources in India. V. 278, No. 7130, Apr. 14, 1972, p. 299.

tons, 3,300 tons of this having been used by the refractories industry and the balance by the asbestos and glass industries. The Planning Commission estimated that demand for sillimanite would be about 16,000 tons in 1979. The Geological Survey of India has accelerated its work on sillimanite; their present knowledge indicates that there are reserves of slightly less than 500,000 tons grading between 57.0 and 62.2% Al_2O_3. They expect that a total reserve of 2.0 million tons may be ultimately identified.

Magnesite.—Production decreased from the previous year to 273,000 tons (97% from Tamil Nadu) worth $1.1 million. The decline in production was apparently caused by a slack demand for magnesite centered in the export sector, just as in the last several years.

Mica.—As reported last year, the Government officially monopolized mica exports while allowing private mica traders to negotiate export sales of mica on its behalf. Exporters with ongoing contracts or other understandings can function much as they formerly did. Reportedly, even the U.S.S.R. and other East European countries still prefer to buy mica from the private traders, probably because of their proven quality controls.

Table 6.—India: Mica exports by type
(Metric tons)

Type	1971	1972
Block	1,301	1,484
Film	92	159
Cut condenser film and plate	21	16
Cut sheet and strip	34	51
Washer and disc	136	103
Splittings	6,025	6,179
Scrap and waste	13,105	14,350
Powder	3,140	2,996
Micanite and builtup mica	21	17
Total	23,875	25,355

India continued to be a major world producer and exporter of mica, with most of production being exported. Only 8,500 tons of mica were consumed domestically. Of this quantity, 7,000 tons were used in refractories, 600 tons in electrodes, 400 tons in rubber, and the balance in other uses. Table 6 shows the amount of mica exported. The value of the mica exported in 1972 totaled $25.3 million, of which $10.4 million was in the form of blocks, $7.9 million in the form of splittings, $2.7 million in the form of films, $1.6 million in the form of washers and discs, and the balance in other forms. Of the $25.3 million worth of mica exported in 1972, $8.3 million went to the U.S.S.R., $3.0 million to the United States, $2.8 million to Poland, $2.3 million to Japan, and the balance to other destinations.

Phosphate Rock.—Production of phosphate rock in 1972 totaled 228,622 tons averaging 33% P_2O_5 and worth $2.69 million. Over 93% of this production came from the Jhamar Kotra mine in Rajasthan. To help meet demand, more phosphate rock was imported in 1972 than in the previous year; it amounted to a total of 855,298 tons worth $15.53 million, 439,101 tons of which came from Jordan, 347,917 tons from the United States, and the balance from other sources. In spite of the large amount of imports, the Fertilizer Association of India claimed that there was an apparent demand in 1972 for over 1.5 million tons of phosphate rock, for a shortfall of 400,000 tons, and that demand in 1973 would be nearly 2.0 million tons, for a shortfall of even larger dimensions. This high demand was the result of an expansion in fertilizer production facilities. The purported shortage might also be attributed in part to failure to implement the expansion of mining facilities at Jhamar Kotra announced in 1970, possibly because of disagreement about the size of the expansion.

Salt.—Salt production increased from 5.4 million tons worth $12.5 million in 1971 to 6.5 million tons worth $15.0 million in 1972. Most of the salt is produced from sea water, and around 90% of it usually produced by private firms. Domestic consumption accounted for 6.2 million tons of the 1972 production, with 4.5 million tons of salt consumed by humans and animals, 1.6 million tons consumed in chemicals, and the balance consumed in other uses.

Sulfur and Pyrite.—Domestic production of sulfur-bearing materials continued at the unsatisfactorily low levels of previous years. The sole producing source of pyrite, the Amjhore-Ghoga deposit of the Pyrites and Chemicals Development Co. Ltd., had an output of 30,723 tons of ore (quality unavailable) or 22% of the planned output. Production is unlikely to increase significantly in the foreseeable future. By-product sulfuric acid production from the zinc smelters totaled only 43,001 tons or 57% of the installed capacity. The expan-

sion plans at both smelters are far behind schedule, and since the plans to recover sulfur from the copper smelting operations are also lagging, no significant increase in production of byproduct sulfuric acid is likely.

Most of the sulfur consumed in India was imported. Of the 623,991 tons of sulfur imported in 1972, 307,072 tons came from Poland, 164,745 tons from Iran, 134,969 tons from Canada, and the balance from other sources.

MINERAL FUELS

Coal.—In May 1972, Parliament completed the nationalization of the 214 coking coal mines that was begun in 1971.

The Government made plans to nationalize the rest of the coal industry, and began putting these plans into effect on January 30, 1973, by taking over the management of 738 noncoking coal mines. Thus all coal mines are now in the hands of the Government, except for a few mines owned by TISCO. The Government's justification was that "coal mine owners had been indulging in unhealthy mining practices with a view to maximizing short term gains," thus forcing the Government to step in "to reorganize, restructure, and rationalize coal mining and to secure a rapid increase in production."

Production of coal, India's most important mineral commodity, rose in 1972, as did the average value per ton, which rose from $4.75 (revised) in 1971 to $4.77 in 1972. Pithead stocks were unchanged at 8.4 million tons.

India produced 74.8 million tons of coal in 1972, which can be broken down several ways. Because of nationalization of the coking coal industry, privately-owned collieries accounted for only 53.2% of the total coal output. At the same time the following government-owned firms accounted for the remainder: National Coal Development Corp. for 24.1%, Bharat Coking Coal Ltd. for 16.0%, and Singareni Collieries Co. Ltd. for 6.7%. Underground mines produced 78% of the total output and open pit mines produced the balance. Bihar supplied 44.2% of the coal produced in 1972, West Bengal supplied 24.2%, Madhya Pradesh supplied 17.9%, and other states supplied the balance.

India consumed 74.6 million tons of coal in 1972, of which the railways used 15.0 million tons, steel plants used 14.5 million tons, thermal powerplants used 10.9 million tons, cement plants and brick kilns used 7.9 million tons, merchant coke ovens and soft coke plants used 5.7 million tons, and other consumers took the remaining 20.6 million tons. Any significant increase in coal consumption in the next few years is unlikely and the Planning Commission acknowledged that their previous estimates for coal consumption for the 1973–83 period were too high.

Lignite.—India's only lignite producer in 1972 was the Neyveli mine of the government-owned Neyveli Lignite Corp, Ltd. in Tamil Nadu. The associated fertilizer plant and carbon briquet plant were both shutdown by September 1972 because of a worsening lignite shortage. The company reported its largest annual loss so far for the fiscal year covering most of 1972. Any improvement in the near future is unlikely because the necessary corrective measures would take several years to take effect.

Natural Gas.—Natural gas production in 1972 increased from that of the previous year, in terms of both gross amount and marketable product. Natural gas reserves declined a significant amount; as of January 1, 1972, they were 1,500 billion cubic feet, 300 billion cubic feet less than those of the previous year.

Petroleum.—The petroleum industry had a somewhat better year in 1972, and some interesting changes (mentioned in the introduction) seemed to be developing in the manner in which India obtains its crude petroleum. Crude petroleum production increased to 57.0 million barrels in 1972, 52% of this from Gujarat and the balance from Assam. Imports of crude petroleum declined slightly to 90.2 million barrels in 1972, compared with 92.7 million barrels in the previous year. Iran supplied 72.0 million barrels of the imports in 1972, and Saudi Arabia supplied the balance. Indian refineries had a throughput of 143.3 million barrels and an output of 132.5 million barrels, excluding plant fuel and losses. Imports of refined products in 1972 were almost double those of the previous year. No exports of refined products were reported, but it is known that some products were furnished to Bangladesh.

Exploration, Drilling and Crude Oil Production.—There were no significant petroleum discoveries in 1972, but there were

some interesting developments. The deep well at Suruin (near Jammu) was abandoned because of bad underground conditions at an unknown depth below 8,000 feet. The first exploratory drilling in the State of Tripura was begun at a point only a few miles from the boundary with Bangladesh. The detailed seismic survey of the offshore Bombay High appeared promising and will allow accurate exploratory drilling. The Government of India announced that it would seek the assistance of foreign oil companies in its offshore drilling program, and active pursuit of a foreign petroleum supply was started.

The Oil and Natural Gas Commission (ONGC) completed 70 wells for a total of 452,750 feet drilled in 1972, which was better than the achievement of the previous year but still not up to target. Similar information on drilling is unavailable for Oil India, Ltd. and Assam Oil Co., Ltd. At yearend 1972, India had 1,084 producing oil wells, 106 gas wells, 136 wells under test, 38 water injection holes in operation, and about 952 dry, abandoned, or shutdown wells.

Refining.—Some new public sector refinery capacity is scheduled to come onstream in the next several years. The refinery expansion at Cochin is now scheduled for completion in 1973. The 18.43 million-barrel-per-year capacity refinery at Haldia is now scheduled for completion in 1974, several years late. The new refinery at Bongaigon and the refinery expansion at Barauni are both hopefully scheduled for completion in 1975. The refinery expansion (to 52.9 million-barrels-per-year capacity) at Koyali is now planned for completion in 1976.

The following tabulation shows refinery output in millions of barrels:

Refineries	1971	1972
Private:		
Digboi	3.4	3.6
Burmah-Shell	28.0	25.2
ESSO	19.8	17.1
Caltex	8.8	7.7
Total [1]	59.9	53.6
Government-controlled:		
Gauhati	5.3	5.4
Barauni	16.1	15.0
Koyali	26.1	25.2
Cochin	17.3	16.0
Madras	14.4	17.4
Total [1]	79.2	78.9
Grand total [1]	139.1	132.5

[1] Data may not add to totals shown because of independent rounding.

Private sector refinery output declined because of disputes between government and companies about the pricing of imported crude oil and the resulting inadequate foreign exchange allocations granted by the Government on the basis of the lower price. Public sector refinery output declined slightly because of crude supply shortages and minor local problems.

The consumption of petroleum products in India increased by about 9% in 1972 to 150.8 million barrels. Demand probably increased by 12%. It is likely that use of petroleum products will grow at similar rates through 1975 and probably beyond. The supply of petroleum products will be inadequate unless all existing refineries run at installed capacity level, all new capacity comes onstream on schedule, crude oil supply increases as necessary, and product imports are made as required.

Pricing.—Crude oil pricing has been a continuing issue ever since the Government began to pressure the companies to lower prices for imported crude in the 1960's. The Government's success in 1969 lasted only until the Tehran Settlement occurred in February 1971, after which the companies demanded an increase in foreign exchange allocations commensurate with the settlement. While the Government granted a similar request for the public sector refineries, the request of the private companies was refused, forcing a reduction in the quantity of imported crude purchased by these companies. Thus the private sector refineries have been operating more or less at a reduced level in an uncertain environment ever since, even though the Government relented "provisionally" in August 1971 to assure supplies in case of possible hostilities with Pakistan. The Government appears to have continued its acceptance of the higher prices, but on an unofficial basis.

Marketing.—The public sector Indian Oil Corp (IOC) sold about 60% of all petroleum products in India during 1972, compared with 56% during the previous year. The increase in the public sector's share resulted from the same factors operating in 1971, plus the Government's ban on any importation of petroleum products by the private sector. The Government also stopped all sales by private companies of automobile accessories marketed under their proprietary brand names.

The Mineral Industry of Indonesia

By Walter Pajalich [1]

During 1972, Indonesia's economy made significant progress. Prices have become more stabilized, with increases held at about the same level as those in 1971. Meanwhile, petroleum and mining production, the two leading sources of foreign revenue, rose considerably.

The Government has approved approximately 500 foreign, nonoil investment projects, involving a total planned capitalization of $1.8 billion. One-third of these projects have already been implemented. The United States with 73 approved nonoil investments and a planned capitalization of $422 million lead the foreign investors. Domestic investments in the nonoil area were greater than foreign investments. Approximately 1,500 projects have been submitted for approval with a planned capitalization of $1.9 billion.

As Indonesia approaches the end of the first 5-year plan, it will be seeking more import capital, intermediate industry, and management know-how. Industrial development and expanded trade are high on the priority list in the country's second 5-year plan. Indonesian exports of $1.7 billion in 1972 were again dominated by raw materials, mainly oil and minerals.

Oil was the single most important source of foreign revenue and will continue to provide the basic support for the next 5-year plan. Oil earnings contributed about 40% of the Government budget in 1972, as compared with 30% last year, and these earnings are expected to grow in the future. Value of oil exports in 1972 was approximately $1 billion, much larger than all other exports put together. Indonesia has become the world's ninth largest oil producer and the seventh largest oil exporter. Since 1966, 43 new oil- and gasfields, both onshore and offshore have been discovered.

As a result of the Government's efforts to rehabilitate operations and improve marketing, mineral production under the auspices of state mining companies increased moderately in 1972. Indonesia became a producer and exporter of copper concentrate when Freeport Indonesia, Inc., made its first shipment from the Ertsberg deposit in West Irian. Except for this deposit, most of the country's production of minerals was by state enterprises. To date, 14 Mining Contracts of Work have been signed with foreign companies for mineral exploration and development. Efforts have also been made to attract domestic capital to the mining sector, and roughly 200 licenses have been issued to national investors for mineral exploration and development. A number have been withdrawn, however, because of the failure of some national investors to demonstrate meaningful mining activity during the period of license validity.

In March, the Ministry of Mines issued a series of decrees affecting foreign companies involved in oil and gas undertakings in Indonesia. These deal with procedures for the licensing of foreign oil service companies and subcontractors, the employment of foreigners, and the use of Indonesian goods. The decrees were designed to give the Government some control over the operation of foreign companies not registered in Indonesia.

In August, a decree covering nonoil operation permits for mining services companies were also issued. This decree specifies that all companies, domestic and foreign, providing services, such as mapping, exploration, drilling, research, and consulting, must apply for a permit to operate in Indonesia. In addition, any mining operation, pursuant to the Law of Foreign Capital Investment, will be obliged to have national capital participation. The amount will be determined by the Minister of Mines each time.

[1] Mining engineer, Division of Nonmetallic Minerals—Mineral Supply.

Imperial Chemical Industries Australia Ltd., the Australian subsidiary of Imperial Chemical Industries, U.K., has joined with Broken Hill Pty. Co., Ltd., and a group of Japanese and American companies in a large-scale mineral exploration project for copper and other base metals. Prospecting will take place in West Irian, and in northern Sumatra. P.T. Baliem Valley Minerals, (participants are Imperial Chemical, Philipp Brothers, American Smelting and Refining Co., and Newmont Mining Corp.) and P.T. Paniai Lake Minerals (participants are Broken Hill, Imperial Chemical, Philipp Brothers, and Newmont Mining) will explore in West Irian, and Atjeh Minerals Indonesia (participants are Broken Hill, American Smelting and Refining, Sumitomo Shoji Kaisha Ltd., and Sumitomo Metal Mining Co., Ltd.), in northern Sumatra. The exploration program will cost about $1.7 million and last 2 years. Newmont Mining, through its Australian-based subsidiary, Newmont Proprietary Ltd., has a 40% interest in each of the three companies and will manage the exploration.

PRODUCTION

Production of the major mineral commodities, oil, tin, nickel, and bauxite increased substantially. The most dramatic increase was in the production of petroleum, which increased about 20% over the previous year's production. The significant increase in crude oil production was primarily due to the expansion of exploration and development programs by foreign contractors. The production of petroleum has been and will continue to be the most important mineral industry in the future.

Nickel production increased about 12%, tin 8%, and bauxite and gold 3% respectively. Manganese production dropped about 37% and iron sand about 2%. Copper production started in December 1972, with the first shipment of copper concentrate from the Ertsberg deposit.

Table 1.—Indonesia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum, bauxite, gross weight	1,229,168	1,237,607	1,276,578
Copper, mine output, metal content	--	--	2,974
Gold, metal [2] ---troy ounces	7,608	10,600	10,899
Iron and steel, iron sand	--	270,900	265,915
Lead, mine output, metal content [e]	200	200	--
Manganese ore	[r] 10,837	11,958	7,538
Nickel, mine output, metal content [3]	[r] 15,600	19,800	22,442
Silver ---thousand troy ounces	283	285	279
Tin:			
Mine output, metal content ---long tons	18,761	19,411	20,992
Metal ---do	5,108	9,074	11,819
NONMETALS			
Cement ---thousand tons	553	547	[e] 550
Clays, kaolin powder	[e] 9,500	[e] 10,000	6,013
Diamond:			
Industrial [e] ---thousand carats	6	[r] 3	3
Gem [e] ---do	14	[r] 12	12
Total [e] ---do	20	[r] 15	15
Gypsum [e]	8,000	8,000	8,000
Iodine	[e] 1,000	[e] 1,000	10,035
Salt, all types [e] ---thousand tons	180	180	180
Stone:			
Limestone	NA	NA	838,240
Quartz	[e] 10,000	NA	52,388
Sulfur, elemental	[e] 1,500	[e] 1,500	2,400
MINERAL FUELS AND RELATED MATERIALS			
Asphalt rock, bitumen content [e]	18,300	43,000	NA
Coal ---thousand tons	172	198	179
Gas, natural:			
Gross production ---million cubic feet	108,561	121,160	145,629
Marketed ---do	45,622	43,839	42,710
Natural gasoline ---thousand 42-gallon barrels	254	120	146
Petroleum:			
Crude ---do	311,552	325,672	394,606
Refinery products:			
Gasoline ---do	12,253	12,811	11,412
Kerosine and jet fuel ---do	15,779	15,886	16,510
Distillate fuel oil ---do	11,762	10,364	12,877
Residual fuel oil ---do	12,418	14,099	12,620
Lubricants (including grease) ---do	17	13	31
Other [4] ---do	28,379	28,206	48,452
Fuel and losses ---do	2,851	8,599	1,626
Total ---do	83,459	89,978	103,528

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

[1] In addition to the commodities listed, a variety of crude construction materials including sand, gravel, and additional types of clay, and stone are also produced but information available is inadequate to make reliable estimates of output levels.

[2] Officially reported Indonesian statistics representing government output; private production by small unorganized producers may be as much as 30,000 troy ounces per year.

[3] Includes a small amount of cobalt which is not recovered separately.

[4] Includes unfinished oils requiring further processing.

TRADE

Mineral commodity exports during 1972 accounted for about half of the value of total export trade. Crude oil and refined products were the most significant mineral exports. Mineral commodity imports accounted for only a small proportion of Indonesia's total imports.

Japan continued as a major customer for mineral exports and was a major supplier of mineral commodities to Indonesia. The main mineral imports were cement, manufactured fertilizers, and iron and steel products.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, bauxite	1,136,646	1,114,516	Japan 1,103,000; Italy 10,516.
Copper:			
Ores and concentrates	338	459	All to Japan.
Scrap	56	200	West Germany 100; Japan 100.
Unwrought and semimanufactures	--	21	All to Israel.
Iron and steel:			
Ore and concentrate	--	226,341	Japan 215,441; West Germany 10,900.
Metal, scrap	5,067	--	
Manganese ore and concentrate	4,433	12,404	All to Japan.
Nickel ore and concentrate	524,534	817,581	Do.
Silver, unwrought and semimanufactures value, thousands	--	$403	Italy $216; United Kingdom $152; Japan $35.
Tin:			
Ore and concentrate ____long tons	506	726	All to Spain.
Metal, alloys, unwrought ____do____	7,096	9,609	Japan 3,225; West Germany 2,614; France 1,783.
Other and unspecified:			
Nonferrous ores and concentrates, unspecified	--	302	NA.
Nonferrous scrap, unspecified	--	81	Japan 71; West Germany 10.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined:			
Crude thousand 42-gallon barrels	201,913	234,904	Japan 193,399; United States 35,160.
Partly refined ____do____	5,982	4,534	Japan 4,078.
Refinery products:			
Gasoline, motor ____do____	1,988	427	Japan 433.
White spirit, kerosine ___do____	20	--	
Distillate fuel oil ____do____	--	455	All to United States.
Residual fuel oil ____do____	22,914	24,552	Japan 24,049.
Mineral jelly and wax __do____	190	901	Australia 851.
Other ____do____	--	4	Mainly to West Germany.
Total ____do____	25,112	26,339	

NA Not available.

[1] Compiled from import data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and Yugoslavia.

Source: Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York, 1972, pp. 262–267; 1971 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York, 1974, pp. 252–257.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	1,063	29	All from France.
Metal, including alloys, all forms	5,395	[2] 6,952	Japan 5,277; United States 800.
Chromium, oxides and hydroxides	--	111	All from Japan.
Copper metal, including alloys, unwrought and semimanufactures	1,755	2,419	Japan 1,681; West Germany 477; United Kingdom 128.
Iron and steel:			
Metal:			
Scrap	324	812	Japan 500; Australia 312.
Pig iron and cast iron	1,375	[2] 1,146	West Germany 613; Japan 533.
Primary forms	--	496	All from France.
Semimanufactures:			
Bars, rods, angles, shapes, sections	46,769	82,467	Japan 67,621; West Germany 5,234; Belgium-Luxembourg 5,094.
Universals, plates, sheets	130,557	138,153	Japan 111,383; Australia 11,020.
Hoop and strip	9,153	11,436	Japan 10,728.
Rails and accessories	6,986	7,618	Japan 2,581; France 2,108; Australia 1,949.
Wire	38,876	34,898	Japan 34,016.
Tubes, pipes, fittings	83,319	151,297	Japan 127,034.
Castings and forgings, rough	124	391	Italy 163; United States 146; United Kingdom 82.
Total	315,784	426,260	
Lead:			
Oxides	266	[2] 80	All from West Germany.
Metal, alloys, unwrought	288	646	Australia 493; Japan 153.
Manganese oxides	325	680	All from Japan.
Nickel, metal, semimanufactures	7	471	West Germany 246; Australia 225.
Tin metal, including alloys, unwrought ---long tons	29	16	Netherlands 9; United Kingdom 7.
Titanium oxides	776	204	West Germany 72; Japan 71; United Kingdom 61.
Zinc:			
Oxides	124	94	All from Japan.
Metal, including alloys	5,162	9,508	Australia 7,041; Japan 2,017.
Other, oxides, hydroxides and peroxides of metals, n.e.s	18	93	All from Japan.
NONMETALS			
Abrasives, natural, grinding and polishing wheels and stones	74	[2] 55	West Germany 35; Japan 20.
Asbestos	136	118	All from Canada.
Barite and witherite	24,609	7,368	United States 4,885; Australia 2,483.
Cement	435,827	497,406	Japan 490,184.
Clays and clay products:			
Crude clays, n.e.s	1,806	7,934	United States 5,365; Japan 2,569.
Products ---value, thousands	$1,425	$1,713	Japan $874; Austria $240; United States $211.
Diamond, gem ---do	$44	$30	All from Belgium-Luxembourg.
Diatomite	253	240	All from Netherlands.
Feldspar and fluorspar	NA	650	All from Italy.
Fertilizer materials, manufactured:			
Nitrogenous	105,632	85,577	Japan 53,926; Netherlands 24,809; West Germany 6,842.
Phosphatic	7,447	4,578	West Germany 1,730; Japan 1,593; Belgium-Luxembourg 1,255.
Potassic	23,310	22,580	West Germany 16,758; France 4,920.
Mixed	12,467	28,349	Japan 18,080; West Germany 9,218; Belgium-Luxembourg 1,051.
Total	148,856	141,084	
Graphite ---value, thousands	--	$38	NA.
Gypsum and plasters ---do	$43	$92	All from Australia.
Mercury ---76-pound flasks	--	87	All from Japan.
Mica	--	203	All from United States.
Pigments, mineral, iron oxide	216	228	West Germany 117; Netherlands 111.
Precious and semiprecious stones, n.e.s ---value, thousands	$169	$38	All from West Germany.
Salt ---do	--	$37	NA.
Sodium compounds, caustic soda	20,809	18,073	West Germany 7,404; Japan 5,630; United Kingdom 1,913.
Stone, sand and gravel:			
Limestone	3,224	3,495	All from Japan.
Sand ---value, thousands	--	$25	NA.

See footnotes at end of table.

Table 3.—Indonesia: Apparent imports of selected mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Sulfur, elemental	13,512	2,625	All from West Germany.
Talc value, thousands	$31	$30	NA.
Other nonmetals, n.e.s.:			
Crude	5,624	7,199	All from West Germany.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	2,425	[2] 4,425	Japan 2,365; Belgium-Luxembourg 2,060.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	1,412	[2] 1,069	Japan 570; West Germany 324; United States 175.
Coal	6,556	8,197	West Germany 5,000; Australia 3,197.
Coke	398	16,905	West Germany 16,055; Japan 850.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	NA	48	Japan 41; Australia 7.
Kerosine do	NA	166	Japan 157; Australia 9.
Distillate fuel oil do	10	13	Japan 8; Australia 5.
Residual fuel oil do	266	282	All from Japan.
Lubricants do	41	[3] 62	United Kingdom 46; Netherlands 12.
Mineral jelly and wax do	13	14	West Germany 7; Netherlands 4; United States 3.
Other do	689	168	Japan 150; United States 9; Netherlands 5.
Total do	1,019	753	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals value, thousands	--	$87	United Kingdom $51; Australia $28.

NA Not available.
[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and Yugoslavia.
[2] Partial figure. Excludes unreported quantity from Australia.
[3] Partial figure. Excludes production of United States valued at $1,843,000, Japan valued at $1,344,000 and Australia valued at $249,000.

Source: Statistical Office of the United Nations. 1970 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York 1972, pp. 268–285; 1971 Supplement to the World Trade Annual. V. 5 (Far East), Walker and Company, New York 1974, pp. 258–276.

COMMODITY REVIEW

METALS

Aluminum.—The Asahan aluminum-hydroelectric power dam project in north Sumatra was still in the early negotiation stage. The "Asahan scheme" envisages a 200,000-ton-per-year aluminum smelter (reduction plant) at Kuala Tandjung on the Asahan River at a cost of $240 million and a corresponding 440,000-kilowatt powerplant at a cost of $160 million.

The Japanese consortium, comprised of Mitsui Aluminium Industry Co., Ltd., Mitsubishi Chemical Industries Inc., Nippon Light Metal Co., Ltd., Showa Denko Co., Ltd., Sumitomo Chemical Co., Ltd. and their U.S. partners, Aluminum Company of America (Alcoa) and Kaiser Aluminum & Chemical Corp., has not yet reached an agreement with the Indonesian Government on the project. The Indonesian Government wanted the smelter and powerplant to be parts of a single project and ownership of the powerplant to be reverted to the Government after 30 years. On the other hand, the consortium felt that financing the powerplant with private capital was not feasible and that the Indonesian Government was in a better position to obtain such financing; also, nationalization in 30 years was believed to be too soon.

Showa Denko, Nippon Light Metal, and Sumitomo Chemical of Japan have jointly reached an agreement with the Indonesian Government to mine bauxite deposits in the Enam Region in the southern part of Bintan Island. A $120-million, 400,000-ton-per-year alumina plant was also planned. Enam's reserves have been estimated at 78

million tons of ore analyzing 50% alumina and 7% silica. Under the original plan the plant was to have been completed in 1976. Plans now call for rescheduling the project and perhaps relating it to the pending Asahan project.

Alcan Aluminum Ltd., of Canada has set up a new subsidiary of P.T. Alcan Indonesia, 85% owned by Alcan and 15% by the Municipal Government of Jakarta. The subsidiary will undertake the construction of a $1.5–million aluminum fabricating plant in Jakarta. The plant will have a 1,800-ton extrusion press. A 1,000 kilowatt diesel-power generating plant will be provided to make the complex self-contained with respect to power requirements.

Comalco Ltd., announced plans to establish a joint venture company with Indonesian and Hong Kong partners to manufacture and market aluminum extrusions and fabricated aluminum building products. Comalco will hold 45% of the shares, three Indonesian businessmen 30%, and Chiap Hua Comalco Ltd. of Hong Kong 25%. The 1.5-million fabricating facility will be built at Bandung with production scheduled to start in early 1973.

Copper.—The first shipment of 10,000 tons of copper concentrate from the famed Ertsberg deposit in West Irian to the Hibi Refinery of Mitsui Mining and Smelting Co. was due to arrive in December. Renegotiations were underway between the Japanese and Freeport Sulphur Corp. regarding the purchasing agreement. Freeport requested that the treatment charge be reduced to 2.25 cents per pound for the first 3 years and 2.75 cents thereafter, because of the expected increase in copper content of concentrate from 26% to about 30%. The Japanese were requesting a treatment charge of 3.4 cents per pound, a decrease in import volume by 10%, and importation of 65% to 75% of Ertsbergs' annual production of 250,000 tons of copper concentrate based on 26% copper content as originally agreed upon.

Additional diamond drilling of the deposit indicates that Ertsbergs' ore will average closer to 2.7% copper than the original estimate of 2.5% for proven reserves.

Iron and Steel.—P.N. Aneka Tambang, a State enterprise, continued to export iron sands to Japan from Tjilatjap, central Java. In 1972, 265,915 tons were exported. Sales to other countries were being considered along with the possibility of kiln processing of the sands within Indonesia and exporting of a semifinished iron product. P.N. Aneka Tambang also looked into the matter of expanding operations in the Jogjakarta Area, central Java, where a larger iron sand deposit reportedly exists.

Four major Japanese steelmakers, six Japanese trading firms, and Krakatau Steel Co. of Indonesia have agreed to set up a $10-million joint venture to produce material sheet for galvanizing. The Japanese will supply 80% of the capital and Krakatau Steel Co., 20%. A material sheet plant of 125,000-ton per year capacity will be built, with hot rolled coils supplied by Japanese steelmakers.

Manganese.—P.T. Pertambangan Djabar has placed Indonesia's manganese ore production target at 12,000 tons per year. Only 7,538 tons were produced in 1972. The largest manganese mine in the country is operated by West Java's provincial administration.

Nickel.—Nickel mining in the Pomalaa Area of southeastern Sulawesi (Celebes), has been controlled by P.N. Aneka Tambang. An agreement has been reached between Sulawesi Nickel Development Corp. (Sunideco) and P.N. Aneka Tambang to base the export price of the nickel ore produced in Sulawesi on the ferronickel price. Thus far about 3 million tons of nickel ore have been shipped to Japan from the Pomalaa Area at a rate of about 800,000 tons per year. Since last year, 7 million tons of additional nickel ore reserves have been discovered. The total reserve in the area was estimated at 10 million tons with a combined average nickel-cobalt grade of 2.4%. The Japanese and Indonesian partners have agreed to mine and ship the 10 million tons of ore in the next 10 years.

Taiheiyo Kinzoku Co. (Pacific Metals Co.) of Japan was contracted by P.N. Aneka Tambang to build a ferronickel plant in the Pomalaa Area. The Indonesian Government requested the Japanese Government for a yen loan to meet half of the cost, and construction will begin as soon as the loan is granted. Scheduled to start operation in 1975, the plant under consideration will be rated at 4,000 tons of contained nickel in ferronickel. Total investment in the project would be about $25

million. Proven reserves total about 130 million tons of nickeliferous lateritic ores containing 1.8% combined nickel and cobalt, which should be capable of supplying the plant for at least 30 years.

The Indonesian Nickel Development Co. Ltd. exploration survey program at Obi and Gebe, Halahera Islands, has established the existence of an estimated 60 to 70 million ton reserve of 1.6% to 2.2% nickel-bearing ore. Feasibility studies were underway, with the objective of developing a mine by 1975. The company also has plans to build a combination nickel matte and ferronickel plant in the late 1970's.

Pacific Nickel Indonesia's nickel ores from a deposit at Weigo, West Irian, were still undergoing metallurgical testing at Sherritt Gordons Mines' plant at Fort Saskatchewan, Alberta, Canada. Sherritt Gordon has 10% interest in Pacific Nickel Indonesia.

P.T. International Nickel of Indonesia, a subsidiary of International Nickel Company of Canada (INCO), which is developing nickel deposits on Sulawesi, has signed sales agreements with six Japanese firms for future deliveries. The Japanese companies involved are Shimura Kato Co. Ltd., Sumitomo Metal Mining Co. Ltd., Tokyo Nickel Co. Ltd., Mitsui and Co. Ltd., Nissho-Iwai Co. Ltd., and Sumitomo Shoji Kaisha Ltd. P.T. International Nickel of Indonesia will ultimately be owned 60% by INCO, 20% by Japanese partners, and 20% by Indonesians. INCO is a shareholder in Shimura Kako and Tokyo Nickel. The mining and processing facilities to be established by P.T. International Nickel of Indonesia in the vicinity of Soroako, eastern Sulawesi, will represent the first stage of a program to develop lateritic ores in various areas of Sulawesi. Capacity of the initial plant will be 14,000 tons per year of contained nickel-cobalt in the form of a 75% nickel matte. Shipments are scheduled to begin in the second half of 1975.

Tin.—The tin industry, under the direction of the State Enterprise, P.N. Timah, has shown remarkable progress in recent years. During 1966-70 mine output increased by more than 50%. Production rose to about 19,400 long tons in 1971 and 20,992 long tons in 1972. The framework for sustained growth now appears to be established following the reoganization of the industry in 1968. The present program is to modernize the existing dredging fleet, conduct extensive exploration, increase smelting capacity, continue research in mineral processing with United Nations help, and improve technical training facilities for Indonesians. All this has been made possible partly as a result of the decision of the Indonesian Government to reduce taxes for the State tin enterprise from 70% of the gross proceed to 10%, leaving 60% free for reinvestment.

A loan from the Netherlands was of great assistance to the program of modernizing and rehabilitating Indonesia's fleet of bucket dredges. The Mining & Transport Division (MTD) of IHC Holland of Rotterdam undertook the project to modernize three small bucket dredges, namely Klantji, Lais, and Rajah. The 9-cubic-foot dredge Klantji was the last of the steam-fired dredges, and the 7-cubic-foot dredges Lais and Rajah, were the oldest of the Indonesian fleet of 30 tin dredges. The Rambat and Tempiland dredges were electrified, resulting in the doubling of capacity.

A contract for the expansion of the Peltin smelter at Mentok has been signed with Paul Bergsoe & Son of Glostrup, Denmark, in partnership with S.C. Pearce & Associates of Southport, Lancashire. The agreement calls for improving the performance of the three existing rotary furnaces, and the construction of three stationary furnaces to increase total smelter capacity to a minimum of 28,000 tons of refined tin per year. Thomas S. Mackey of Associated Metals & Minerals Corp. of New York has been appointed as technical advisor for the expansion program. Trial runs will begin in mid-1974.

Foreign investors are welcome in tin mining and the Government has opened the following areas for exploration and development: Northern part of Riau Archipelago, excluding Karimun and Kundur; southern part of the Riau Archipelago, except Singkep; the open sea between Singkep and Banka Island; selected areas on Banka and Bilitunga, areas around Karimata; and some land group areas of Bangkinang on Sumatra.

Early in the year the program of deepening the Mentok Harbor on Banka Island was completed. Harbor facilities can now accommodate 10,000-deadweight-ton vessels.

Overseas exploration companies continued their prospecting. P.T. Koba Tin was prospecting onshore and offshore Koba Island. P.N. Timah and N.V. Billiton Maatschappij were prospecting off Air Kantung to depths of 250 feet. Billiton holds two concessions: Karimata, southwest of Kalimantan, and Pulau Tudju off the east coast of Sumatra.

Bluemetal Industries, Ltd., of Australia has completed negotiations with the Indonesian Government regarding tin mining on Banka Island where substantial new reserves have reportedly been proven.

NONMETALS

Cement.—Cibinong Cement Co. was planning to install a single, dry-process kiln with a suspension preheater at Cibinong, 30 miles south of Jakarta. Scheduled for completion by yearend 1974, the plant will have an annual capacity of 550,000 tons. Yuo Ming Co. Ltd. of Hong Kong in a joint venture with P.T. Gunung Ngadeg Djaya plans to build a $20-million cement plant in central Java.

Diamond.—The Indonesian company of C.V. Djaja Niagara Permata and the Australian companies, Allstate Explorations N.L., Goodearth Developments Pty. Ltd., and MIM Holdings, planned a joint exploration venture for diamonds in central Kalimantan. Application was made for leasing 62,500 acres, including a 10,000-square-mile area surrounding the lease area. Kalimantan has a history of small diamond production, mainly from Martapura in the southeast.

Fertilizer.—Indonesia is both a major consumer and producer of nitrogen fertilizers. During the year, consumption exceeded 200,000 tons of contained nitrogen, of which about 40% was supplied by P.T. Pupuk Sriwidjaja (PUSRI) from Palembang and by Petrokimia from Gresik in eastern Java.

Construction was started on an $84-million nitrogen fertilizer complex near Palembang in southern Sumatra. Capacity will be 600 tons per day of ammonia and 1,550 tons per day of urea. The complex is expected to be completed in 1974.

Another fertilizer plant called PUSRI II is being built next to the existing PUSRI I plant. Capacity of the new plant will be 63,000 tons per year of ammonia and 100,000 tons per year of urea.

Petrokimia, a government-owned company, expects to complete a fertilizer project in East Java near Surabaya. Annual capacity will be 77,000 tons of ammonia, 65,000 tons of urea, and 110,000 tons of ammonium sulfate.

MINERAL FUELS

Petroleum.—Since 1966 oil production in Indonesia has more than doubled. Output at yearend 1972 exceeded 1 million barrels per day, making Indonesia the non-Communist ninth ranking oil producing country. Oil is by far the largest single domestic source of foreign revenue, and has contributed an estimated 40% of the country's budget. Export revenue from oil, approximately $1 billion, exceeds the total of all other exports. Not taking into consideration new discoveries, production is expected to increase to 2 million barrels per day by 1975.

Some major finds that are expected to push Indonesian oil production well over 1 million barrels per day are: Atlantic Richfield Indonesia, Ltd.'s (ARCO) Ardjuna Field; Independent Indonesian Petroleum's (IIAPCO) Cinta Fields, which went onstream last year; the anticipated output from the Attaka Field of Union Oil Co. of Indonesia and Japanese Petroleum Exploration Co. Ltd. (Japex); and ARCO's second Ardjuna platform.

The intensive exploration program undertaken since 1966 has resulted in the discovery of 17 major fields offshore and 26 onshore. The significance of the new discoveries is that they are not concentrated in one area, but rather are scattered throughout the 900,000 square miles under exploration by 45 companies. Exploration commitments by these companies is about $503 million over the next 8 years. The list of the oil companies under contract with the Indonesian Government are shown in table 4. Oil and gas well discoveries in 1972 are shown in table 5. The oil-bearing area delineated extends from northwest Sumatra to West Irian. This distance is comparable to that between the State of Washington east to the Bahama Islands in the Atlantic.

Pertamina, the state-owned oil corporation, and Shell International Petroleum of the Netherlands recently signed an agreement whereby the latter will give technical

service and planning advice for an oil refinery complex to be built by Pertamina at Tjilatjap in central Java. The refinery will have a capacity of 100,000 barrels per day, including a lubricating oil installation rated at 80,000 tons per year. Completion is expected in 1974.

Maruzen Oil Co., in cooperation with Daikyo Oil Co. of Japan, announced that they would build a 100,000-barrel-per-day oil refinery on Bataam Island by 1975.

A 106-mile 8⅝-inch-outer diameter pipeline was constructed on Java Island by Nippon Kokan. The line, linking Maos and Jogjakarta will be used to transport various kerosine and diesel fuel products.

Development cost of Union Oil's Attaka Field was estimated at $100 million. This field will be one of the major producers in the country.

A Japanese syndicate of 15 banks have agreed to supply a loan of $40 million to Pertamina for oil development projects. Terms of the loan are 5 years at 6.25% interest.

An oil arrangment has been reached between the Government of Japan and that of Indonesia for a $200-million loan for oil development. Half of the loan is an advance on a supply contract for 100,000 barrels per day over the next 10 years, subject to yearly negotiations. At current prices a 10-year supply of oil would involve close to $1 billion.

Sumitomo Shoji Kaisha Ltd. and Japan Gasoline Co. have been contracted by Union Oil of Indonesia for an onshore crude oil processing plant to be constructed in the Santan Area. The 100,000-barrels-per-day plant is for processing crude oil produced from the Attaka Field off east Kalimantan. The cost of the plant, scheduled for completion by yearend, was estimated at $5 million.

A $84.5-million petrochemical complex has been announced. Kellogg Overseas Corp., an affiliate of M.W. Kellogg of Houston, is general contractor for the major portion of the complex, including erection of all process and offshore facilities, except gas gathering and transmission. Williams Brothers of Tulsa is responsible for gas gathering, transmission, and scientific design.

Table 4.—Indonesia: Oil investment contracts 1967–72

Name of contractor and country	Location	Approximate area (square kilometers)	Required investment in exploration activities	Production split in favor of Pertamina (percent)	Duration and effective year of contract
Refining Associates, Ltd. (Refican) (United States).	Offshore Southeast Kalimantan.	70,812	$7,500,000 (within 6 years)	65/35	30 years, 1967.
Asian American Exploration Refining Association (Asamera) (United States).	North Sumatra --------	7,025	$7,500,000	65/35	30 years, 1967.
Independent Indonesian American Petroleum Co. (IIAPCO) (United States).	Offshore Northwest Java_	53,437	$7,500,000 (within 6 years)	65/35	30 years, 1967.
Kyushu Oil Co., Ltd. (Kyushu) (Japan).	Offshore South Kalimantan.	127,062	$25,750,000 (within 8 years)	65/35	30 years, 1967.
Japanese Petroleum Exploration Co., Ltd. (Japex) (Japan).	Offshore East Kalimantan.	30,000	$7,500,000 (within 6 years)	65/35	30 years, 1967.
Continental Overseas Oil Co. (Continental) (United States).	Onshore South Kalimantan.	16,500	$12,000,000 (within 6 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1967.
Australian Drilling Co., Pty. Ltd. (A.D.C.) (Australia).	Offshore Northeast Java_	154,687	$7,500,000 (within 6 years)	65/35	30 years, 1967.
Union Oil Co. of Indonesia (Union Oil) (United States).	On and offshore East Kalimantan.	12,062	$4,000,000 (within 6 years)	65/35 67½/37½ (when production exceeds 50,000 barrels per day)	30 years, 1968.
International Oils Exploration, Ltd. (International) (Australia).	On and offshore Timor, Roti, and Sawu Island Group.	28,812	$2,450,000 (within 6 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.
Phillips Petroleum Co. Indonesia/ Indonesian Superior Oil Co. (Phillips/ Superior) (United States).	On and offshore South of West Irian Barat.	325,250	$17,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 100,000 barrels per day)	30 years, 1968.
Compagnie Française des Pétroles (C.F.P.) (France).	On and offshore Northeast South Sumatra.	20,625	$10,500,000 (within 6 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.

Table 4.—Indonesia: Oil investment contracts 1967–72—Continued

Name of contractor and country	Location	Approximate area (square kilometers)	Required investment in exploration activities	Production split in favor of Pertamina (percent)	Duration and effective year of contract
Roy M. Huffington, Inc.,/Virginia International Co. (Vico/Huffington) (United States).	(Secondary recovery) Onshore South Sumatra; onshore East Kalimantan.	5,160 12,617	$11,000,000 (within 6 years)	65/35 67½/32½ (when production exceeds 100,000 barrels per day)	30 years, 1968.
Independent Indonesian American Petroleum Co. (IIAPCO) (United States).	Offshore Southeast Sumatra.	121,750	$22,500,000 (within 10 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.
AGIP S.p.A.—Direzione Mineraria (AGIP S.p.A.) (Italy).	On and offshore West Irian Barat.	104,750	$16,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.
Rehabilitation, Engineering & Development Co. (REDCO) (United States).	(Secondary recovery) Sumatra: Mangundjaja, Keban, Suban Djerigi, Sungai Tahan Java: Kruka Kalimantan: Sanga-Sanga, Tarakan		$5,500,000 (within 4 years)	65/35	20 years, 1968.
Mobile Oil Indonesia, Inc. (Mobil Oil) (United States).	Offshore in Strait of Malacca.	46,250	$5,500,000 (within 6 years)	65/35	30 years, 1968.
Continental Oil Co. of Indonesia (Continental) (United States).	Offshore South China Sea.	106,375	$14,000,000 (within 6 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.
Union Oil Co. of Indonesia (Union Oil) (United States).	On and offshore Northwest, onshore Southeast, in North Sumatra.	90,625	$4,600,000 (within 6 years)	65/35 67½/32½ (when production exceeds 50,000 barrels per day)	30 years, 1968.
Indonesian Frontier Petroleum Co. (Frontier) (United States).	Offshore South China Sea.	113,562	$15,450,000 (within 6 years)	65/35 67½/32½ (when production exceeds 50,000 barrels per day)	30 years, 1968.

Indonesian Gulf Oil Co. (Gulf Oil) (United States).	Offshore of Kalimantan.	161,125	$11,300,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.
Java Sea Oil Co. (Java Sea) (United States).	Offshore Java Sea ----	8,665	$625,000 (within 4 years)	--	30 years, 1968.
AGIP S.p.A.—Direzione Mineraria Asia) (United States).	Offshore South China Sea.	106,375	$21,000,000 (within 10 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1968.
Southeast—Asia Oil & Gas Co. (Southeast Asia) (United States).	Offshore South Sulawesi.	99,750	$8,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1969.
Jenney Manufacturing Co. (Jenney Mfg.) (United States).	Offshore Karimata, Southeast Sumatra.	47,250	$11,900,000 (within 8 years)	65/35 67½/32½ (when production exceeds 60,000 barrels per day)	30 years, 1969.
Asia Oil Corp (A.O.C.) (United States).	Offshore Lampung and Banten.	72,500	$17,500,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1969.
Jenney Manufacturing Co. (Jenney Mfg.) (United States).	Offshore Mentawai ----	69,250	$11,600,000 (within 8 years)	65/35 67½/32½ (when production exceeds 65,000 barrels per day)	30 years, 1969.
Dearborn Computer & Marine Corp. (Dearborn) (United States).	On and offshore Halmahera.	47,500	$7,250,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1969.
Gulf & Western Industries, Inc. (Gulf Western) (United States).	On and offshore on the Cerum, Ambon, Buru, and Sula Islands.	120,000	$14,500,000 (within 8 years)	65/35 67½/32½ (when production exceeds 55,000 barrels per day)	30 years, 1969.
Shell Indonesia, N.V. (Shell) (Netherlands).	Onshore North East Kalimantan.	31,330	$20,880,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1969.
Total Indonesia (Total Indonesia) (France).	Onshore South Sumatra (Tebo Area).	14,010	$10,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1969.
Prof. Dr. Wendell Phillips (Wendell Phillips) (United States).	On and offshore North of West Irian.	31,000	$17,500,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1970.

Table 4.—Indonesia: Oil investment contracts 1967–72—Continued

Name of contractor and country	Location	Approximate area (square kilometers)	Required investment in exploration activities	Production split in favor of Pertamina (percent)	Duration and effective year of contract
California Asiatic Oil Co./Texaco Overseas Petroleum Co. (Calasiatic/Topco) (United States).	Offshore East of Java Sea.	55,250	$9,800,000 (within 8 years)	65/35 67½/32½ (when production exceeds 65,000 barrels per day)	30 years, 1970.
B.P. Petroleum Development of Indonesia, Ltd., (British Petroleum) (United Kingdom).	Offshore East of Kalimantan (Celebes Sea).	23,520	$8,500,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1970.
Kondur Petroleum S.A. (Kondur S.A.) (United States).	On and offshore Central Sumatra.	39,500	$11,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1970.
Trend Exploration, Ltd. (Trend) (United States).	Onshore West Irian (Vogelkop).	5,070	$5,350,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1970.
Indonesian Gulf Oil Co. (Gulf Oil) (United States).	On and offshore South and West Sulawesi.	10,000	$8,500,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1970.
Whitestone Indonesia, Inc. (Whitestone) (United States).	Onshore West Irian (Bomberai Peninsula).	15,450	$10,150,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day)	30 years, 1970.
Pexa Oil (Pexa Oil) (Australia).	Onshore East Kalimantan.	1,550	$7,250,000 (within 8 years) (expenditure split 25% Pertamina 75% Pexa)	Financial and technical assistance agreement. Pexa will recover 75% and Pertamina 25% of the operating costs. Balance of crude oil remaining to be split 73¾ Pertamina and 26¼ Pexa).	25 years, 1970.

Java Shell (Java Shell) (Netherlands) ---	Offshore South of Central Java (Tjilatjap).	9,500	$18,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 75,000 barrels per day) 70/30 (when production exceeds 200,000 barrels per day)	30 years, 1971.
California Asiatic Oil Co./Texaco Overseas Petroleum Co. (represented in Indonesia by P.T. Caltex Indonesia) (Calasiatic/Topo) (United States).	Onshore Central Sumatra.	21,920	$15,000,000 (within 8 years)	65/35 67½/32½ (when production exceeds 60,000 barrels per day) 70/30 (when production exceeds 100,000 barrels per day)	30 years, 1971.
P.T. Caltex Pacific Indonesia (Caltex) (United States).	Onshore Central Sumatra.	12,406	(No provisions within 8 years)	70/30	18 years, 1971.
Atlantic Richfield Indonesia, Ltd. (ARCO) (United States).	Northeast Kalimantan--	16,000	$19,750,000 (within 8 years)	65/35 67½/32½ (when production exceeds 50,000 barrels per day) 70/30 (when production exceeds 75,000 barrels per day)	30 years, 1971.
Continental Oil Co. of Indonesia (Continental) (United States).	Onshore West Irian, Barat.	52,750	$17,500,000 (within 8 years)	65/35 67½/32½ (when production exceeds 67½/32½ 70/30 (when production exceeds 100,000 barrels per day)	30 years, 1971.
Indonesian Offshore Operators Inc. (United States).	Offshore South of West Irian.	10,000	$13,250,000 (within 8 years)	65/35 67½/32½ (when production exceeds 60,000 barrels per day)	30 years, 1972.
Trend Exploration, Ltd. (Trend) (United States).	South Sumatra --------	3,185	$3,000,000 (within 4 years)	--	30 years, 1972.

Table 5.—Indonesia: Onshore oil and gas wells discovered in 1972

Company	Area	Well name and number	Discovery
The State Oil and Gas Enterprise (Pertamina).	North Sumatra	Diski No. 1	Oil and gas.
	----do	Wampu No. 2	Gas.
	South Sumatra	Sengeti No. 1	Oil and gas.
	----do	Sengeti No. 2	Condensate and gas.
	----do	Prabumenang No. 2	Oil and gas.
	----do	Tandjung Miring No. 5.	Gas.
Mobil Oil Indonesia, Inc	North Sumatra	Arun No. 2	Condensate and gas.
	----do	Arun No. 3	Do.
	----do	Lho Sukon No. 1	Gas.
Roy M. Huffington, Inc./ Virginia International Co.	East Kalimantan	Badak No. 1	Oil and gas.
	----do	Badak No. 2	Gas.
	----do	Badak No. 3	Condensate and gas.
	----do	Badak No. 4	Do.
	----do	Badak No. 5	Do.
Trend Exploration, Ltd	West Irian	Kasim No. 1	Oil.
Asian American Exploration Refining Association.	North Sumatra	Alur Siwah No. 3	Condensate and gas.
	----do	Alur Djimon No. 1	Oil and gas.
	----do	Alur Djimon No. 2	Do.
Union Oil Co. of Indonesia	Central Sumatra	Jorang No. 1	Oil.
	----do	Pudu No. 1	Oil.
	----do	Pinggir No. 1	Oil.
	----do	Lindai No. 2	Oil.
	----do	S. E. Balam No. 1	Oil.
California Asiatic Oil Co./ Texaco Overseas Petroleum Co.	----do	Ksikan No. 1	Oil.
P. T. Stanvac Indonesia	South Sumatra	S. E. Ibul No. 1	Oil and gas.
	----do	N. E. Terras No. 1	Do.
	----do	Nau No. 1	Do.
	----do	Candi No. 1	Condensate and gas.
	----do	Rambutan No. 1	Oil, condensate, gas.
	----do	Suban No. 1	Condensate and gas.
	----do	Bentayan No. 8	Oil.
	----do	Bentayan No. 9	Oil.
AGIP S.p.A	South China Sea	A. 1—9	Gas.
Independent Indonesian American Petroleum Co.	South East Sumatra	Gita No. 1	Oil.
	----do	Gita No. 4	Oil.
	----do	Zelda No. 3	Oil.
	----do	Zelda No. 5	Oil.
Atlantic Richfield Indonesia, Ltd.	Java Sea	PSI L2	Oil and gas.
	----do	PSI E8	Do.
	----do	PSI E9	Do.
	----do	PSI X1	Do.
Australian Drilling Co., Pty. Ltd.	Java and Madura Straights.	JS 20—1	Do.
Union Oil Co. of Indonesia	East Kalimantan	Kerindingan No. 2	Do.
	----do	Melahin No. 1	Do.
	----do	Melahin No. 2	Oil.
	----do	Attaka No. 8	Oil and gas.
	----do	Attaka No. 9	Do.
Total Indonesia	Mahakam	Bekapai No. 1	Oil.
	----do	Penyilatan No. 1	Gas.

The Mineral Industry of Iran

By Bernadette Michalski [1]

The fourth 5-year plan was drawing to a most successful conclusion by the close of 1972. Real gross national product (GNP) annual increases averaged 12% to 13% during the plan period of March 1968 to March 1973. The mineral industry, particularly the petroleum and natural gas producing and processing units, was a major contributor to the nation's economic growth.

Petroleum revenues contributed 40%, or $2.35 billion, to government income in 1972, compared with $1.9 billion in 1971 and $1.1 billion in 1969. Output of minerals other than petroleum and natural gas totaled $115.5 million; cement production contributed about 79% of this total, followed by lead-zinc ore, 10% and coal, 7%.

Major mineral industry developments during the year included expansion of crude petroleum productive capacity with parallel expansion in pipeline and pump station networks and storage facilities. In addition, a second sea island tanker-loading terminal at Kharg and the aluminum refinery at Araq were completed, and contractual agreements were signed for development of the Sar Cheshmeh copper deposit and the Goli Ghawar iron ore deposits. It was also announced that plans include the utilization of abundant natural gas supplies in the direct reduction of iron ore.

PRODUCTION

While crude petroleum output valued at approximately $3 billion dominated the Iranian mineral industry, significant increases in production of other mineral commodities reflected the development and diversification activities undertaken by the Iranian Government. During the year production of aluminum from imported Australian alumina was initiated. The production of nitrogenous fertilizer materials from the Shahpur and Kharg petro-chemical operations was reported. Manganese ore and coke output were expanded to supply the Isfahan steel mill. The decline in iron ore production, a temporary measure resulting from a delay in the startup of the Isfahan blast furnace, should be reversed in 1973, followed by even greater increases in iron ore mining activity in succeeding years. While no steel production is anticipated from the Isfahan steel complex before 1973, pig iron production from the plant was reported during 1972.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Iran: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970 [2]	1971 [2]	1972 [p] [2]
METALS			
Aluminum, metal	--	--	[e] 20,000
Chromium, chromite, gross weight	200,000	175,600	180,000
Copper:			
Mine output, metal content	[r] 286	1,003	[e] 2,000
Smelter output [e]	100	500	500
Iron and steel:			
Iron ore, gross weight	10,000	150,000	98,000
Pig iron	--	--	[e] 300,000
Lead:			
Mine output, metal content	47,000	38,800	43,550
Smelter [e]	180	180	180
Manganese ore, gross weight	9,144	12,320	20,000
Zinc, mine output, metal content	41,500	39,200	52,250
NONMETALS			
Barite	77,000	60,000	80,000
Cement, hydraulic ---thousand tons	2,575	2,850	3,392
Clays:			
Bentonite	12,000	[e] 13,000	[e] 14,000
Fire clay	NA	NA	5,500
Kaolin	45,000	48,000	55,000
Fertilizer materials, ammonia	--	--	374
Gem stones, turquoise, crude	[e] 300	NA	4
Gypsum ---thousand tons	2,100	2,250	2,400
Lime [e] ---do---	1,000	1,000	1,000
Magnesite	20,000	21,000	3,000
Mineral pigments, natural, ocher	8,000	4,600	12,500
Salt:			
Rock	NA	NA	350,000
Evaporation	NA	NA	50,000
Total	390,000	390,000	400,000
Stone, sand and gravel:			
Limestone ---thousand tons	4,000	4,500	5,200
Marble ---do---	12	15	NA
Silica ---do---	35	36	NA
Strontium minerals, celestite	300	300	[e] 300
Sulfates, natural:			
Aluminum-potassium sulfate (alum)	6,500	7,000	300
Sodium sulfate (mineral not specified)	9,000	NA	3,000
Sulfur:			
From ores (refined)	1,900	2,000	3,000
Elemental, byproduct	[e] 412,000	495,000	700,000
MINERAL FUELS AND RELATED MATERIALS			
Coal ---thousand tons	[r] 584	660	1,000
Coke ---do---	54	57	[e] 400
Gas, natural:			
Gross production ---million cubic feet	1,094,194	1,305,228	1,469,730
Marketed production ---do---	[r] 71,226	298,962	447,908
Natural gas liquids:			
Raw natural gas liquids thousand 42-gallon barrels	8,270	11,800	14,800
Refined natural gas liquids ---do---	NA	8,915	9,829
Petroleum:			
Crude (net)[3] ---thousand 42-gallon barrels	1,397,460	1,661,901	1,843,869
Refinery products:			
Gasoline:			
Aviation ---do---	5,752	5,361	5,630
Motor ---do---	18,718	20,809	21,344
Jet fuel ---do---	12,743	10,776	13,282
Kerosine ---do---	18,338	19,683	23,977
Distillate fuel oil ---do---	33,160	36,297	36,124
Residual fuel oil ---do---	84,127	88,084	83,741
Lubricants ---do---	560	560	546
Other:			
Naphtha and solvents ---do---	4,438	2,718	4,105
Asphalt ---do---	2,165	2,662	1,684
Liquefied petroleum gas ---do---	1,310	913	865
Unspecified ---do---	13,652	14,172	8,390
Refinery fuel and losses ---do---	5,802	6,673	4,376
Total ---do---	200,765	208,708	204,064

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

[1] 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 also produced, but output is unreported, and available information is inadequate to make reliable estimates of output levels.

[2] Data presented are for the Iranian calendar year beginning March 21 of the year stated except for figures on natural gas and petroleum, which are for regular calendar years.

[3] Excludes petroleum produced but reinjected into fields.

TRADE

During 1972 Iranian exports of all commodities were valued at $2,937 million. Crude petroleum and petroleum products contributed 88% of total exports by value. Total imports in 1972 were valued at $2,410 million, affording Iran a favorable trade balance of $527 million.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971 [3]
METALS			
Aluminum metal, including alloys, all forms	22	--	
Chromium, chromite, 48% Cr_2O_3	222,463	151,828	France 29,350; Japan 19,250; Czechoslovakia 17,600.
Copper ore and concentrate	1,500	840	All to Japan.
Iron and steel:			
Scrap	23,975	38	Do.
Semimanufactures	648	1,677	Kuwait 1,174; Afghanistan 217; Pakistan 200.
Lead ore and concentrate	89,468	99,139	U.S.S.R 54,914; Belgium 18,550; Japan 10,350.
Manganese ore and concentrate	9,144	12,320	All to Poland.
Mercury ---76-pound flasks	2	2	All to Afghanistan.
Zinc ore and concentrate	96,629	66,223	Japan 32,350; Belgium 13,650; Netherlands 6,150.
Other:			
Ore and concentrate	5,880	675	Japan 300; Dubai 275; Kuwait 100.
Ash and residue containing nonferrous metals	120	20	All to Japan.
NONMETALS			
Abrasives, natural:			
Crude, n.e.s	(2)	282	Mainly to Japan.
Grinding and polishing wheels and stones	5	5	Kuwait 2; West Germany 2.
Barite, natural	r 9,828	19,522	Dubai 7,462; U.S.S.R 4,000; Kuwait 3,896.
Cement	96,991	35,873	Kuwait 17,000; Oman 15,973; Bahrain 2,500.
Chalk	r 887	35	Dubai 23; Afghanistan 11; Kuwait 1.
Clays and clay products:			
Crude clays, n.e.s.:			
Fuller's earth	12	87	Dubai 74; Oman 7; Bahrain 6.
Kaolin	9	--	
Other	r 5,388	5,923	Dubai 3,926; U.S.S.R. 1,122; Kuwait 625.
Products, nonrefractory	790	1,586	U.S.S.R. 996; Dubai 215; Kuwait 162.
Fertilizer materials:			
Nitrogenous	73	31	Kuwait 30; Dubai 1.
Phosphatic	--	7,187	Afghanistan 7,162; Republic of South Africa 25.
Potassic	--	500	All to Afghanistan.
Other	--	4,990	All to India.
Ammonia	12,500	80,000	Republic of South Africa 60,000; Mozambique 20,000.
Gypsum	1,851	1,294	Kuwait 870; Dubai 280; Oman 68.
Lime	--	21	All to Kuwait.
Mica ---kilograms	--	295	All to Oman.
Pigments, ochre	7,653	10,882	France 9,200; India 1,030; United Kingdom 650.
Precious and semiprecious stones:			
Turquoise, raw, cut and uncut grams	r 135,882	250,894	India 124,000; United States 62,110; West Germany 43,090.
Other ---do	328,000	40	All to Saudi Arabia.
Salt	4,164	3,077	Oman 1,239; Kuwait 995; Dubai 467.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971[3]
NONMETALS—Continued			
Stone:			
Dimension:			
Alabaster	350	--	
Marble	18,209	17,758	Italy 13,651; West Germany 954; Japan 864.
Other	6,624	5,518	Kuwait 3,350; West Germany 833; Italy 416.
Worked:			
Slate	--	64	All to Dubai.
Other	183	89	Dubai 35; Kuwait 30; Italy 23.
Crushed stone	r 29,231	28,878	Kuwait 20,758; Oman 8,021.
Limestone	110	1,600	U.S.S.R. 900; Kuwait 700.
Quartz	49	--	
Sulfur:			
Raw	139,332	--	
Refined	59,927	464,029	India 185,922; Republic of South Africa 150,000; Taiwan 47,689.
MINERAL FUELS AND RELATED MATERIALS			
Coal: Lignite and coking coal	85	62	Kuwait 41; Oman 21.
Gas, natural ——million cubic feet	47,212	209,634	All to U.S.S.R.
Petroleum:[3]			
Crude—thousand 42-gallon barrels	r 1,098,378	1,182,294	Asia 638,026; Europe 360,391; United States 120,448.
Refinery products:			
Gasoline:			
Aviation ——do——	7,543	6,171	Asia 2,977; Africa 1,635; Europe 1,189.
Motor ——do——	17,919	18,085	Asia 7,082; Africa 6,454; Australia 1,952.
Kerosine ——do——	6,558	4,231	Africa 1,834; Asia 1,519; Australia 414.
Jet fuel ——do——	9,191	8,457	Asia 3,241; Africa 2,154; United States 1,284.
Distillate fuel oil ——do——	15,404	17,375	Africa 8,201; Asia 6,517; Europe 2,315.
Residual fuel oil ——do——	74,177	60,372	Asia 34,735; Europe 11,671; United States 5,677.
Lubricants ——do——	r (2)	3	All to Asia.
Other:			
Liquefied petroleum gas ——do——	3,831	7,025	Japan 6,086; Argentina 545; Brazil 275.
Asphalt ——do——	407	385	Africa 209; Asia 164.
Solvents ——do——	r 1,084	620	Asia 253; Africa 195; Europe 168.
Total ——do——	r 136,114	122,724	

r Revised.
[1] Data are for Iranian calendar years beginning March 21 of the year indicated.
[2] Less than ½ unit.
[3] Destinations of petroleum shipments reported by continent only in most cases; detail by country not available, except as shown.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum:			
Bauxite		10	--
Oxide and hydroxide		185	3,182
Metal, including alloys:			
Scrap		1,374	1,042
Unwrought		3,480	8,129
Semimanufactures		6,597	5,305
Antimony metal, including alloys, all forms		66	630
Arsenic trioxide, pentoxide, and acids		28	7
Cadmium metal, including alloys, all forms	kilograms	666	1,185
Chromium:			
Oxide and hydroxide		11	50
Metal, including alloys, all forms		(2)	3
Cobalt metal, including alloys, all forms	kilograms	368	853
Scrap		162	405
Unwrought		38	219
Semimanufactures		10,789	10,526
Gold metal, all forms	troy ounces	r 804	23,502
Iron and steel:			
Ore		132	--
Metal:			
Scrap		r 8,325	8,437
Cast iron		7,612	12,564
Ferroalloys		959	4,206
Steel, primary forms		218,177	305,910
Semimanufactures	thousand tons	r 1,052	1,260
Lead:			
Ore and concentrate		--	10
Oxide		r 576	818
Metal, including alloys:			
Scrap		r 3	1
Unwrought		r 7,689	8,246
Semimanufactures		33	34
Magnesium metal, including alloys, all forms		7	5
Manganese:			
Ore and concentrate		--	4
Oxide		650	584
Mercury	76-pound flasks	9	444
Nickel metal, including alloys:			
Scrap		(2)	1
Unwrought		26	27
Semimanufactures		74	103
Platinum metal, including scrap, waste, and ash	troy ounces	1,284	831
Silver metal, including scrap, waste, and ash	do	287,684	652,627
Tin:			
Oxide	long tons	2	59
Metal, including alloys:			
Scrap	do	3	(2)
Unwrought	do	r 299	270
Semimanufactures	do	r 424	218
Titanium oxide		1,994	2,469
Tungsten metal, including alloys, all forms		2	4
Zinc:			
Oxide		760	848
Metal, including alloys:			
Scrap		47	7
Unwrought		3,332	5,191
Semimanufactures		507	353
Other:			
Ore and concentrate, n.e.s		233	1,209
Ash and residue containing nonferrous metals		r 148	197
NONMETALS			
Abrasives, natural:			
Crude, n.e.s		r 77	84
Grinding and polishing wheels and stones		r 1,146	1,093
Asbestos		11,197	10,514
Barite		r 1,171	1,515
Cement		54,513	79,550
Chalk		178	253

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Fire clay		2,864	4,728
Kaolin		3,559	5,801
Pozzolana and similar earths for cement manufacture		100	--
Other		149	27,915
Products:			
Refractory (including nonclay bricks)		24,592	20,261
Nonrefractory		76	103
Diatomite		434	512
Fertilizer materials:			
Manufactured:			
Nitrogenous		17,666	51,590
Phosphatic		42,200	146,735
Other, including mixed		r 57,196	7,924
Ammonia		12,082	8,401
Graphite		678	1,576
Gypsum		695	768
Iodine	kilograms	r 200	900
Lime		322	97
Magnesite		108	10
Mica:			
Crude		60	173
Worked		83	113
Pigments, mineral:			
Iron (including processed)		439	628
Other		129	5
Precious and semiprecious stones:			
Turquoise	grams	200	--
Other	do	711,636	593,663
Manufactured	do	--	32,500
Salt		r 112	111
Stone, sand and gravel:			
Dimension stone:			
Crude		15	30
Worked:			
Slate		35	--
Other		183	--
Crushed stone		401	289
Limestone		1,338	1,173
Quartz		718	1,300
Sand and gravel		256	1,363
Sulfur:			
Elemental		429	355
Sulfuric acid		154	166
Talc, steatite, soapstone, pyrophyllite		r 248	118
Other nonmetals, n.e.s.:			
Crude, meerschaum, amber, jet		25	4
Oxides and hydroxides:			
Magnesium		233	73
Barium		10	300
Other		3,526	2,045
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural		150	29
Coal		1,551	3,739
Rare gases, including neon		56	82
Petroleum refinery products:			
Gasoline:			
Aviation	42-gallon barrels	3	2
Motor	do	20	(2)
Kerosine	do	--	1
Distillate fuel oil	do	363	361
Lubricants	do	31,009	44,960
Mineral jelly and wax	do	14,282	17,023
Other:			
Liquefied petroleum gas	do	153	450
Asphalt and bitumen	do	15,327	15,823
Solvents	do	18,252	21,579
Other	do	r 1,344	3,179
Total	do	r 80,753	103,378
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		4,667	1,178

r Revised.
[1] Data are for Iranian calendar years beginning March 21 of the year indicated.
[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—The Araq aluminum plant operated by the Iranian Aluminum Co. (Iralco) supplied some of the domestic requirement for aluminum ingot and billet during 1972. The plant has a designed capacity of 45,000 tons of aluminum annually. Full-capacity operation is anticipated by 1974, at which time 25,000 to 30,000 tons of aluminum metal will be available for export. Alumina for the $50 million Araq plant comes from Australia. The alumina is transported to the plant by rail from port of Bandar Shahpur.

Copper.—While limited quantities of copper concentrate are destined for export markets, the bulk of mine output is processed at the Qanibad smelter. Current production levels satisfy only a fraction of domestic consumption requirements; however, development of large copper deposits in south-central Iran will place the nation among the ranking copper metal exporters by 1978.

The Sar Cheshmeh Copper Co. was created in March to implement the Iranian Government decision to develop the 400-million-ton 1.2% copper deposit at Sar Cheshmeh without foreign participation, abandoning negotiations with the Iranian Selection Trust Ltd., Péchiney S.A., and others. The Sar Cheshmeh Copper Co. anticipates ore production at a rate of 42,000 tons per day, yielding an estimated 145,000 tons of copper metal annually by 1977. A U.S. firm, Parsons-Jurden Corp., has been selected as principal contractor, assuming project management, engineering, design, construction, and related services for mine site, crushing plant, concentrator, and smelter. The Anaconda Co. was awarded the contract for personnel training and technical assistance during the development and construction period and the first 10 years of operation.

Exploration activities at Qaleh Zari confirmed three ore bodies, one of which was reported to contain 850,000 tons of 4.2% copper. The area is within the concession held by an Iranian firm, Société Maaden Laute. Mine development in partnership with a Japanese consortium is under consideration.

Exploration activities in areas south of Kerman indicated an 80-million-ton ore body of 0.4% copper. In the Yazd Region deposits of 25 million tons of 0.2% copper and 5 million tons of 0.9% copper were reported.

Iron and Steel.—Construction delays continued at the Soviet-built integrated steel plant at Isfahan. Apparently no steel was produced during the year; however, a single blast furnace was reported in operation in April at the rate of 1,800 tons of pig iron daily. Converters, slabbing mills, and bar mills would reportedly not be in production before the spring of 1973.

The Iranian Government announced its intention to construct several facilities for the direct reduction of iron ore with natural gas. Ores from the 250-million-ton Goli Ghawar deposit have proven suitable for use in the direct reduction process.

Lead-Zinc.—The Industrial Development and Renovation Organization (IDRO) of Iran announced plans for construction of a 40,000-ton-annual-capacity lead smelter and an 80,000-ton-annual-capacity zinc smelter at a combined cost of $42 million. The smelters will process Iranian lead-zinc concentrate.

NONMETALS

Cement.—Shortages and resulting high prices prompted the Iranian Government to propose the construction of nine new cement plants and the expansion of all major existing plants to raise cement production capacity to 15 million tons annually by 1976. Construction sites include Bandar Abbas and Kermanshah. Cement imports approached 100,000 tons in 1972, and negotiations were underway for the import of 500,000 tons during 1973.

Fertilizer Materials.—The Shahpur chemical plant produced 330,000 tons of ammonia and 164,000 tons of urea in its second full year of operation. The Iran Fertilizer Co. reported production of 44,000 tons of ammonia, 55,000 tons of urea, and 30,000 tons of ammonium nitrate.

Sulfur.—While mining of natural sulfur continues, output is limited. The bulk of sulfur production is obtained from byproduct recovery operations at the Shahpur and Kharg chemical plants. Production at Shahpur is reported at 450,000 tons recovered from sour natural gas containing 25% H_2S. The Kharg chemical plant recovered 212,000 tons of sulfur from associated gases from fields in the proximity of Kharg Island. Expansion plans for the chemical industry during the fifth 5-year plan in-

clude the doubling of sulfur recovery capacities at both the Shahpur and Kharg plants.

MINERAL FUELS

Iran leads the Middle East in the production and utilization of natural gas. It is second to Saudi Arabia in Middle East petroleum production. Coal production is, however, limited. Of a total production of 1 million tons in 1972, about 600,000 tons was used in the manufacture of coke. Iran's energy consumption in 1972 was reported as follows:

	Million Btu	Percent
Petroleum	448,700	82.3
Coal [1] and hydropower	56,300	10.3
Natural gas	34,179	6.3
Other	6,000	1.1
Total	545,179	100.0

[1] Including imported coal.

Natural Gas.—Reserves are estimated at 200 trillion cubic feet, ranking behind those of the Soviet Union and the United States. Major fields include Pazanan with reserves of 50 trillion feet and the Khangiran (Saraks) in northeastern Iran where reserves are estimated at 21 trillion cubic feet.

Gas production approached 1.5 trillion cubic feet in 1972. Of this total about 0.8 trillion cubic feet was flared and the remainder was utilized for company and domestic fuels, plant feedstock, field fuel, and exports to the U.S.S.R. About 92% of the gross natural gas production, or 1,340,421 million cubic feet was produced by the Iranian Oil Operating Companies (Consortium) in the agreement area. While more than half of the Consortium's gross production was flared, 45.27%, or 606,137 million cubic feet, was utilized. The five natural gas liquid plants at Agha Jari and Marun processed 444,190 million cubic feet of this production and yielded 14.8 million barrels of raw natural gas liquids. This compares to 11.8 million barrels of raw natural gas liquids produced from 374,125 million cubic feet of natural gas processed in 1971. The construction of a sixth natural gas liquids plant was near completion by yearend. The plant, located near Ahwaz Production Unit I, will have a capacity to process 500 million cubic feet of gas per day when it comes onstream in early 1973. Feedstock for the plant will be obtained from the three Ahwaz production units.

The National Iranian Gas Co. (NIGC), in October, entered into an agreement with the U.S. firm International System and Controls Corp., the Japanese firm Nissho-Iwai Co., Ltd., and the Norwegian firms Fred Olso and Co. and Halfdan Ditlev-Simonsen and Co. The agreement calls for the export of 76.8 and 115.2 million barrels of liquefied natural gas (LNG) annually from Iran to the United States and Japan. To implement the plan Kangan Liquefied Natural Gas Co., in which NIGC holds 50% equity, was formed. Construction of the liquefaction plant is scheduled for 1973 with completion by 1976. Cost of the land units is estimated at $700 million. At least an additional $1 billion is earmarked for construction of 13 to 19 ships of 125,000 to 160,000 deadweight tons' capacity for transporting the LNG.

An earlier agreement between NIGC and C. Itoh & Co., Ltd. for constructing LNG facilities was canceled in 1972.

Petroleum.—Iran's petroleum production increased by an average of 484,740 barrels per day during 1972 to a daily average of 5,037,893 barrels for the year, making Iran the second largest producer in the Middle East and the fourth largest in the world. Increased production was largely the result of development work conducted by the Consortium, the major oil producer and refiner in Iran. Output from Consortium operations accounted for the bulk of the total production, more than 4.5 million barrels per day. A daily average of nearly 470,000 barrels was extracted from a total of 92 offshore wells operated by four companies, each in partnership with the National Iranian Oil Co. (NIOC). The largest offshore producer among these was Lavan Petroleum Co. (LAPCO), followed by the Iran Pan-American Oil Co. (IPAC), Société Irano-Italiènne des Pétroles (SIRIP), and Iranian Marine International Oil Co. (IMINOCO). Crude production from the Naft-e Shah Field operated by NIOC contributed the remainder of the nation's total crude output (14,700 barrels per day). Other companies in partnership or under contract with NIOC are Iran Nippon Petroleum (INPECO), Hormuz Petroleum Co. (HOPECO), Bushire Petroleum Co. (BUSHCO), Société Française des Pétroles d'Iran (SOFIRAN), European Group of Oil Co.'s. (EGOCO), Continental Oil Co. of Iran (CONIRAN), Iranian Offshore Petroleum Co. (IROPCO), and Per-

sian Gulf Petroleum Co. (PEGUPCO). No production has as yet been reported from these company operations.

Consortium.—Production from the Consortium agreement area is obtained from a total of 214 producing wells in 18 fields; however, production increases in 1972 are largely attributable to expanded production at the Marun, Ahwaz, Kharg and Rag-e-Safid Fields.

A total of 950,000 barrels per day of productive capacity was added to the Consortium operations, bringing total capacity in the agreement area to 5,370,000 barrels per day. More than half, or 550,000 barrels per day, of the increase was added at the Ahwaz Field and attendant facilities. This capacity, when combined with a planned 165,000-barrel-per-day expansion in 1973, will raise the field's production to nearly 1 million barrels per day by yearend 1973, raising the Ahwaz Field production levels to those of Iran's major fields (Marun, Agha Jari, and Gachsaran), where daily average production in 1972 was reported at 1,043,481 barrels, 947,844 barrels, and 861,156 barrels, respectively.

In support of the anticipated increased production, transportation, storage, and loading facilities were expanded. A pipeline from Ahwaz to the Persian Gulf at Ganaveh, a distance of 153 miles, was completed in 1972. Engineering was completed for the sixth submarine pipeline from Ganaveh to Kharg Island. Construction of this 52-inch-diameter pipeline is scheduled for 1973. Construction of a two-berth loading facility on the west side of Kharg Island was completed in November 1972. The facility accommodates tankers of up to 500,000 deadweight tons on the outer berth and 300,000 deadweight tons on the inner berth with a designed loading rate of 200,000 barrels per hour. Crude is supplied via two 78-inch-diameter overland pipelines and two 56-inch-diameter submarine pipelines.

Storage capacity at Kharg Island increased by 1 million barrels, raising total storage capacity on the island to 42 million barrels. Three additional storage tanks, each of 1-million-barrel capacity, were under construction during the year.

Crude processed in the Consortium's Abadan refinery and the Masjid Sulaiman topping plant averaged 415,978 and 33,333 barrels per day, respectively. The Consortium accounted for 81% of Iran's total refinery products output. The following tabulation shows products produced by these two refineries in 1971 and 1972 in volume percent:

	1971	1972
Aviation gasoline	3.4	3.6
Motor gasoline	12.2	12.2
Jet fuel	7.3	8.6
Kerosine	11.6	9.6
Distillate fuel oil	18.1	17.0
Residual fuel oil	44.6	46.0
Other	2.8	3.0
Total	100.0	100.0

Revenues paid by the Consortium members to the Government of Iran totaled $2.16 billion[2] in 1972, an increase of 21% over the 1971 payment. The Consortium's capital investment in production, field processing, and refining totaled $1.06 billion. The Consortium's annual capital expenditures are expected to remain at this level for the coming decade.

NIOC.—Crude production from the Naft-e Shah Field increased by 22.2% over 1971 production to a total of 5,383,883 barrels in 1972. The crude is processed at the 15,000-barrel-per-day-capacity Kermanshah refinery. The 100,000-barrel-per-day Teheran refinery operated by NIOC average 93,000 barrels per day throughput. In July NIOC announced that a second Teheran refinery of 100,000-barrel-per-day would be constructed by 1978. Construction of the Fars refinery near Shiraz was near completion by yearend. This 40,000-barrel-per-day refinery should be onstream by 1973. The Gachsaran Field will provide 31°–32° API gravity feedstock for the refinery designed to maximize middle distillate output.

During the year NIOC announced the signing of an agreement with Niarchos interests establishing the Irano-Greek Refining and Marketing Co. The refinery at Aspropyrgos, Greece, will be expanded to 90,000 barrels per day. Feedstock for the refinery will be supplied by Iran under a 12-year contract. The formation of the Irano-Greek Refining and Marketing Co. represents the second foreign refinery participation arrangement by NIOC, the first being NIOC's 17.5% ownership in the Sasolburg refinery in the Republic of South Africa. A possible third refinery participation is under consideration pending a

[2] Converted from United Kingdom pounds (UK£) to U.S. dollars at the rate of UK£ 1 = US$2.40.

feasibility study for an 80,000-barrel-per-day refinery at Liege, Belgium.

IPAC.—Iran Pan-American Oil Co. (IPAC) concession area constitutes 627.3 square kilometers in the northern part of the Persian Gulf. Production totaled 135,351 barrels per day in 1972, most of which was derived from the 12 producing wells in the Darius Field near Kharg Island. Production from a total of seven producing wells in the Cyrus Field totaled 19,173 barrels per day. A third field, Fereidon, will enter production by 1974.

LAPCO.—LAPCO production from 12 producing wells in the Sassan Field totaled 168,779 barrels per day. Desalting and crude stabilization facilities valued at $7.8 million were installed, raising field capacity to 200,000 barrels per day by yearend. Crude is carried via a 22-inch-outside-diameter pipeline from Sassan Field to Lavan Island, a distance of 89 miles. Storage capacity on the island consists of six 512,00-barrel-capacity tanks. A shoreline jetty can accommodate 200,000-deadweight-ton tankers on the sea side and 65,000-deadweight-ton tankers on the shore side for simultaneous loading. During 1972 LAPCO exports were reported at 168,184 barrels per day.

IMINOCO.—IMINOCO production totaled 79,696 barrels per day from a total of 38 producing wells. The bulk of crude production was obtained from the Rakhsh Field, which yielded a daily average of 44,925 barrels per day in its first full year of operation. Production from the Rostam Field averaged 34,757 barrels per day. A discovery well tested at 1,800 barrels per day in a third offshore field, Alpha.

SIRIP.—SIRIP's crude production averaged 86,109 barrels per day in 1972, nearly doubling the previous year's output. The Nowrouz Field was brought into production during the early months of the year, yielding a total of 13,676,139 barrels by yearend averaging 37,469 barrels per day. Other fields in the concession area include Hendijan, which averaged 28,896 barrels per day, and Behregansar, which averaged 19,744 barrels per day in 1972. The Shorum Field in the Zagross Mountains south of Isfahan was declared commercial in August 1972. A 15-well development program is planned to yield a production of 60,000 barrels per day.

INPECO.—This newly formed company combining Iranian, Japanese, and United States (Mobil Oil) interests conducted an active exploration program during the year, including gravity survey studies throughout its 3,100-square-mile concession area in Luristan. The first wildcat well, located on the Bankul anticline, was spudded in November, and was drilling at 2,000 feet by yearend.

BUSHCO.—Exploration activities on a 1,550-square-mile offshore concession area south of Bushehr included a marine reflection seismic survey and the drilling of two exploratory wells. By midyear the first wildcat well tested at 2,000 to 3,000 barrels per day of 14° API gravity crude.

The Mineral Industry of Iraq

By John L. Albright [1]

Petroleum provided an estimated 60% of Iraq's income and accounted for more than 90% of the country's exports; petroleum industry activities far exceeded developments in all other sectors of the economy. New ocean tankers, oil wells, pipelines, and refining units were placed in service, and the country maintained its position as the fourth largest oil producer in the Middle East. Iraq Company for Oil Operations (ICOO) took over petroleum activities at the northern oilfields after nationalization of Iraq Petroleum Co., Ltd.'s (IPC) oil wells and pipelines, and Iraq National Oil Co. (INOC) brought the North Rumaila oilfield into production and announced a large extension of that field which should significantly increase the country's oil reserves. Iraq's oil reserves were estimated at 33 billion barrels, and natural gas reserves were placed at 20 trillion cubic feet. Numerous foreign markets for the nationalized oil were developed, and INOC and Basrah Petroleum Co., Ltd. (BPC) embarked on programs to expand oil production and exports. Mosul Petroleum Co. Ltd. (MPC) continued its modest oil production in northern Iraq. Iraq joined the Organization of Arab Petroleum Exporting Countries (OAPEC) and applied for associate membership in the Council for Mutual Economic Assistance (COMECON). Iraq's second sulfur facility began commercial production, and the country's cement plants were being enlarged. Bentonite was discovered in northern Iraq, and geological and geophysical surveys were carried out for oil and numerous nonpetroleum minerals.

Electricity produced in 1972 reached 3.9 billion kilowatt hours, up 0.4 billion kilowatt hours from the previous year. Increased demand for electric power by Iraq's expanding industries was met as the National Electricity Administration placed the country's first hydroelectric powerplant in service in mid-1972 at Sāmarrā on the Tigris River in northern Iraq.[2] This estimated $18 million, 84,000-kilowatt facility, representing about 10% of Iraq's total installed capacity, is one of the largest powerplants in the country.

PRODUCTION

Iraq's 1972 crude oil production was 15% below that of the previous year. However, increases in production by BPC and the significant production from the nationalized IPC fields and INOC's North Rumaila field permitted the country to account for an estimated 8% of the 1972 Middle East production. The country's average daily crude oil production was estimated as follows:

Company	Thousand barrels
Basrah Petroleum Co., Ltd. (BPC)	656.4
Iraq Petroleum Co., Ltd. (IPC)	390.9
Iraq Company for Oil Operations (ICOO) and Iraq National Oil Co. (INOC)	388.6
Mosul Petroleum Co., Ltd. (MPC)	10.5
Total	1,446.5

[1]Data may not add to total shown because of independent rounding.

Bai Hassen, Jambur, and Kirkuk oilfields were operated by IPC from January through May and by ICOO from June through December. INOC's important North Rumaila field began producing crude oil April 1972.

Cement production remained unchanged from its 1970–71 level, and sulfur production increased appreciably as improved operations were registered at the Kirkuk recovery plant and production began at the Mishraq sulfur deposit.

[1] Mineral specialist (petroleum), Division of Fossil Fuels—Mineral Supply.

[2] Baghdad Observer. July 19, 1972.

Table 1.—Iraq: Production of mineral commodities

Commodity [1]		1970	1971	1972 [p]
Cement, hydraulic [e]	thousand metric tons	1,400	1,400	1,400
Gas, natural:				
Gross production	million cubic feet	200,000	220,000	185,000
Marketed production	do	27,720	30,722	30,000
Petroleum:				
Crude [2]	thousand 42-gallon barrels	[r] 569,726	624,312	529,419
Refinery products:				
Gasoline	do	3,239	3,636	6,698
Jet fuel	do	608	972	6,112
Kerosine	do	4,480	4,637	
Distillate fuel oil	do	5,737	5,775	10,468
Residual fuel oil	do	9,790	10,749	5,270
Lubricants	do	329	757	NA
Other	do	1,062	767	5,197
Refinery fuel and losses [e]	do	1,515	1,969	1,318
Total [e]	do	26,760	29,262	35,063
Salt	thousand metric tons	[r] 51	54	[e] 55
Sulfur, elemental: [e]				
Native	do	--	NA	100
Byproduct, recovered	do	NA	60	110

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

[1] In addition to the commodities listed, juss (an impure sandy gypsum), lime and a variety of crude construction materials (clays, stone, sand, and gravel) are produced, but output is not reported quantitatively, and available information is inadequate to permit formulation of reliable estimates of output levels.

[2] Includes an estimate for production from the Government-owned Naft Khaneh field.

TRADE

Petroleum was the most important commodity in international trade. Crude oil exports from Mediterranean and Persian Gulf ports declined by 17.5% during 1972, owing to a conflict between the Government and the producing companies. However, the estimated value of the oil exports was $903.8 million, representing 98.8% of the value of Iraq's mineral exports. Cement, valued at $7.9 million, was the most important nonpetroleum mineral exported during the year, and large quantities of sulfur were scheduled for export beginning in 1973. Manufactured iron and steel products accounted for most of the mineral imports, supplied mainly by European countries including the U.S.S.R.

Table 2.—Iraq: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Copper metal and alloys, all forms	1,200	
Iron and steel:		
Waste and scrap	24,359	
Semimanufactures	53	
Magnesium and beryllium	70	
Silver metal, partly worked but not rolled, kilograms	1	
Zinc metal and alloys, unwrought	100	
NONMETALS		
Cement	335,638	NA
Clays, products, refractory and nonrefractory	199	
Diamond (other than industrial), not set or strung, thousand carats	295	
Gypsum and plasters	3,481	
Stone, sand and gravel:		
Dimension stone:		
Crude	9	
Worked	9	
Gravel and crushed rock	37,542	
Sand excluding metal bearing	74	

See footnotes at end of table.

Table 2.—Iraq: Exports and reexports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	537,761	593,414
Refinery products:			
Gasoline	do	(1)	8
Kerosine	do	--	[2] 150
Distillate fuel oil	do	563	[2] 845
Residual fuel oil	do	--	[2] 11
Lubricants	do	54	95
Naphtha	do	64	
Bitumen	do	228	157
Other	do	6	
Total	do	915	1,266

NA Not available.
[1] Less than ½ unit.
[2] Excludes bunker loadings as follows in thousand barrels: distillate fuel oil and jet fuel—14; residual fuel oil—545.
Sources: 1970—Central Statistical Organization, Ministry of Planning, Republic of Iraq, Baghdad. Foreign Trade Statistics, 1970, 816 pp.; 1971—U.S. Bureau of Mines. World Petroleum Annual 1971. 1973, 32 pp.

Table 3.—Iraq: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	3	
Metal, including alloys, all forms	3,424	
Arsenic trioxide	7	
Chromium oxide and hydroxide	14	
Copper metal, including alloys, all forms	1,310	
Iron and steel:		
Sponge, shot, grit, iron pellets	369	
Steel:		
Ingots	966	
Blooms, billets, slabs, sheet, bars	25	
Tubes and pipe blanks	22,564	
Semimanufactures	311,529	
Lead metal, including alloys, all forms	167	
Magnesium and beryllium	119	
Mercury, 76-pound flasks	67	
Nickel metal, including alloys, all forms	8	
Platinum-group metals, partly worked or unworked, troy ounces	289	
Tin metal, including alloys, all forms, long tons	195	
Titanium oxides	303	
Zinc:		
Oxide and peroxide	17	NA
Metal, including alloys, all forms	124	
Other:		
Ore and concentrate of nonferrous base metals n.e.s	81	
Oxides, hydroxides, and peroxides of metals n.e.s	114	
Metals, metalloids	26	
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice stone, emery, natural corundum, and other	9	
Grinding and polishing wheels and stones	242	
Asbestos	2,000	
Barite and witherite	154	
Cement	22,935	
Chalk	673	
Clays and products (including all refractory brick):		
Crude n.e.s	4,666	
Products:		
Refractory (including nonclay bricks)	3,145	
Nonrefractory	4,271	
Diamond:		
Gem not set or strung, carats	140,000	
Industrial, do	10,000	

See footnotes at end of table.

Table 3.—Iraq: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
Nonmetals—Continued			
Fertilizer materials:			
Crude, nitrogenous		94	
Manufactured:			
Nitrogenous		45,504	
Phosphatic		7,005	
Other, including mixed		1	
Ammonia		253	
Graphite, natural		4	
Gypsum and plasters		176	
Lime		50	
Mica		29	
Pigments, mineral:			
Natural, crude		819	
Iron oxides, processed		60	
Salt		407	
Sodium and potassium compounds n.e.s.:			
Caustic soda		3,007	NA
Caustic potash, sodic and potassic peroxides		63	
Stone, sand and gravel:			
Dimension stone, crude and partly worked		1,992	
Gravel and crushed rock		10	
Limestone		60	
Sand, excluding metal bearing		74	
Sulfur:			
Elemental:			
Other than colloidal		610	
Colloidal		51	
Sulfur dioxide		1	
Sulfuric acid		41	
Talc, steatite, natural		592	
Other:			
Bromine, iodine, chlorine, fluorine		(1)	
Oxides, hydroxides, and peroxides of barium, strontium, and magnesium		24	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		35	
Carbon black		98	
Coal and briquets		348	
Coke and semicoke		56	NA
Hydrogen and rare gases		6	
Peat, including peat briquets and litter		2	
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	10	--
Distillate fuel oil	do.	--	47
Residual fuel oil	do.	--	117
Lubricants	do.	3	3
Other:			
Jelly and wax	do.	1	
Nonlubricating oils n.e.s	do.	2	
Bitumen and other residues	do.	1	1
Bituminous mixtures n.e.s	do.	1	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		7	NA

NA Not available.
[1] Less than ½ unit.
Sources: 1970—Central Statistical Organization, Ministry of Planning, Republic of Iraq, Baghdad. Foreign Trade Statistics, 1970, 816 pp.; 1971—U.S. Bureau of Mines. World Petroleum Annual 1971. 1973, 32 pp.

COMMODITY REVIEW

Two geological teams searched for minerals in Iraq. Surveys of phosphate deposits were carried out in the desert areas west of the Euphrates River, in the northern areas of Iraq. Surveys were conducted for asbestos, bentonite, ceramic clay, copper, lead, lime, salt, and zinc deposits. Results were not announced. An airborne geophysical survey between Baghdad and Karbalā' in central Iraq, utilizing magnetic and radiometric equipment, was scheduled for June 1972 by the Canadian firm Spartan Air Services, Ltd. The Canadians obtained a $1.8 million contract from the Iraq National Minerals Co. (INMC) to conduct a 2-year aerial geophysical survey of the entire country. The search focused on petroleum, radioactive elements, and iron, lead, and zinc ores. In January 1972 Iraqi representatives joined geologists from the Arab Republic of Egypt, Jordan, and Syria in forming the Arab Geologists Federation

(AGF). Exchange of geological information is the principal aim of AGF members.[3]

METALS

Iron and Steel.—Preliminary operations began at yearend at the $7.6 million factory constructed at Basrah to produce 20,000 tons per year of steel pipes. Plans were reviewed by the Iraqi Government to build a natural-gas-fired steel rolling mill which will probably also be located in the Basrah area. In December 1972 a delegation from India visited the country and discussed the rolling mill project with Iraqi officials.

NONMETALS

Cement.—More than three-fourths of Iraq's cement output was used in domestic construction, and the remainder was exported. Expansion at the Samawah cement plant continued during the year and was expected to be completed in early 1973. Plans were announced for a new plant at Al Fallūjah, about 56 kilometers west of Baghdad, to serve central Iraq. The plant is scheduled to begin operation in 1974 with an annual capacity of 200,000 tons.

Clays.—*Bentonite.*—INMC announced an important discovery of bentonite in the northern part of the country, with preliminary estimates of reserves set at more than one-half million tons. During the year mineral prospecting and geologic surveys continued for this and other minerals, and Iraqi-Soviet talks were held concerning a proposed bentonite plant for producing petroleum industry drilling muds.

Fertilizer Materials.—In January 1972 Iraqi officials signed a contract valued at nearly $816,000 for the export of 10,000 tons of urea and 15,000 tons of ammonium sulfate to the People's Republic of China (PRC). Later in the year, the Indian Government proposed the establishment of an ammonia plant in Iraq to have a capacity of either 1,000 or 2,000 tons per day. The plant will utilize natural gas feedstocks, and the entire production is to be shipped to India.

Sulfur.—In January 1972 INMC and a Polish engineering firm Centrozap, began commercial production operations at the Mishraq deposit, the first Frasch-type sulfur mine in the Middle East. The Frasch process has been employed in mining sulfur in Mexico, Poland, the United States, and the U.S.S.R., but sulfur production in Middle East countries had been restricted to recovering the element from petroleum and natural gas. On a dry basis Mishraq sulfur is rated 99.6% to 99.9% pure, and reserves are estimated at 100 million tons. First-year production totaled 100,000 tons, less than half of the mine's 1972 target capacity of 250,000 tons. Developments continued during the year under the guidance of Centrozap, and the 1-million-ton-per-year production rate should be reached in 1973. Sulfur exports were scheduled to begin in November 1972, but delays were encountered and none was reported for the year. Exports will begin in 1973, with India to receive 100,000 tons at the rate of 12,000 tons per month, and a minimum of 100,000 tons annually for the next 5 years will be shipped to the PRC.[4] A direct railroad connection between northern Iraq and the Syrian port of Tartus remained in the planning stage. Until it is completed, initial consignments of Mishraq sulfur will be railed nearly 1,300 kilometers to the ocean terminal facilities at Umm Qasr in southern Iraq for export.

Repairs and modifications were completed early in the year at the Government's Kirkuk sulfur plant. The technical problems were solved which had held recovery of sulfur from natural gas to about 200 tons per day in 1971. By mid-1972 the plant was producing sulfur at the rate of 400 tons per day.

MINERAL FUELS

Natural Gas.—Field surveys were carried out in 1971, and in 1972 Swiss technicians from the Chemical Construction Corp. (Chemico) completed feasibility studies of a projected natural gas liquefaction plant for southern Iraq.

Nearly 4.5 billion cubic feet of Rumaila associated gas was piped to the Government's Najibiyah electric power generating plant near Basrah, and 2.7 billion cubic feet of Rumalia and Zubair natural gas was consumed in BPC operations. ICOO reported that 13.1 million cubic feet of associated gas was sent to the Kirkuk sulfur recovery plant and nearby powerplant by yearend. A 25-centimeter, 140-kilometer natural gas pipeline for moving North Rumaila gas to the port of Fao was under consideration by INOC. Iraq continued

[3] Iraq National Oil Co. Weekly Bulletin. 2d year, No. 12, Jan. 9, 1972, pp. 8–9.
[4] Canada Commerce (Ottawa). V. 136, No. 5, May 1972, p. 42.

discussions with Turkey concerning the planned natural gas trunkline from Kirkuk field to Batman, Turkey, but final agreements were not signed. This line's planned annual capacity was 200 million cubic feet.

Petroleum.—On June 1, 1972, the Iraqi Government nationalized IPC's major oilfields and supporting facilities in northern Iraq. This culminated a series of threats by the Government resulting from declining production, especially from the large Kirkuk field. The company contended cost differentials between crudes shipped from Eastern Mediterranean and Persian Gulf terminals in early 1972 were too wide and that it could land in northern Europe oil from its Persian Gulf outlet at $0.24 per barrel cheaper than exports from the Mediterranean ports. From January to April IPC's northern oilfield production dropped from 1.1 million to less than 700,000 barrels per day and exports fell accordingly. The Government's Revolutionary Command Council (RCC) complained of severe revenue losses from reduced royalties and taxes and instructed IPC to resume full northern production and exports. IPC-RCC negotiated without an agreement being reached, and the Government nationalized IPC's Bai Hassan, Jambur, and Kirkuk oilfields; supporting installations; and the Iraqi section of the crude oil pipeline to Syria and Lebanon. BPC and MPC operations were unchallenged. The Government formed ICOO to take over the IPC properties and announced that IPC's owners would be paid for the seized properties. However, by yearend IPC and RCC had not reached an agreement settling outstanding disputes and nationalization. An interim agreement was signed with Cie. Française des Pétroles, one of IPC's owners, allowing the French company to continue lifting their 23.75% share of the nationalized crude oil.

In June 1972 Syria nationalized the section of IPC's pipeline within its borders, but Lebanon did not take over the pipeline within its boundaries. Syria and Iraq disputed transit fees, but deliveries of oil continued through the pipeline to the port of Banias.

During the year an agreement was signed calling for an undisclosed amount of INOC crude oil to be shipped to East Germany over the next 5 years, and India ordered 14.9 million barrels of Iraqi crude oil to be delivered over the next 3 years. The first two deliveries were made to India by yearend 1972. Extensive negotiations took place and large barter deals and loans were arranged by INOC with industrial and governmental representatives from numerous countries. Early in the year Iraq signed a long-term contract with the Brazilian enterprise Petróleo Brasileiro S.A. (Petrobrás) under which Brazil will supply goods and services valued at $5 million in exchange for 14.9 million barrels of crude oil. Petroleum deliveries were scheduled for 1972 through 1976. INOC and Bulgarian Government officials signed contracts providing for seismic surveying and exploratory operations in northern Iraq by Technoexportstroy, within the framework of a 1970 economic agreement. A $50 million Czechoslovakian loan was extended to Iraq, of which 90% of the value is to be repaid in crude oil. Czechoslovakia will purchase 16.4 million barrels of Kirkuk and North Rumaila crude oil over the next 3 years. During the year the Arab Republic of Egypt signed contracts to barter 2.0 million barrels of Iraqi crude oil for Egyptian commodities, and two countries held discussions concerning the possible shipment of a further 14.9 million barrels of crude oil in 1973. Over the next 10 years, the French will provide technical assistance for Iraqi industrial development and receive 104.3 million barrels of Kirkuk crude oil. A joint INOC-Enterprise de Recherches et d'Activités Pétrolierès (Erap) company is to be formed to carry out the petroleum activities in Iraq. In 1972 the Iraqis agreed to sell 149.1 million barrels of crude oil to the Italian firm Ente Nazionale Idrocarburi (ENI) over a period of 10 years, with the Italians paying for the oil with industrial plants, machinery, and services. During the year Hungary agreed to supply Iraq with oil industry goods and services valued at $50 million. Iraqi payments are to be made predominantly in crude oil. In 1972 Spain and Iraq signed a 5-year barter agreement calling for Spanish industrial goods and services in exchange for Iraqi crude oil. Contracts specify that 44.7 million barrels of crude oil are to be purchased by Spain between 1973 and 1975. The U.S.S.R. will assist Iraq in developing the Khānaqīn, Nahr Umr, and North Rumaila oilfields and possibly the Quayara field, and the Soviets are studying plans for a Baghdad-Basrah petroleum products pipeline and bentonite plant to produce petroleum industry drilling muds. The U.S.S.R.

has agreed to help Iraq establish an oil industry institute for design and planning. During 1972 Soviet and Iraqi negotiators agreed that all loans for Soviet goods and services may be paid in crude oil. Yugoslavia and Iraq signed a 1972 protocol for Yugoslavian imports of 10,000 barrels per day of Kirkuk crude oil for a period of 5 years. Payments are to be made in cash, industrial equipment, and services.

A Soviet-Iraqi team completed a 9-month-long study of oil and gas areas in southern Iraq, and similar studies were conducted in the central and northern areas. At yearend the Russians completed a study of Iraqi oil and gas reserves, but results were not announced. During the year three INOC teams, with a total manpower of 300, carried out seismic surveys mainly in the Hawr al Hammār area near Basrah in southern Iraq. INOC's Seismic Interpretation Center completed analysis of field data obtained from Gerishan, Luhais, Nahr Umr, Rachi, and Ratawi structures. Petrobrás obtained a 7-year service contract to search for oil over 7,500 square kilometers in three areas in central and southern Iraq and began seismic surveys in December 1972 near Basrah and 'Alī al Gharbī. Wildcat drilling can begin within 18 months of the contract date.[5] Fieldwork will probably be carried out by the newly formed Petrobrás subsidiary, Petrobrás Internacional S.A. (Braspetro). A joint-venture protocol was reportedly signed in midyear by INOC and West Germany's Deminex for exploration and production in east-central Iraq, but details of the agreement were not made public.

IPC did not conduct geological or geophysical activities, nor did they drill any new wells in 1972, and the BPC carried out workovers on three Zubair wells and one Rumaila well. The Hungarian firm Chemocomplex completed the first of three wells in the Jambur oilfield, and at yearend drilling operations proceeded at the second well site. During 1972, ICOO drilled three producing wells in the Bai Hassan oilfield, completed two wells and began drilling a third in the Kirkuk oilfield, and spudded a well at Jabal Hamrīn. INOC's 1972 exploratory drilling was limited to one wildcat well spudded in the Luhais oilfield. It drilled well No. 4 in the Nahr Umr oilfield, delineated sites for two wells in the Quayara oilfield (production is to be piped to the nearby petroleum refinery), and drilled its first of four wells in the Ratawi field. INOC's efforts were concentrated on the development of the North Rumaila field. Three rigs drilled nine wells, four new well sites were delineated for 1973 drilling operations, a degassing station was placed in service, and construction was completed on the crude oil trunkline to Fao. North Rumaila wells began producing on April 7, 1972, and export operations commenced 5 days later when a Soviet tanker left Fao with a cargo of 156,500 barrels of crude oil. INOC announced the discovery of large oil deposits at Hawr al Hammār, which reportedly will double the national reserves. The deposit extends northward from the Rumaila field for more than 50 kilometers and is estimated to exceed 20 kilometers in width.[6]

Refinery construction activities were carried out during the year at three locations, Basrah, Hammām al 'Alīl, and Kirkuk, in an effort to raise Iraq's daily refining capacity by 120,000 barrels. New units installed or contracted for during 1972 will more than double the country's refining capability, but Iraq will remain one of the smallest refiners in the Middle East. Czechoslovakia's Technoexport continued work on the 70,000-barrel-per-day refinery near Basrah. Government Oil Refineries Administration (GORA) will begin operations at this plant in late 1973 or early 1974, producing gas oil, kerosine, and motor gasoline for domestic and foreign markets. During the year an agreement was concluded with the Soviet firm Neftekhimpromexport for the construction of an INOC petroleum refinery at Hammām al 'Alīl, 22 kilometers southeast of Mosul. Scheduled for completion in 1974, this $33 million plant will supply petroleum products to northern Iraq, and surplus production will be exported to Syria and possibly Turkey. Major units will be a crude distillation unit with a crude oil throughput capacity of 30,000 barrels per day, a 12,200-barrels-per-day desulfurization unit, and a 3,660-barrel-per-day gasoline improvement unit. Crude oil will be transported to the plant site by a 170-kilometer-long pipeline from the K2 pumping station on the former IPC pipeline from Kirkuk. Diesel oil, fuel oil, gas oil, gasoline, jet fuel, and

[5] Oil and Gas Journal. V. 70, No. 35, Aug. 28, 1972, p. 28.
[6] Middle East Economic Survey (Beirut, Lebanon). V. 15, No. 25, Apr. 14, 1972, p. 10.

kerosine will be distributed by railroad tank cars and highway trucks. Electric power will be supplied by the Hammām al 'Alīl powerplant.[7] Near yearend GORA plans were finalized and preliminary construction began to increase the refining capacity in the Kirkuk area by 20,000 barrels per day. Twin 10,000-barrel-per-day prefabricated units were ordered from the U.S. firm Howe-Baker Engineers, Inc. The first unit arrived at Kirkuk in December 1972, and the second was scheduled for delivery in February 1973. Near yearend, construction activities were underway at the refinery's storage depot, and a 30-centimeter-diameter, 1.4-kilometer-long pipeline connected the new refining area to the storage facility. GORA planned to begin producing diesel oil, fuel oil, and kerosine at the $3.8 million plant by the end of first quarter 1973. A lubricating oil plant was under consideration for the Basrah area, and INOC studied plans to participate in petroleum refinery operations in Belgium, India, and Romania. During the year Chemico conducted a survey of international markets for Iraqi-produced liquefied petroleum gases.

In February 1972 deliveries began on the seven 35,470-deadweight-ton oil tankers that Iraq had ordered from Spain in 1970. By yearend *Rumaila*, *Kirkuk*, and *Ain Zala* were in service, and the remaining four tankers were scheduled for delivery in 1973. In April 1972 the Oil Tankers Co. (OTC) was established as a wholly owned subsidiary of INOC to transport Iraq's crude oil and refined petroleum products. OTC placed Iraq's newly acquired tankers and two chartered Soviet tankers in service delivering Iraqi crude oil to foreign countries. Iraq was admitted to OAPEC in March 1972, and during the third quarter 1972 the Government ratified an OAPEC agreement establishing the Arab Oil Transport Co.[8] Talks were finalized in Moscow near yearend concerning the establishment of a joint Iraqi-Soviet oil tanker company.

During 1972 plans were finalized for two offshore supertanker terminals to be built near Fao in the Persian Gulf. One will be built at Khor al-Amaya and the other at Khor al-Khafji. BPC began construction of a third berth at its Khor al-Amaya tanker terminal, an $8.5 million structure to accommodate ships as large as 330,000 deadweight tons. INOC port facilities at Fao were enlarged with the completion of several storage tanks, a new administration building, and a laboratory, but shipping was restricted to 35,000-deadweight-ton tankers. Plans were completed for an offshore deepwater terminal to facilitate supertankers which will transport North Rumaila oil. Several foreign engineering firms have been consulted, and an estimated $100 to $120 million loading facility capable of servicing 300,000-deadweight-ton tankers is scheduled for service in 1976.

During 1972 one crude oil pipeline was placed in service, and more than 3,800 kilometers of large-capacity petroleum pipelines were planned. In first quarter 1972 crude oil began flowing through the 138-kilometer-long, 71-centimeter-diameter line from the North Rumaila oilfield to the Fao marine petroleum terminal at the rate of 360,000 barrels per day. Three domestic and two international crude oil trunklines were planned, and a refined products pipeline 600 kilometers in length may be constructed between petroleum processing and storage facilities in Baghdad and Basrah. By yearend 1975 a new pipeline is also to be laid parallel to the North Rumaila-Fao line to increase the export capability from producing wells in the area, and a 655-kilometer-long pipeline may interconnect oilfields in Kirkuk and North Rumaila. Soviet engineers planned a crude oil line to supply the new petroleum refinery near Mosul. That pipeline will extend approximately 170 kilometers from the K2 pumping station and will have an initial capacity of 30,000 barrels per day. Studies were conducted on the two proposed international trunklines by the Italian firm Snam Progetti S.p.A. Survey works were completed for the 1,250-kilometer-long, 1-million-barrel-per-day connection from the North Rumaila oilfield to Syrian ports on the Mediterranean Sea, and a crude oil line of more than 1,000 kilometers in length is planned from the Kirkuk oilfields to Turkish port facilities at Dortyol. Construction of the Dortyol line is expected to begin in 1974 and should be completed by 1976. Plans call for 373 kilometers of pipes to be laid in Iraq, and the Turkey section will be 632 kilometers in length. Forty percent of the

[7] Petroleum Times (London). V. 76, No. 1949, Nov. 17, 1972, p. 8.
[8] Petroleum Intelligence Weekly. V. 11, No. 36, Sept. 4, 1972, p. 8.

throughput will be purchased by Turkey, and the remainder will be exported. INOC considered a long-distance crude oil pipeline to Mediterranean ports from producing wells in the Abu Ghirab, Buzurgan, and Jambur fields. The line may not be built, since Essence et Lubrifiant de France-Entreprise de Recherches et d'Activités Pétrolières (Elf-ERAP) reported discoveries in the Abu Ghirab-Buzurgan fields may not justify commercial exploitation.

The Mineral Industry of Ireland

By J. M. West [1]

The development of an estimated 77 million tons of high-grade zinc-lead ore at Navan by Tara Exploration and Development Co., Ltd., and the preparations to mine this exceptionally rich ore body were the most outstanding mineral activities of the year. Controversy was faced in acquiring rights to mine the total ore body because of other claims to part of the area and because of factional efforts to nationalize the property. Nevertheless, planning, equipment installation, and underground development work proceeded with strong determination, and 1975 was set for initial production. The operation will nearly triple Ireland's zinc and lead production.

Generally, in 1972 the country's metals industry recovered from recession and produced at higher rates. Most other segments of the minerals industry reported increased activities. Prospecting for natural gas, oil, and other mineral materials was conducted at an accelerated pace. No further action was taken on a proposed lead-zinc smelter planned at Cork.

Underlying problems in the Irish economy continued to be inflation, economic stagnation, and unemployment. Growth in the real gross national product (GNP) was estimated at 4% to 5% in 1972, somewhat higher than that of 1971. The bulk of the growth, however, was in the second half of the year. The GNP amounted to $5.6 billion at current prices, or $3.8 billion at constant 1968 prices.[2] The country's trade deficit, partly due to oil imports, declined 8% during 1972 to a yearend figure of about $0.49 billion. Ireland entered into the European Community in mid-1972, and the event was expected to have a marked stimulus on Irish economic growth, including growth in the minerals producing and consuming industries. Ireland continued to offer generous grants to finance new plants and equipment through its Industrial Development Authority. Also, the Government allowed a 15-year tax holiday on all profits derived from exports as an incentive for establishing mineral processing and other industrial plants. Ireland's labor costs, although rising, continued to be comparatively low for a relatively developed country. Unemployment at 8% remained high, although wage increases averaged over 14% during the year.

PRODUCTION

Outputs of lead, zinc, silver, and copper were all higher in 1972 as expansions continued at the principal mining operatons. Mercury producton, a byproduct at the Gortdrum copper operation, was lower than that of 1971, owing to high treatment costs and a slump in world mercury prices. Outputs of most construction materials were higher in accordance with increased construction activities. Production of refined petroleum products was lower than that of 1971.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from the Irish pound to U.S. dollars at the rate of £1 = US$2.50.

Table 1.—Ireland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Copper, mine output, metal content		[r] 8,281	11,800	13,200
Lead, mine output, metal content		[r] 62,873	51,592	59,500
Iron and steel, crude steel	thousand tons	[r] 80	80	77
Mercury	76-pound flasks	1,304	2,345	1,234
Silver, mine output, metal content	thousand troy ounces	[r] 2,243	1,432	1,553
Zinc, mine output, metal content		96,500	87,500	94,800
NONMETALS				
Barite		221,000	196,100	237,217
Cement, hydraulic	thousand tons	[r] 859	1,500	1,534
Gypsum	do.	295	338	386
Lime	do.	59	54	[e] 50
Sand and gravel [2]	do.	4,779	5,954	NA
Stone, limestone [2]	do.	5,488	6,777	NA
Other [3]	do.	2,766	3,095	NA
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Anthracite	do.	[r] 80	27	[e] 30
Bituminous	do.	75	63	[e] 45
Coke, gashouse, including breeze	do.	36	--	NA
Peat:				
Agricultural use	do.	53	57	[e] 60
Fuel use:				
Briquets	do.	319	327	[e] 330
Sod peat [4]	do.	2,160	2,183	[e] 2,200
Milled peat [5]	do.	2,881	2,985	[e] 3,000
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	4,260	4,208	4,046
Jet fuel	do.	488	602	608
Distillate fuel oil	do.	5,326	5,185	4,968
Residual fuel oil	do.	8,449	9,485	8,671
Other	do.	1,035	1,172	960
Refinery fuel and losses	do.	718	762	777
Total	do.	20,276	21,414	20,030

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

[1] In addition to the commodities listed, substantial quantities of stone, and sand and gravel are produced by local authorities for purposes such as maintenance of roads, but statistics on such output are not reported and available general information is inadequate to make reliable estimates of output levels.

[2] Excludes output by local authorities.

[3] Figures given as reported in source; includes granite, marble, silica rock, sand, calcspar, fire clay, and shale and clays for cement production, but apparently excludes output of these materials by local authorities.

[4] Includes production by farmers and by Bord Na Mona.

[5] Includes milled peat used in the production of peat briquets listed previously in this table.

TRADE

The tonnage of imported minerals continued to exceed that of exported minerals by a ratio of about two to one. Both exports and imports rose significantly during the year. The Irish Republic decided in May, by popular referendum, to enter the European Community (EC), As a result, under the Common External Tariff of the EC, it was expected that high existing Irish tariffs on finished products imported for the building industry would drop sharply; products produced in the EC would enter Ireland duty free. Many raw materials, such as coal, crude oil, naphtha, and ores, would also enter duty free, although industrial chemicals would carry tariffs ranging from 3% to 18%. Under the agreement negotiated with the EC, Ireland was permitted to retain its incentive grants to new industry, covering up to 50% of fixed assets, and tax exemptions for profits derived from exports. Late in the year, the Government published a notice of the new Irish Customs and Excise Tariff to become effective January 1, 1973.[3] The new schedule eliminated duties on coal.

[3] U.S. Embassy, Dublin, Ireland. State Department Airgram A-137, Oct. 16, 1972, 2 pp.

Table 2.—Ireland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Metal, including alloys:			
Scrap	566	478	NA.
Unwrought and semimanufactures	3,964	2,585	United Kingdom 2,529.
Copper:			
Ore and concentrate	11,732	39,241	Spain 22,346; Sweden 11,574.
Metal, including alloys:			
Scrap	4,243	6,274	Spain 2,370; United Kingdom 2,169; Netherlands 718.
Unwrought	839	810	Netherlands 396; Italy 260; Japan 50.
Semimanufactures	682	802	United Kingdom 441; United States 324.
Iron and steel:			
Metal:			
Scrap	10,864	9,845	Spain 6,085; France 2,671; United Kingdom 890.
Semimanufactures	17,217	14,108	United Kingdom 13,823.
Lead:			
Ore and concentrate	145,766	116,820	France 30,632; West Germany 27,731; Belgium-Luxembourg 26,614.
Metal, including alloys:			
Scrap	262	5,000	West Germany 2,731; Belgium-Luxembourg 2,050; United Kingdom 218.
Unwrought and semimanufactures	2,541	1,560	United Kingdom 1,460.
Zinc ore and concentrate	194,329	129,297	France 26,676; Belgium-Luxembourg 23,635; United Kingdom 18,341.
NONMETALS			
Barite and witherite	222,142	192,290	United States 101,306; Nigeria 25,054; Republic of South Africa 16,567.
Cement	37,363	99,012	All to United Kingdom.
Clay products, refractory (including nonclay bricks)	46,156	43,749	United Kingdom 12,322; Italy 9,030; Netherlands 7,909.
Fertilizer materials:			
Crude	5,390	6,314	All to United Kingdom.
Manufactured	18,366	32,099	United Kingdom 31,093; West Germany 975.
Gypsum and plasters	108,268	114,741	All to United Kingdom.
Stone, sand and gravel:			
Dimension stone, worked	218	285	United Kingdom 283.
Gravel and crushed stone	304,808	255,171	West Germany 152,326; United Kingdom 63,416; Netherlands 35,881.
Limestone (except dimension)	21,960	17,628	All to United Kingdom.
Other nonmetals, n.e.s.			
Crude, other	222,142	192,290	United States 101,306; Nigeria 25,054; Republic of South Africa 16,567.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s.	8,580	10,187	United Kingdom 7,471; Hong Kong 2,394.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous coal	12,782	684	NA.
Briquets of anthracite and bituminous coal	57,070	25,715	Netherlands 12,858; United Kingdom 12,337.
Coke and semicoke	23,652	18,823	Norway 15,485; Netherlands 2,481.
Gas, hydrocarbon, natural	15,338	6,295	All to United Kingdom.
Peat, including peat briquets and litter	89,840	91,120	United Kingdom 88,820; Spain 1,085.
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	r 57	22	All to United Kingdom.
Kerosine—do	126	--	
Distillate fuel oil—do	732	216	All to United Kingdom.
Residual fuel oil—do	r 3,372	4,618	Do.
Lubricants—do	r 4	8	Mainly to United Kingdom.
Total—do	r 4,291	4,864	

r Revised. NA Not available.

Table 3.—Ireland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum metal, including alloys:			
Unwrought	5,082	3,117	Canada 1,437; United Kingdom 949; Yugoslavia 400.
Semimanufactures	6,536	6,276	United Kingdom 4,817; West Germany 409; France 326.
Copper metal, including alloys:			
Unwrought	156	265	United Kingdom 257.
Semimanufactures	7,965	8,527	United Kingdom 8,162; Belgium-Luxembourg 138; West Germany 100.
Iron and steel:			
Metal:			
Pig iron, including cast iron	18,226	19,079	U.S.S.R. 16,691; United Kingdom 1,879.
Sponge iron, powder and shot	974	165	U.S.S.R. 112; United Kingdom 48.
Ferromanganese	10,690	1,057	Belgium-Luxembourg 508.
Steel, primary forms	r 15,153	13,506	Belgium-Luxembourg 5,056; France 2,981; West Germany 2,643.
Steel, semimanufactures:			
Bars, rods, angles, shapes and sections	100,209	82,993	United Kingdom 45,250; West Germany 17,430; Belgium-Luxembourg 13,519.
Universals, plates and sheets	89,844	96,771	United Kingdom 43,861; West Germany 15,865; Japan 13,382.
Hoop and strip	9,527	7,591	United Kingdom 6,220; West Germany 912.
Rails and accessories	3,699	7,173	United Kingdom 5,312; Belgium-Luxembourg 692; West Germany 519.
Wire	8,127	9,199	United Kingdom 5,989; West Germany 1,725; Belgium-Luxembourg 409.
Tubes, pipes, and fittings	48,250	52,600	United Kingdom 37,208; Japan 3,992; Netherlands 3,295.
Castings and forgings, rough	r 440	893	United Kingdom 572; Japan 270.
Total	r 260,096	257,220	
Lead:			
Oxides	1,881	2,485	United Kingdom 2,459.
Metal, including alloys, all forms	1,566	824	United Kingdom 809.
Manganese oxides	517	--	
Nickel metal, including alloys, unwrought and semimanufactures	539	367	United Kingdom 284; Switzerland 43.
Platinum-group metals and silver:			
Metals, including alloys:			
Platinum group value, thousands	$183	$326	United Kingdom $314.
Silver do	$302	$290	United Kingdom $279.
Tin metal, including alloys, unwrought and semimanufactures long tons	341	57	United Kingdom 50.
Titanium oxides	3,201	3,207	United Kingdom 1,603; France 645; West Germany 529.
Zinc:			
Oxides	783	944	United Kingdom 759.
Metal, including alloys:			
Unwrought	2,767	3,104	United Kingdom 2,398; U.S.S.R. 506.
Semimanufactures	890	1,033	United Kingdom 561; U.S.S.R. 260.
Other:			
Nonferrous ore and concentrate, n.e.s.	15,581	10,766	Republic of South Africa 10,065; Australia 500.
Metals, nonferrous base metals, including alloys, all forms, n.e.s. value, thousands	$432	$434	United States $253; United Kingdom $118.
NONMETALS			
Abrasives, natural:			
Crude, n.e.s. value, thousands	$188	$164	United Kingdom $67; United States $60.
Grinding and polishing wheels and stones	307	435	United Kingdom 255; West Germany 81.
Asbestos	4,350	5,182	Republic of South Africa 1,606; Cyprus 1,437; Canada 1,107.
Cement	207,717	129,933	Denmark 55,533; United Kingdom 45,941; Sweden 21,554.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	18,705	17,706	United Kingdom 15,964.
Products:			
Refractory (including nonclay bricks)	17,756	16,383	United Kingdom 13,166; Canada 1,363; West Germany 910.
Nonrefractory	7,121	7,327	United Kingdom 5,232; West Germany 1,603.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Phosphatic	385,381	400,855	Morocco 400,793.
Other	1,409	1,416	NA.
Manufactured:			
Nitrogenous	15,767	31,093	United Kingdom 16,458; Poland 8,368; Netherlands 4,137.
Phosphatic:			
Thomas slag	152,469	179,194	Belgium-Luxembourg 178,889.
Other	19,658	13,090	United Kingdom 10,347; Netherlands 1,627.
Potassic	253,259	252,740	France 66,093; West Germany 56,310; East Germany 55,435.
Other, including mixed	60,428	80,094	United Kingdom 65,593; West Germany 8,554; Belgium-Luxembourg 2,436.
Ammonia	40,235	51,520	France 28,154; United Kingdom 12,969; Netherlands 9,616.
Lime	4,839	7,982	All from United Kingdom.
Magnesite	22,396	19,547	United Kingdom 16,750; Czechoslovakia 1,011.
Pigments, mineral, iron oxides, processed	1,562	2,351	United Kingdom 1,366; West Germany 772.
Salt	56,213	56,814	United Kingdom 37,627; West Germany 11,041; Spain 5,779.
Sodium and potassium compounds, n.e.s	6,560	7,772	United Kingdom 7,241.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	2,448	3,622	United Kingdom 1,500; Italy 1,218; Republic of South Africa 681.
Worked	r 278	252	Italy 103.
Dolomite, chiefly refractory grade	--	1,541	NA.
Gravel and crushed rock	64,687	68,019	United Kingdom 66,617.
Limestone (except dimension) including gypsum	4,750	4,355	United Kingdom 4,210.
Sand, excluding metal bearing	50,811	54,447	Belgium-Luxembourg 36,056; United Kingdom 18,063.
Sulfur:			
Elemental, other than colloidal	120,686	121,380	United States 101,136; France 19,132.
Sulfuric acid, including oleum	--	6,644	United Kingdom 3,947; West Germany 2,697.
Other:			
Crude nonmetals, n.e.s	14,351	18,964	United Kingdom 8,745; Italy 4,208; France 1,553.
Slag, dross and similar waste, not metal bearing	4,489	8,377	All from United Kingdom.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	6,586	6,117	United Kingdom 5,624.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	10,098	7,730	United Kingdom 5,793; Trinidad and Tobago 1,530.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,218	1,038	Poland 770; United Kingdom 170; United States 38.
Briquets of coal ---do---	2	--	
Coke and semicoke ---do---	11	14	United Kingdom 12; West Germany 2.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 20,184	22,849	Kuwait 12,605; Iran 5,657; Saudi Arabia 3,415.
Refinery products:			
Gasoline, motor ---do---	r 1,197	1,581	United Kingdom 1,522; Israel 59.
Kerosine ---do---	r 2,271	2,817	Mainly from United Kingdom.
Distillate fuel oil ---do---	r 1,397	2,026	United Kingdom 1,971; Israel 55.
Residual fuel oil ---do---	r 8,631	11,382	United Kingdom 6,866; U.S.S.R. 2,166; Netherlands 955.
Lubricants ---do---	r 264	263	United Kingdom 253; United States 4.
Mineral jelly and wax ---do---	23	23	West Germany 14; United Kingdom 8.
Other:			
Nonlubricating oils, n.e.s. ---do---	523	647	United Kingdom 618; Denmark 28.
Liquefied petroleum gas ---do---	r 362	479	United Kingdom 464; Netherlands 14.
Bitumen and other residues, and bituminous mixtures, n.e.s ---do---	r 685	694	Netherlands 419; United Kingdom 185; Belgium-Luxembourg 74.
Total ---do---	15,353	19,912	

r Revised. NA Not available.

[1] Does not include blooms, billets, slabs, and sheet bars value at $699,000.

COMMODITY REVIEW

METALS

Copper, Lead, Zinc, Mercury, and Silver.—Total investments, exploration costs, and net profits from Ireland's metal mining industry were evaluated.[4] The sum of investments in exploration and mine development since 1955 was estimated at about $112 million, and total profits were estimated at $52 million. Production continued to come essentially from four base metal mines—the Tynagh in County Galway, the Gortdrum and the Silvermines in County Tipperary, and the Avoca in County Wicklow. Output of all metals were up in 1972. The Tynagh mine of Irish Base Metals Ltd., a subsidiary of Northgate Exploration Ltd., produced 45,200 short tons of lead, 30,800 tons of zinc, 2,050 tons of copper, and 1,242,000 ounces of silver from 587,233 tons of ore in 1972. Equipment for treating oxidized zinc ore was installed allowing increased zinc production. Sulfide ores were treated in a dense-media plant. Direct mining and milling costs were reported at $8.57 per ton of ore, compared with $7.10 per ton in 1971. Full-scale production from a new underground operation at Tynagh was scheduled for about yearend 1973.

The work week was reduced to 5 days at the Gortdrum mine about mid-year, and 433,900 tons of ore grading 1.17% copper was produced during the year. The mill treated 401,635 tons of ore grading (after blending) 1.26% copper and 0.93 ounce of silver per ton. After roasting, the mill concentrate totaled 10,871 tons, averaging 33.34% copper and 26.03 ounces of silver per ton. Recovery of byproduct mercury amounted to 1,250 flasks. Concentrates shipped contained 4,750 tons of copper and 335,000 ounces of silver; also, 1,308 flasks of mercury were sold. Direct operating costs were estimated at $7.97 per ton of ore treated, compared with $5.82 per ton in 1971, the unit increase being attributed to a drop in overall production.

Higher grade ore was found in the Cronebane open pit section at Avoca Mines (Canada) Ltd's. copper and pyrite mine; Avoca's production in 1972 was expected to exceed the 1971 output of 874,175 tons of ore averaging 0.84% copper. About 75% of that production was from underground mining and most of the balance was from low-grade stockpiles left over from former operations. In early 1972, sales of byproduct pyrite were initiated to a local government-owned fertilizer plant. A long-range development program began in 1972 to explore ore bodies at depth.

Ore reserves in Irish mines included an estimated 10 million metric tons at Tynagh, 4.6 million tons at Gortdrum, 12 million tons at Silvermines, and 8 million tons at Avoca. In addition, an estimated 77 million tons of ore grading 10.99% zinc and 2.62% lead, was recently discovered at Navan, County Meath. The Navan deposit, under development in 1972 by Tara Exploration and Development Co., Ltd., a Northgate Exploration Ltd. subsidiary, was scheduled to go into production at a daily milling rate of 7,500 tons in 1975. Capital costs for the project were expected to total $85 million, and direct employment at the mine when fully operating was estimated at 600. New port facilities were under construction at Mornington, County Meath, to accommodate shipment of concentrates to the European Continent for smelting. Based on metallurgical tests, zinc and lead recoveries were expected to be 90% and 82%, respectively; annual concentrate production will contain over 240,000 tons of zinc and lead in a 5:1 ratio.

Iron and Steel.—Irish Steel Holdings, Ltd., completed installation of a 30-ton-per-charge electric ore furnace and a continuous bar and rod mill in 1972. The equipment expanded steelmaking capacity by 80,000 tons to a total of about 150,000 tons of ingot annually. The cost was estimated at $8.6 million. Standard Pressed Steel Co. (United States) opened new iron and steel research facilities in the Industrial Development Authority Research Park at Naas, County Kildare. The firm provided research and development services on contract and for its own U.S. and European operations.

NONMETALS

Barite was produced from one of the world's largest deposits in County Tipperary by Magcobar (Ireland) Ltd., mainly for U.S. markets. Exports to the United States in 1972 totaled 192,290 tons valued at $1.8 million. Reserves were estimated at 2 million tons of proved and 1 million tons

[4] Michael O'Reilly Associated International Ltd., (Dublin, Ireland). The Irish Mining Industry, 1955–1972. 1972, 18 pp.

additional of indicated ores. Quigley Magnesite Divison of Pfizer, Inc. (United States), produced magnesia from seawater and dolomite at Dungarvan, County Waterford, operating at a capacity of 70,000 tons per year and providing products to plants in Ireland and other European countries, the United States, and Canada.

MINERAL FUELS

Ireland in 1972 depended largely on imported oil and coal for its primary energy supplies. Other domestic energy sources were peat, produced largely by Bord na Mona, a state organization; a small output of coal; and hydroelectricity produced under authority of the Electricity Supply Board, a state organization with a monopoly on electricity production and distribution. All gas continued to be produced from imported coal or oil, although natural gas discovered in 1971 by Marathon Petroleum (Ireland) Ltd., off the coast of Kinsale, County Cork, was under investigation. Oil and peat supplied nearly 90% of the fuel for electrical generation. A decision was delayed on construction of a $200 million, 500-megawatt nuclear power station by the Electricity Supply Board, pending evaluation of potential offshore gas production.

Coal, Coke, and Peat.—Output of sod and milled peat was approximately the same as 1971; estimated production of bituminous coal decreased. The quantity of briquets manufactured from peat remained about the same, and significant quantities of these briquets and of agricultural peat were exported, with the United Kingdom the principal destination. Imports of coal and coke included gas coal from Poland, as in the past.

Petroleum.—A new Irish company, Celtic Oil Ltd., was formed in association with Hunt International Petroleum Co. (United States) to explore for oil and gas off the Irish coast. Marathon Oil Co. (United States), through its Irish subsidiary, continued exploration of a licensed area, covering about one-third of the Irish coast, mainly off the South coast and Counties Sligo and Clare. Marathon, having discovered gas in late 1971, remained the only holder of an exclusive offshore prospecting license. A total of 16 nonexclusive licenses have been issued to that number of other companies for prospecting purposes.

Irish Hydro Carbon Co., in which the American Petroleum Co. (United States) has a principal interest, received qualified permission in December from the Cork County Council to build a $135 million, 150,000-barrel-per-day oil refinery on Whiddy Island in Bantry Bay, Cork. Negotiations were continued with the Industrial Development Authority over the form and amount of assistance that agency would contribute to the project. Also, a $200 million liquefied synthetic gas plant was reported under consideration by a combine of U.S. and British firms at a location yet to be decided on the Irish coast. The feedstock would be naphtha supplied from North Sea crude oil, and most of the output would be exported to the United States.

Ireland imported 17.25 million 42-gallon barrels of crude petroleum in 1972, nearly 22% less than in 1971, and of this, 58% came from Kuwait, 20% from Iran, 19% from Saudi Arabia, and nearly all of the balance from Southern Yemen and the Trucial States. Partly refined petroleum totaling 0.66 million barrels was imported from the United Kingdom and Italy in 1972. Refined products were also imported. Estimated consumption of refined products, as reported by a principal Irish distributor, was 35.5 million barrels, including bunker fuels. Consumption, excluding bunkering of foreign aircraft was as shown below, in thousand metric tons:

Product	1971	1972
Gasoline	669	710
Aviation fuel	392	333
Kerosine	93	85
Gas/diesel oil	872	979
Residuel fuel oil	2,401	2,373
Other	200	130
Total	4,627	4,610

Source: Organization for Economic Cooperation and Development (OECD), Paris). Provisional Oil Statistics by Quarters (4th Quarter 1972), 1972.

The Mineral Industry of Israel

By Donald E. Eilertsen [1]

Israel continued to strive for greater industrial and agricultural production and exports. The mineral industry, although small, is vital to the national economy. The official rate of monetary exchange in force since August 1971 was 4.2 Israel pounds (IS£) per U.S. dollar. Based on this value of exchange, Israel's gross national product (GNP) in current dollars was $6.937 billion in 1972 compared with $5.546 billion in 1971, and $4.511 billion in 1970—an increase of 25.1% in 1972 compared with an increase of 22.9% in 1971. Expressed in constant 1971 dollars, Israel's GNP was $6.072 billion in 1972, $5.546 billion in 1971, and $5.135 billion in 1970—an increase of 9.5% in 1972 compared with an increase of 8.0% in 1971.[2]

A few highlights of the mineral and associated industries in 1972 were as follows: Large deposits of copper, tungsten, and feldspar were discovered in the Sinai desert; an improved method for recovering uranium from Negev phosphate rock was developed; the cement industry made plans to expand greatly; reserves of oil in Israel were almost depleted and those in Sinai may last only 10 years; and despite cheap tanker freight rates around the African Continent to Europe, pipeline transportation of oil increased during the year.

Geologists from Hebrew University completed a comprehensive study of the geology of the Sinai Peninsula which was acquired in June 1967. Of the peninsula's 60,000 square kilometers, 14,000 in the southern portion are covered with Precambrian rocks. Ten geological maps of Sinai will be published in the near future and 20 others are in various stages of preparation. During the observations, interesting occurrences of tungsten, copper, and feldspar were discovered.[3]

Geological and structural maps of the Nahariyya area, northeast of Haifa, were published.[4]

A report was published describing the microfossil composition of samples of sand obtained at a depth of 1,500 meters from Gaza 1 well. The drill hole is located about 75 kilometers southwest of Tel Aviv.[5]

A summary of Israel's mining and petroleum laws was published.[6]

PRODUCTION

Production quantities were estimated for most of the mineral commodities produced in Israel in 1972 as shown in table 1. According to the available information, cement copper, elemental bromine, hydraulic cement, nitrogenous fertilizer, and superphosphate increased in production over that of 1971 while seven other commodities showed declines and seven others were steady. Of those which increased in production, cement copper and hydraulic cement increased for the fifth consecutive year; elemental bromine and nitrogenous fertilizer increased for the second year in a row; and superphosphate increased steadily for a number of years.

[1] Physical scientist, Division of Nonmetallic Minerals (retired).

[2] U.S. Embassy, Tel Aviv. State Department Airgram A–79, Mar. 15, 1973, p. 2.

[3] Joint Publications Research Service (JPRS). Tungsten, Copper, and Other Minerals Found in Sinai. Translations on Near East, No. 909. JPRS No. 58355, Feb. 28, 1973, pp. 46–47.

[4] Kafri, U. Geological Map of Israel, Sheets I–IV: Nahariyya. Israel Geol. Survey, Jerusalem, 1972, 10 pp.

[5] Martinotti, G. M. Miogypsina in the Gaza 1 Well, Coastal Plain, Israel. Israel Geol. Survey, Jerusalem. Bull. 57, January 1973, 7 pp.

[6] Ely, N. Summary of Mining and Petroleum Laws of the World (in Five Parts). Part 3. Near East and South Asia. BuMines, IC 8544, 1972, pp. 32–38.

Table 1.—Israel: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Copper (cement), 70–80 percent Cu, gross weight	metric tons	10,988	13,500	[e] 14,000
Iron and steel:				
Pig iron [e]		40	40	40
Crude steel [e]		120	120	120
NONMETALS				
Bromine:				
Elemental	metric tons	[2] 8,000	[e] 8,800	[e] 9,000
Compounds	do.	[2] 4,000	[e] 4,400	[e] 4,000
Cement, hydraulic		[r] 1,384	1,405	[e] 1,450
Clays, flint		100	27	NA
Fertilizer materials:				
Crude:				
Phosphatic, beneficiated		1,162	764	[e] 687
Potash (potassium chloride):				
Gross weight		909	[e] 1,000	[e] 1,000
Potassium oxide (K_2O) equivalent		554	[e] 610	[e] 600
Manufactured:				
Nitrogenous [e]		100	105	110
Phosphatic (superphosphate)		170	184	[e] 213
Potassic		2	3	[e] 2
Gypsum		70	80	[e] 80
Lime		130	180	[e] 180
Salt, marketed (mainly marine)		66	79	[e] 64
Sulfur [e]		8	10	10
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural, marketed	million cubic feet	4,752	4,400	[e] 3,920
Peat [e]		20	20	20
Petroleum:				
Crude [3]	thousand 42-gallon barrels	566	440	[e] 350
Refinery products:				
Gasoline	do.	4,072	[e] 6,067	NA
Kerosine and jet fuel	do.	4,263	[e] 4,767	NA
Distillate fuel oil	do.	7,288	[e] 8,667	NA
Residual fuel oil	do.	16,737	[e] 19,068	NA
Other	do.	2,471	[e] 3,033	NA
Refinery fuel and losses	do.	[e] 1,393	[e] 1,734	NA
Total	do.	36,224	[e] 43,336	NA

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

[1] In addition to the commodities listed, ball clay, fire clay, and a wide variety of crude construction materials, such as dimension stone, crushed rock, and sand and gravel, are produced, but available information is inadequate to make reliable estimates of output levels.

[2] Sales.

[3] Does not include Israeli production from occupied Sinai Peninsula oilfields.

TRADE

Exports and imports of mineral commodities during 1970 and 1971 are shown in tables 2 and 3. Similar data for 1972 were not available. In 1971, declines in exports and imports outnumbered advances.

Some exports which were up in quantity in 1971 were as follows: Aluminum and aluminum alloys, 1.6%; cement copper, 2.2%; bromine and bromine products, 4.5%; gem diamond, 19%, and petroleum refinery products, 18.3%. Some exports with very large declines were: Copper, lead, and zinc metal and their alloys, cement and clinker, crude clays, crude phosphate, and crude and partly refined petroleum.

The list of imports is long. Some of the large-quantity imports which showed gains were: Primary forms of steel, 43.5%; bars, angles, shapes, and sections, 5.9%; universal plates and sheets, 5.7%; cement 465%; gem diamond, 28.3%; nitrogenous fertilizers, 144%; and sulfur 70.9%.

Table 2.—Israel: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1970
METALS			
Aluminum metal, including alloys, all forms	r 2,810	2,856	West Germany 530; Nigeria 333; Belgium 258.
Copper:			
Concentrate (cement copper)	17,038	17,419	United Kingdom 5,602; Spain 5,232.
Metal, including alloys, all forms	r 4,263	2,479	Spain 739; West Germany 478; Belgium 413.
Iron and steel:			
Scrap	2,129	1,649	Greece 1,271; Belgium 102; Netherlands 96.
Semimanufactures:			
Tubes, pipes and fittings	r 11,249	10,709	Bulgaria 2,400; Romania 1,880; United States 1,510.
Others	r 356	126	United States 63; Uganda 22; Iran 15.
Lead metal, including alloys, all forms	817	239	United Kingdom 233.
Nickel metal, including alloys, all forms	r 463	466	West Germany 464.
Tin metal, including alloys, all forms	--	2	All to United Kingdom.
Zinc metal, including alloys, all forms	432	17	All to Spain.
Other base metals, including alloys, all forms	18	--	
NONMETALS			
Bromine and products	r 6,246	6,530	United Kingdom 3,047; United States 522; Italy 488; Hungary 470.
Cement and clinker	1,850	--	
Clays and clay products:			
Crude clays, n.e.s	8,160	3,969	West Germany 2,782; Switzerland 1,001.
Products, refractory	6,002	5,249	Greece 2,114; Iran 1,584; West Germany 1,314.
Diamond, gem not set or strung thousand carats	1,778	2,116	United States 705; Hong Kong 300; Belgium 218; Netherlands 217.
Fertilizer materials:			
Crude:			
Phosphatic	529,583	357,710	Italy 104,265; Romania 77,363; Austria 50,331.
Other	5,003	--	
Manufactured:			
Nitrogenous	179	435	Malta 300; Ethiopia 135.
Phosphatic	241,125	185,879	Yugoslavia 72,346; Austria 27,644; Romania 24,876.
Potassic—value, thousands	$197	$84	Cyprus $71; Kenya $13.
Other, including mixed	855,365	862,453	France 172,322; Japan 100,362; Belgium 93,941; United Kingdom 85,521.
Ammonia	4	26	Iran 15; Kenya 2.
Gypsum and plasters	--	79	Ivory Coast 35.
Precious and semiprecious stones, except diamond—value, thousands	$952	$2,720	United States $1,429; Switzerland $598; United Kingdom $275.
Salt and brine	191	111	Malaysia 105.
Sodium and potassium compounds, n.e.s	100	--	
Stone, dimension:			
Crude and partly worked	94	13	All to United States.
Worked	55	18	All to Republic of South Africa.
Sulfur:			
Elemental, all forms	47	67	Iran 40; Thailand 25.
Sulfuric acid	9	91	Ethiopia 63; Mauritius 15.
Other nonmetals, n.e.s., building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals, n.e.s	r 4,512	7,657	Nigeria 3,415; Ghana 2,139; Kenya 993.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	15	--	
Carbon black and gas carbon	r 5,663	4,077	Turkey 1,991; United States 1,148; Austria 480.
Hydrogen, helium, and rare gases	8	6	Iran 4; Turkey 2.
Petroleum:			
Crude and partly refined e thousand 42-gallon barrels	31,181	23,725	NA.
Refinery products:e			
Gasoline—do	--	1,443	NA.
Kerosine and jet fuel—do	20	100	NA.
Distillate fuel oil—do	1,354	2,499	NA.
Residual fuel oil—do	2,500	713	NA.
Other—do	218	87	NA.
Total—do	4,092	4,842	

e Estimate. r Revised. NA Not available.

Table 3.—Israel: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Bauxite and concentrate	21	403
Oxide and hydroxide	718	1,033
Metal, including alloys, all forms	r 17,688	17,577
Arsenic trioxides, pentoxides and acid	523	61
Chromium oxide, hydroxide and trioxide	86	67
Copper:		
Matte	84	6
Metal, including alloys, all forms	r 12,198	11,571
Gold metal, unworked or partly refined—value, thousands	$4,634	$7,262
Iron and steel:		
Scrap	739	598
Pig iron	19,267	10,147
Sponge iron, powder and shot	1,646	420
Spiegeleisen	297	113
Ferroalloys	1,351	1,190
Steel, primary forms	r 5,060	7,259
Semimanufactures	502,286	509,189
Lead:		
Oxides	744	1,001
Metal, including alloys, all forms	2,918	2,652
Magnesium metal, including alloys, all forms	288	45
Manganese oxide	r 270	363
Mercury—76-pound flasks	377	464
Molybdenum metal, including alloys, all forms	r 6	--
Nickel metal, including alloys, all forms	r 250	177
Platinum-group metals, including alloys, all forms—troy ounces	r 6,462	32
Silver metal, including alloys—value, thousands	$1,264	$1,735
Tin:		
Oxides—long tons	3	4
Metal, including alloys, all forms—do	r 558	999
Titanium oxide	2,469	2,667
Tungsten metal, including alloys, all forms	26	3
Zinc:		
Oxides and peroxides	r 597	668
Metal, including alloys, all forms	r 4,606	4,475
Other:		
Ore and slag	188	1,107
Oxides, hydroxides and peroxides of metals, n.e.s	242	244
Base metals, including alloys, all forms	154	61
NONMETALS		
Abrasives, n.e.s.:		
Pumice, emery, natural corundum, etc	r 251	344
Corundum, artificial	270	105
Asbestos	7,589	9,435
Barite and witherite	r 3,394	2,528
Boron materials, oxide and acid	r 334	417
Cement	r 34,588	195,437
Chalk	303	291
Clays and clay products (including refractory brick):		
Crude clays, kyanite, andalusite, etc	r 30,296	29,884
Products:		
Refractory (including nonclay brick)	r 2,259	4,111
Nonrefractory—thousand square meters	r 753	3,680
Cryolite and chiolite	88	55
Diamond:		
Gem not set or strung—thousand carats	r 3,883	4,982
Industrial—do	404	346
Diatomite and other infusorial earths	r 483	356
Feldspar and fluorspar	r 2,644	2,751
Fertilizer materials, manufactured:		
Nitrogenous	r 18,354	44,847
Other including mixed	34	96
Graphite, natural	48	93
Gypsum and plasters	151	251
Lime	2	7,971
Magnesite	1,108	586
Mica, all forms	95	91
Pigments mineral, including iron oxides	476	645
Precious and semiprecious stones, except diamond—value, thousands	r $1,652	$1,907
Sodium and potassium compounds, n.e.s	2,471	1,162
Stone, sand and gravel:		
Dimension stone, crude and partly worked:		
Calcareous	860	822

See footnotes at end of table.

Table 3.—Israel: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Dimension stone, crude and partly worked—Continued			
Other		240	26
Dolomite, chiefly refractory grade		42	206
Gravel and crushed rock		5,058	5,236
Quartz and quartzite		661	891
Sulfur:			
Elemental, all forms		r 41,339	70,660
Sulfuric acid		27,876	7,967
Talc, steatite, soapstone, and pyrophyllite		r 2,686	1,965
Other nonmetals, n.e.s.:			
Crude		r 503	842
Oxides, and hydroxides of magnesium, strontium and barium		109	109
Building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals, n.e.s.		r 50	45
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		r 132	274
Carbon black and gas carbon		r 2,235	2,289
Coal and coke, including briquets		r 8,635	8,630
Peat, including peat briquets and litter		360	198
Petroleum:			
Crude and partly refined e	thousand 42-gallon barrels	37,360	27,375
Refinery products:e			
Gasoline (including natural)	do	140	95
Kerosine and jet fuel	do	375	770
Distillate fuel oil	do	750	919
Residual fuel oil	do	2,220	--
Lubricants	do	74	76
Other	do	1,179	328
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		2,571	4,079

e Estimate. r Revised.

COMMODITY REVIEW

METALS

Copper.—Geologists discovered showings of copper in large deposits of diorite rocks in southern Sinai that extend over an area of approximately 250 square kilometers. The group also found indications of copper in deposits north of Sharm el-Sheikh which warrant further study.

Iron.—Small exposures of high-quality iron ore were discovered during an investigation of various mineral phenomena in the Menuha Ridge area in southern Negev. Exploration work is needed to determine the economic value of the deposits at depth.[7]

Magnesium.—The Dead Sea Periclase Co., organized in 1969 and equally owned by American and Austrian investors, expects to start producing magnesium oxide for refractories, and also salicyclic acid for aspirin by the middle of 1973. The magnesia will be produced from magnesium chloride obtained from Dead Sea brine. Initial capacities will be 55,000 tons of magnesia and 80,000 tons of salicylic acid annually; the entire production will be exported.[8]

Tungsten.—Occurrences of tungsten assaying well over 0.1% tungsten were discovered in central southern Sinai. According to superficial examinations, the occurrences extend over an area of approximately 40 square kilometers.

Uranium.—A new and promising technique for extracting uranium from Negev phosphate rock was developed by the Nuclear Research Center in Negev. The technique is based on Israel Mining Industries' (IMI) method, which recovers uranium as a byproduct from phosphate rock. In the IMI method, phosphate rock treated with hydrochloric acid leaves a residue containing 9.9% U_3O_8. In the new technique, this residue could be upgraded to 12% U_3O_8 by carbonate leaching, and in a subsequent stage, could be further upgraded to a concentrate containing 60 to 70% U_3O_8.[9]

[7] Shraga, M. G. Hydrothermal Iron Deposits of the Menuha Ridge. Israel J. of Earth Sci., v. 20, No. 2, 1971, 88 pp.
[8] U.S. Embassy, Tel Aviv. State Department Airgram A-213, June 29, 1972, p. 5.
[9] Joint Publications Research Service (JPRS). Uranium From Negev Phosphates. Translations on Near East, No. 909. JPRS No. 58355, Feb. 28, 1973, p. 47.

NONMETALS

Cement.—Nesher Cement Co., Ltd., is the only producer and supplier of cement in Israel. The company has plants in Haifa and Ramla and is planning to reopen a third plant in 1973 and construct a fourth plant in 1975. With the new facilities, the company expects to produce 2.5 million tons of cement annually.[10]

Feldspar.—A "mountain" of high-quality feldspar several kilometers square was discovered in southeastern Sinai, about one-half hour drive from Sharm el-Sheikh. Feldspar is used in glassmaking, pottery, porcelain, tile, and other products.

Fertilizers.—Negev Phosphates, Ltd., is no longer a subsidiary of Chemicals & Phosphates, Ltd.; the separation was made retroactive to March 31, 1971. Negev mines phosphate rock at Oron and Little Crater. The Oron facility also has a calciner and a large roaster. The calciner removes fluoride from the mined rock and the remaining product is used as an additive to cattle feeds. The roaster, installed about 5 years ago, was designed to upgrade phosphate rock from 28% P_2O_5 to 35% P_2O_5, but the venture proved too costly to operate and has been recommended for closure. Little Crater phosphate rock contains 31% P_2O_5 and is exported without further treatment.[11]

Arad Chemical Industries Ltd.'s new phosphoric acid plant was forced to shutdown during the breaking-in stage to repair two hydrochloric acid reactors. The hope was to resume operations on a limited basis by November. The two reactors were designed to produce 380,000 tons of hydrochloric acid annually, which in turn would be used to make 166,000 tons of phosphoric acid that would have a value of $7.1 million. Production of phosphoric acid is now scheduled to reach 40,000 tons in 1973 and to gradually increase to 130,000 tons by 1978 if operational problems are overcome.[12]

Israel Mining Industries' new 110,000-ton-per-year potassium nitrate plant came into full production. Briefly, potassium nitrate is obtained as an insoluble product in the reaction of potassium chloride with nitric acid in aqueous isoamyl alcohol.[13]

MINERAL FUELS

Natural Gas.—Reserves of natural gas in Israel were estimated at 29 billion cubic feet.[14]

Petroleum.—Production of crude oil in the Heletz Field dropped from 435,000 barrels in 1971 to 344,000 barrels in 1972; the remaining reserves may be depleted in 1973.

Israel obtained about 38 million barrels of crude oil from fields at Abu Rodeis in Sinai in 1972; production may reach 44 million barrels in 1973. The life of these reserves has been estimated at 10 years.

Eilat-Ashkelon Pipeline Co. (EAP) reportedly transported 25.5 million metric tons (approximately 7.3 barrels per ton) of crude oil through its 42-inch pipeline, between Eilat and Ashkelon, in 1972, compared with 19.5 million tons in 1971 and 11 million tons in 1970, the first year of operation. The pipeline capacity was 30 million tons in 1972 and is expected to reach 45 million tons in 1973 as a result of improvements such as installation of additional pumping stations, construction of a fourth loading terminal at Ashkelon, and greatly increasing storage space. The maximum planned capacity is 60 million tons per year. Although the pipeline operated at a loss since it began in 1970, most of these losses were offset by increased revenue from EAP's tanker business. Tanker freight rates decreased sharply in 1972; it was cheaper to ship oil by tanker around the African Continent to Europe than to use the pipeline.

Israeli oil circles feel sure that the pipeline business will increase as the world energy crisis develops. Moreover, the pipeline is strategically important to Israel since it transports imported oil to meet the country's requirements and carries Sinai oil to the Mediterranean for export or refining. In 1972, 502 tankers loaded oil at Ashkelon compared with 389 in 1971 and 176 in 1970. Israel expects to increase imports of crude oil greatly in the next decade to meet domestic demands and planned refining capacity of 15 million tons by 1980.[15]

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[10] Page 6 of work cited in footnote 8.
[11] Pages 4–5 of work cited in footnote 8.
[12] U.S. Embassy, Tel Aviv. State Department Airgram A–385, Nov. 24, 1972, 2 pp.
[13] European Chemical News. Israel Exports Potassium Nitrate. V. 22, No. 543, July 28, 1972, p. 6.
[14] U.S. Embassy, Tel Aviv. State Department Airgram A–252, July 20, 1972, 2 pp.
[15] U.S. Embassy, Tel Aviv. State Department Airgram A–60, Feb. 24, 1973, 3 pp.

The Mineral Industry of Italy

By Andrew Kuklis [1]

The recovery of the Italian economy was slow in developing, although there were signs that the general recessionary tendencies of the past few years have changed to modest expansionary trends. Exports continued to show good growth in 1972. Imports increased more rapidly than exports as domestic demand showed signs of strengthening. Business attitudes for the short-term outlook remain clouded because of rising costs, declining profit, and declining private investment. At yearend, labor contract settlements in the construction and metal-mechanical industries should provide wage stability with increasing hopes that industrial production will experience a higher and more sustained rate of expansion.

The Italian gross national product (GNP) rose more than 3% to $74.6 billion, an improvement over the growth rate in 1971.[2] Agriculture and related sectors were a weak spot in the economy because of adverse weather conditions. The decision of the Italian Government to "float" the lira independently of other European countries resulted in an effective reevaluation of these currencies against the lira in excess of 10%. The cheaper lira was expected to improve the marketing Italian manufactured products in foreign countries but increase inflation at home.

Investments in the nation's industry by the Government totaled $1,719 million, an increase of 24% over that of 1971. The mineral and mineral-related industries through various government agencies received $862 million, or over 50% of the total amount budgeted for investments.

Work hours lost during the last half of 1972 rose significantly because labor contracts for the nation's largest segment of economy expired. Work hours lost during 1972 owing to strikes, absenteeism, etc. totaled 134 million, an increase of nearly 30% over that of 1971.

PRODUCTION

The Italian mining industry, including oil and natural gas, comprises a small sector of the nation's economy, accounting for less than 1% of the GNP. The gross value of mineral production was $472.0 million, nearly 3% over that of 1971.

Principal gains in mineral production volume compared with 1971 were cadmium, lead, asbestos, natural gas, and petroleum products. Despite weak prices, sulfur ore rose significantly. There were declines in production of bauxite, iron ore, copper, mercury, pyrite, coal, lignite, and crude petroleum.

Performance of the different sectors in the mining industry are shown in the following tabulation:

Sector	Index (1966 = 100)	
	1971 r	1972
Metallic minerals	89.4	83.6
Nonmetallic minerals	121.7	128.7
Marble, building stone	122.8	126.8
Solid fuels	93.0	57.5
Petroleum and natural gas	135.6	141.1
Total	116.4	118.6

r Revised.

[1] Mining engineer, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from Italian Lire (IL) to U.S. dollars at the rate of IL625 = $1.00.

Table 1.—Italy: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Bauxite	224,703	190,847	96,528
Alumina	r 313,300	262,608	206,328
Metal:			
Primary	146,744	136,413	149,459
Secondary	154,000	150,000	164,000
Antimony, mine output, metal content	1,299	1,175	1,200
Cadmium, smelter output	425	356	416
Copper:			
Mine output, metal content	2,113	1,540	1,010
Precipitate, metal content	2,000	--	--
Metal, secondary only	13,700	9,500	8,000
Iron and steel:			
Iron ore and concentrate [1] thousand tons	757	683	616
Roasted pyrite do	NA	NA	NA
Pig iron do	r 8,332	8,536	9,415
Ferroalloys:			
Blast furnace do	22	18	31
Electric furnace do	175	174	171
Crude steel do	17,277	17,452	19,815
Steel semimanufactures: [2]			
Hot rolled:			
Wire rod do	887	933	1,030
Sections do	5,324	5,075	5,596
Plates and sheets do	5,534	6,007	6,613
Strip do	999	854	1,041
Railway track material do	142	190	185
Ingots, semis and solids for tubes do	1,106	1,082	1,129
Other do	772	724	861
Total hot rolled do	14,764	14,865	16,455
Castings and forgings do	361	328	281
Cold-rolled sheet do	2,941	3,171	3,740
Lead:			
Mine output, metal content	35,200	31,600	33,550
Metal:			
Primary	54,288	48,392	50,581
Secondary	25,000	27,400	e 27,000
Magnesium metal, primary	7,580	7,707	7,561
Manganese ore, gross weight	50,091	30,604	25,637
Mercury metal 76-pound flasks	44,469	42,613	41,800
Silicon, elemental	20,220	22,190	21,250
Silver metal thousand troy ounces	1,063	1,236	2,154
Zinc:			
Mine output, metal content	110,700	105,900	102,580
Metal, primary	142,082	139,823	155,759
NONMETALS			
Asbestos	118,518	119,568	132,778
Barite	223,061	201,526	181,768
Cement, hydraulic thousand tons	r 33,076	31,793	33,459
Clays, crude:			
Bentonite do	321	296	273
Fire do	322	294	e 285
For cement do	4,289	NA	NA
For common brick do	27,248	NA	NA
Fuller's earth do	73	75	75
Kaolin do	101	96	69
Kaolinitic earth do	10	15	(4)
Diatomite	59,220	e 60,000	e 60,000
Feldspar	176,905	192,498	175,617
Fertilizer materials:			
Crude potassium salts, natural thousand tons	1,894	1,785	1,803
Manufactured, gross weight:			
Nitrogenous do	2,972	2,932	2,945
Phosphatic do	1,406	1,269	1,213
Potassic do	365	280	281
Mixed and unspecified do	1,762	1,582	1,633
Fluorspar, all grades	289,266	288,243	277,495
Graphite, all grades	2,088	636	773
Gypsum (except dimension stone use) thousand tons	r 3,350	e 3,500	e 3,500
Lime (quicklime and hydrated) do	r e 5,000	4,200	e 4,000
Pumice and related materials:			
Pumice and pumaceous lapilli do	770	e 770	e 770
Pozollan do	4,258	e 4,300	e 4,300
Pyrite, all kinds:			
Gross weight do	1,518	1,504	1,382
Sulfur content do	683	646	594

See footnotes at end of table.

Table 1.—Italy: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NONMETALS—Continued			
Salt:			
Marine, crude—thousand tons	1,497	1,170	719
Other, including brine—do	2,871	3,391	3,360
Sand and gravel:			
Silica sand—do	4,829	NA	NA
Volcanic sand—do	143	NA	NA
Other sand and gravel—do	64,964	NA	NA
Stone:			
Dimension stone:			
Calcareous:			
Alabaster and onyx—do	8	NA	NA
Gypsum for cutting—do	120	NA	NA
Limestone—do	163	NA	NA
Marble in blocks:			
White—do	848	NA	e 1,300
Colored—do	1,129	NA	
Lime schist—do	48	NA	NA
Travertine—do	423	NA	NA
Tufa, calcareous—do	1,600	NA	NA
Other:			
Breccia—do	11	NA	NA
Diorite—do	10	NA	NA
Gneiss—do	r 153	NA	NA
Granite—do	57	NA	NA
Lava, basalt and trachyte—do	115	NA	NA
Porphyry—do	184	NA	NA
Quartz and quartzite—do	10	NA	NA
Sandstone—do	159	NA	NA
Serpentine—do	304	NA	NA
Slate—do	65	NA	NA
Syenite—do	5	NA	NA
Tuff volcanic—do	289	NA	NA
Crushed and broken:			
Calcareous:			
Dolomite—do	1,189	NA	NA
Limestone—do	41,908	NA	NA
Marble, white and colored—do	1,637	NA	NA
Marl for cement—do	6,439	6,813	NA
Travertine—do	373	NA	NA
Tuff—do	4,104	NA	NA
Strontium minerals	845	835	735
Sulfur, native:			
Ore	354,218	573,789	830,279
Concentrate (85% to 90% sulfur)	54,720	52,829	51,085
Fused in briquets	1,681	15,669	33,564
Talc and related materials	154,818	138,741	148,422
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bituminous rock, natural:			
For distillation	111,199	58,648	207,384
For paving	93,455	109,126	
Carbon black	123,559	125,143	1,307,847
Coal:			
Subbituminous (sulcis coal)—thousand tons	295	256	151
Lignite—do	1,393	1,326	839
Coke:			
Metallurgical—do	7,171	7,068	7,555
Gashouse—do	125	113	47
Gas, natural, marketed production—million cubic feet	463,953	472,845	501,009
Petroleum:			
Crude oil—thousand 42-gallon barrels	9,575	9,354	7,850
Refinery products:			
Gasoline—do	109,066	112,172	118,753
Jet fuel—do	12,128	14,778	16,633
Kerosine—do	25,622	32,081	32,133
Distillate fuel oil—do	171,222	177,093	187,843
Residual fuel oil—do	363,683	359,316	368,972
Lubricants—do	4,704	3,818	3,480
Other—do	131,765	128,651	133,214
Refinery fuel and losses—do	64,932	63,967	64,666
Total—do	883,122	891,876	925,694

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Excluding pelletized iron oxide derived from pyrite.

[2] Categories of steel semimanufactures revised from those used in previous editions, with resulting differences in quantities reported.

[3] Includes kaolinitic earth.

[4] Included with fire clay.

TRADE

Italy is self-sufficient in and, in some cases, a net exporter of, antimony, asbestos, fluorspar, marble, mercury, potash, and rock salt. For all other minerals, the nation is a net importer and was expected to remain as such in the future as mineral-processing plants increase their raw material requirements.

In 1972, the increase in exports and imports that characterize Italy's foreign trade was reflected in mineral commodity transactions. As compared with 1971, the value of exports increased $292.7 million, and that of imports rose $568.9 million.

Exports of mineral commodities in 1972 were valued at nearly $2.3 billion, or over 12% of total exports. Of the total value of mineral commodities exported, metal and minerals made up over 63%.

Imports of mineral commodities were valued over $5.3 billion, or 27% of total imports. Mineral fuels accounted for over 50% of total value of mineral commodities imported.

Table 2.—Italy: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite	2,888	2,607	Switzerland 2,607.
Oxide and hydroxide	10,925	5,574	Austria 3,888; Switzerland 655; Bulgaria 539.
Metal, including alloys:			
Scrap	77	67	West Germany 44; France 18; Canada 5.
Unwrought	5,007	12,938	West Germany 4,078; Argentina 3,445; France 2,751.
Semimanufactures	41,495	44,953	France 8,431; West Germany 6,621; United States 3,876; United Kingdom 3,739.
Antimony	1,014	607	West Germany 464; Netherlands 85; France 20.
Arsenic trioxide, pentoxide, and acids	25	20	Yugoslavia 19.
Bismuth	19	16	Netherlands 7; France 5.
Cadmium metal, including alloys, all forms	83	85	United States 29; Netherlands 19.
Chrome, chromite	245	685	Yugoslavia 338; Austria 319.
Cobalt	(1)	2	United Kingdom 2.
Copper:			
Ore and concentrate	9,549	5,802	Spain 4,492; East Germany 941; West Germany 368.
Matte	5	143	West Germany 59; Portugal 50; Netherlands 25.
Metal, including alloys:			
Scrap	1,056	1,217	West Germany 812; France 136.
Unwrought	5,880	4,375	West Germany 4,079; Netherlands 127.
Semimanufactures	20,856	30,936	West Germany 7,184; France 3,883; Romania 3,295.
Iron and steel:			
Ore and concentrate	77	64	Switzerland 45; West Germany 19.
Roasted pyrite, thousand tons	439	287	Austria 242.
Metal:			
Scrap, do	14	9	France 4; Netherlands 3.
Pig iron including cast iron, spiegeleisen powder and shot, do	9	7	France 1; Switzerland 1.
Ferroalloys, do	17	16	West Germany 8.
Steel, primary forms, do	223	353	United States 97; Argentina 70; France 46.
Semimanufactures:			
Bars, rods, angles, shapes and sections, do	561	1,115	West Germany 432; France 150; Switzerland 73.
Universals, plates, and sheets, do	439	948	United States 292; West Germany 156; France 115.
Hoop and strip, do	71	79	United States 16; Yugoslavia 10; France 9.
Rails and accessories, do	14	7	Switzerland 4; Turkey 1.
Wire, do	19	27	Algeria 5; Poland 3; Yugoslavia 3.
Tubes, pipes, and fittings, do	412	592	West Germany 58; France 56; Libya 56; U.S.S.R. 53.
Castings and forgings, unworked, do	63	63	France 13; West Germany 8; Switzerland 4.

See footnotes at end of table.

Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Lead:			
Ore and concentrate	13,369	14,813	Greece 5,959; Austria 5,016; Tunisia 1,600.
Metal, including alloys:			
Scrap	3,360	1,888	Belgium-Luxembourg 1,622; United Kingdom 161; West Germany 105.
Unwrought	r 343	746	Yugoslavia 361; Greece 155; Switzerland 142.
Semimanufactures	r 100	167	Libya 59.
Magnesium metal, including alloys:			
Scrap	75	13	West Germany 8; Mexico 5.
Unwrought	3,815	4,399	West Germany 3,470; Belgium-Luxembourg 718; Austria 110.
Semimanufactures	135	65	France 37; West Germany 10.
Manganese:			
Ore and concentrate	5	458	Yugoslavia 327; United States 105; Austria 24.
Metal all forms	15	6	Belgium-Luxembourg 3; Lebanon 3.
Mercury—76-pound flasks	15,490	15,206	West Germany 5,300; East Germany 2,102; Romania 1,960.
Nickel:			
Metal, including alloys:			
Unwrought including alloys	167	307	Netherlands 244; West Germany 24.
Semimanufactures	632	961	Spain 291; Morocco 250; West Germany 68.
Platinum-group metals and silver, including alloys:			
Platinum group thousand troy ounces	64	25	West Germany 17; Romania 3.
Silver—do	r 948	877	Switzerland 662; West Germany 99.
Selenium, elemental—kilograms	183	214	Spain 109; Portugal 99; Brazil 6.
Silicon, elemental	6,256	7,926	West Germany 3,733; United Kingdom 1,862; United States 600.
Tin metal, all forms—long tons	397	281	France 129; West Germany 88; Denmark 56.
Titanium oxides	r 19,199	19,301	Poland 3,848; Hungary 2,660; West Germany 2,237.
Tungsten:			
Ore and concentrate	3	3	All to France.
Metal, including alloys, all forms	48	23	West Germany 10; France 6; Belgium-Luxembourg 4.
Zinc:			
Ore and concentrate:	11,861	7,132	Yugoslavia 4,495; France 2,238; Austria 396.
Metal, including alloys:			
Blue powder	1,864	484	Yugoslavia 224; Switzerland 120; West Germany 92.
Unwrought	1,993	216	France 72; Greece 50; Netherlands 23.
Semimanufactures	269	304	Switzerland 89; France 54; Yugoslavia 36.
Other:			
Ash and residue containing nonferrous metals—thousand tons	r 23	21	West Germany 10; Netherlands 4; Belgium-Luxembourg 3.
Metal, containing alloys, all forms	r 144	80	France 29; Switzerland 16.
NONMETALS			
Abrasives, natural n.e.s.:			
Pumice, emery, corundum, etc	316,628	383,973	United States 180,059; United Kingdom 111,617; Algeria 43,869.
Dust and powder of precious and semiprecious stones—kilograms	62	10	All to Austria.
Grinding and polishing wheels and stones	6,363	7,326	France 1,594; West Germany 869; Romania 677.
Asbestos	48,662	48,971	West Germany 22,223; France 9,873; Poland 3,887.
Barite and witherite	53,722	35,046	United States 19,900; Netherlands 8,450; West Germany 2,593.
Cement	130,301	304,528	Yugoslavia 122,929; Algeria 57,781; Switzerland 32,943.
Chalk	807	1,328	Switzerland 856; Yugoslavia 427; Greece 20.
Clays and products (including nonclay bricks):			
Crude n.e.s.:			
Bentonite	13,003	9,543	Libya 3,200; France 1,776; Spain 1,682.
Kaolin	1,679	1,196	Greece 792; Uganda 118; France 64.
Other	36,280	31,470	France 29,018; Greece 1,178; Switzerland 1,076.
Products:			
Refractory (including nonclay bricks)	56,524	55,446	West Germany 8,378; Switzerland 6,098; Yugoslavia 5,922.
Nonrefractory	r 754,225	1,219,470	Yugoslavia 555,577; France 164,777; West Germany 139,856.

See footnotes at end of table.

Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Diamond:			
Gem not set or strung value, thousands	r $172	$478	Venezuela $318; United Kingdom $158.
Industrial carats	15,000	--	
Diatomite and other infusorial earths	1,499	1,410	Austria 233; Switzerland 156; Israel 144.
Feldspar	25,890	26,813	West Germany 9,807; Switzerland 3,031; Netherlands 2,830.
Fertilizer:			
Crude	1,620	2,410	France 2,255; Netherlands 95.
Manufactured:			
Nitrogenous thousand tons	697	877	Arab Republic of Egypt 256; Turkey 165; People's Republic of China 119.
Phosphatic do	8	4	Libya 2; Switzerland 2.
Potassic do	46	6	Morocco 2; Somali 2; United States 2.
Other do	398	339	Turkey 77; France 29; Cuba 26; Zambia 26.
Ammonia	33,218	8,011	Greece 4,261; Israel 3,521.
Fluorspar	116,539	155,023	United States 114,954; Norway 16,650; Netherlands 13,540.
Graphite	1,815	1,579	France 1,299; Spain 52; United Kingdom 43.
Gypsum and plaster	34,211	42,845	Yugoslavia 27,191; Switzerland 10,337; France 2,057.
Kyanite	533	948	West Germany 945.
Lime	49,700	70,937	Switzerland 24,864; Libya 24,682; Yugoslavia 19,969.
Magnesite	58	7	Tunisia 2; United Kingom 1; United States 1.
Mica:			
Crude, including splittings and waste	439	249	Nigeria 95; Iran 38; Arab Republic of Egypt 35.
Worked, including agglomerated splittings	41	18	Yugoslavia 5; Sweden 4; Belgium-Luxembourg 3.
Precious and semiprecious stones, except diamond:			
Natural kilograms	r 50	6,938	Switzerland 4,140; West Germany 2,737.
Manufactured do	455	393	United Kingdom 115; Switzerland 104.
Pyrite (gross weight)	19,386	26,896	Switzerland 25,141; West Germany 769; Austria 417.
Salt, all forms	226,600	160,100	United Kingdom 68,840; Norway 32,830; Netherlands 25,762.
Sodium compounds, n.e.s	230,510	275,374	U.S.S.R. 65,385; Yugoslavia 35,605; Netherlands 20,514.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	273,611	174,805	West Germany 66,733; France 42,411; Lebanon 18,474.
Slate	4,951	3,183	Switzerland 1,645; West Germany 792; France 284.
Other	40,451	52,829	Switzerland 17,269; West Germany 16,894; Austria 7,387.
Worked, all forms	519,996	608,615	West Germany 311,194; France 116,210; United States 76,988.
Dolomite, all grades	20,259	21,417	Switzerland 7,387; Argentina 2,715; Austria 2,664.
Gravel and crushed rock	441,187	492,556	West Germany 118,007; Switzerland 84,185; France 63,512.
Limestone (except dimension)	3,420	819	Switzerland 690; United Kingdom 103.
Quartz and quartzite	39,948	32,537	France 16,225; Switzerland 12,472; West Germany 1,510.
Sand, excluding metal bearing	401,009	523,467	Switzerland 497,746; Yugoslavia 21,089; France 3,459.
Sulfur:			
Elemental, all forms	5,971	4,328	Yugoslavia 2,823; Libya 703; Israel 286.
Sulfuric acid	83,828	10,352	Israel 5,117; Turkey 2,308; Tunisia 2,254.
Talc, steatite and soapstone	55,516	48,296	West Germany 15,015; United Kingdom 8,376; United States 6,229.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,573	903	Malta 343; Senegal 220; Yugoslavia 118.
Carbon black	40,392	27,879	Turkey 7,203; Austria 4,630; Greece 2,881.
Coal, excluding briquets, all grades	r 10,485	13,644	Romania 10,700; Yugoslavia 1,287; Switzerland 450.
Coke and semicoke	379,911	408,664	Romania 149,437; Yugoslavia 99,835; France 47,142.

See footnotes at end of table.

Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	50,354	56,602	Belgium-Luxembourg 10,617; France 9,163; United Kingdom 8,789.
Kerosine and jet, do	21,243	21,995	Ship stores 5,065; Netherlands 2,409; United States 2,229; Greece 2,063.
Distillate fuel oil, do	76,778	70,706	France 17,464; West Germany 12,443; Netherlands 9,720.
Residual fuel oil, do	85,121	85,434	United States 28,511; Ship stores 26,380; United Kingdom 3,990.
Liquefied petroleum gases, do	r 3,565	3,620	Arab Republic of Egypt 860; Algeria 669; Lebanon 396.
Lubricants, do	r 1,736	2,042	Switzerland 360; Algeria 301; Netherlands 235.
Bitumen and other, do	132	64	Tunisia 20; Libya 11; Malta 10.
Mineral jelly and wax, do	16	18	NA.
Other, do	r 1,453	1,574	Austria 579; Switzerland 320; Algeria 314.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	15,712	24,785	Netherlands 13,064; Yugoslavia 6,234; Greece 2,524.

r Revised. NA Not available.
1 Less than 1 ton.

Table 3.—Italy: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite	723,785	548,127	Yugoslavia 236,095; Guinea 126,837; Sierra Leone 78,153.
Oxide and hydroxide	71,767	69,765	France 44,728; Greece 13,650; West Germany 3,182; United States 3,150.
Metals, including alloys:			
Scrap	36,568	31,220	France 14,032; West Germany 6,748; Switzerland 2,239.
Unwrought	166,955	155,809	France 31,890; Yugoslavia 20,459; Greece 15,171.
Semimanufactures	37,397	29,285	France 10,185; West Germany 9,822; United States 4,062.
Antimony:			
Ore and concentrate	971	855	Morocco 568; Thailand 287.
Metal, including alloys, all forms	166	140	Belgium-Luxembourg 81; West Germany 25; Yugoslavia 20.
Arsenic:			
Trioxide, pentoxide and acids	1,408	1,386	France 1,014; People's Republic of China 195; West Germany 55.
Metal, including alloys, all forms	78	96	Sweden 71; Canada 7; Switzerland 7; United States 6.
Beryllium:			
Oxide, kilograms	2,000	NA	
Metal, including alloys, all forms, do	3,101	3,410	West Germany 3,410.
Bismuth metal, including alloys, all forms	181	186	United Kingdom 77; West Germany 46; France 26.
Cadmium	40	29	West Germany 7; Republic of South Africa 6; Netherlands 5.
Chromium:			
Chromite	142,762	201,772	Albania 53,101; U.S.S.R. 50,815; Turkey 45,193.
Oxide and hydroxide	321	1,532	West Germany 1,050; Poland 155; Hungary 150.
Metal, including alloys, all forms	113	73	France 43; United Kingdom 21.
Cobalt:			
Oxide and hydroxide	299	306	Belgium-Luxembourg 280; West Germany 20.
Metals, including alloys, all forms	337	316	Belgium-Luxembourg 195; France 26; United Kingdom 22.
Copper:			
Ore and concentrate	NA	NA	
Matte	1,106	1,646	United States 490; Chile 312; Belgium-Luxembourg 200; Zambia 200.
Metal, including alloys:			
Scrap	47,512	46,228	West Germany 13,879; France 12,955; United States 8,692.
Unwrought	295,238	288,179	Chile 64,867; Zambia 62,993; Zaire 43,418.
Semimanufactures	16,483	11,869	West Germany 4,489; France 2,333; Netherlands 1,236.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Gallium, indium, and thallium_kilograms	662	408	United Kingdom 181; United States 152.
Germanium_____do____	5,867	2,777	Belgium-Luxembourg 2,208; United Kingdom 240.
Iron and steel:			
Ore and concentrate__thousand tons__	10,856	11,246	Liberia 2,709; Australia 1,519; Venezuela 1,387; Canada 1,323.
Roasted pyrites_____do____	1	(1)	All from West Germany.
Metal:			
Scrap_____do____	5,156	5,481	France 2,264; West Germany 1,885; United States 535.
Pig iron, including cast iron and speigeleisen_____do____	929	749	West Germany 280; U.S.S.R. 115; Algeria 89.
Sponge iron, powder and shot do____	24	14	France 7; Sweden 5.
Ferroalloys:			
Ferromanganese_____do____	129	117	France 62; Republic of South Africa 18; Belgium-Luxembourg 15.
Other_____do____	76	83	France 25; Norway 17; Yugoslavia 9.
Steel, primary forms_____do____	860	1,975	West Germany 400; Belgium-Luxembourg 222; France 221.
Semimanufactures:			
Bars, rods, angles, shapes, and sections_____do____	760	504	France 128; Belgium-Luxembourg 93; West Germany 92.
Universals, plates, and sheets do____	1,464	1,179	France 259; West Germany 230; Belgium-Luxembourg 210.
Hoop and strip_____do____	112	133	France 43; Belgium-Luxembourg 27; West Germany 24.
Rails and accessories__do____	110	108	France 62; West Germany 37; Belgium-Luxembourg 6.
Wire_____do____	56	53	Belgium-Luxembourg 23; France 8; West Germany 8.
Tubes, pipes, and fittings do____	228	173	West Germany 78; France 32; Yugoslavia 19.
Castings and forgings_do____	29	26	West Germany 13; France 5.
Lead:			
Ore and concentrate_____	31,934	28,165	Canada 12,683; Greece 9,118; Ireland 6,184.
Ash and residue containing lead_____	7,027	10,300	Hungary 4,530; Jordan 2,683; Sweden 1,500.
Metal, including alloys:			
Scrap_____	37,076	19,884	France 7,021; Switzerland 5,582; West Germany 4,941.
Unwrought_____	121,056	127,119	West Germany 30,145; Mexico 20,100; Republic of South Africa 19,304.
Semimanufactures_____	767	378	West Germany 163; France 156.
Magnesium metal, including alloys:			
Scrap_____	648	457	West Germany 371; United Kingdom 40; Austria 31.
Unwrought_____	410	1,042	United States 755; West Germany 77; Netherlands 55.
Semimanufactures_____	70	90	West Germany 31; United Kingdom 19; Switzerland 13.
Manganese:			
Ore and concentrate_____	184,385	290,561	Republic of South Africa 123,679; Brazil 70,701; India 34,274.
Oxides_____	2,803	2,425	Japan 1,197; West Germany 867; Belgium-Luxembourg 287.
Metal, all forms_____	1,855	1,503	France 1,050; Republic of South Africa 249; Japan 102.
Mercury_____76-pound flasks__	4,989	3,875	Yugoslavia 2,017; Mexico 1,126.
Molybdenum:			
Ore and concentrate_____	4,648	3,769	Netherlands 1,495; Canada 1,011; United States 824.
Metal, including alloys, all forms_____	48	43	Austria 16; France 15.
Nickel:			
Matte, speiss, and similar materials____	5,185	2,611	Canada 1,955; Cuba 383; United Kingdom 107.
Metal, including alloys:			
Scrap_____	430	739	United States 442; Canada 105; France 88.
Unwrought_____	12,798	14,169	Canada 4,710; Norway 2,459; United Kingdom 1,602.
Semimanufactures_____	2,847	2,488	West Germany 859; United Kingdom 586; United States 433.
Platinum-group metals and silver:			
Metals, including alloys:			
Platinum group thousand troy ounces__	127	372	West Germany 249; United Kingdom 58.
Silver_____do____	43,709	37,713	West Germany 10,530; Oman 8,038; United Kingdom 5,790.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Selenium, elemental	18	21	United Kingdom 6; West Germany 6; Sweden 3.
Silicon, elemental	542	498	Yugoslavia 332; France 93; Norway 49.
Tin:			
Metal, including alloys:			
Scrap—long tons	47	39	United States 10; Panama 7; Malaysia 5.
Unwrought—do	7,395	7,151	Malaysia 5,274; Thailand 494; Indonesia 390.
Semimanufactures—do	103	99	West Germany 65; Belgium-Luxembourg 8; France 6.
Tantalum, metal	6	9	Belgium-Luxembourg 4; United States 3.
Titanium:			
Ore and concentrate	107,519	107,785	Norway 101,526; Australia 5,317; Ceylon 467.
Oxides	33,103	35,397	West Germany 17,562; France 5,382; Netherlands 4,506.
Metal, including alloys, all forms	899	822	United States 554; West Germany 114; Japan 107.
Tungsten:			
Ore and concentrate	138	115	Netherlands 50; Portugal 39; Brazil 22.
Metal, including alloys, all forms	67	62	West Germany 18; France 12; United States 12.
Uranium and thorium metal—kilograms	42,953	19,435	United Kingdom 14,655; United States 4,775.
Zinc:			
Ore and concentrate	103,563	107,324	Ireland 17,049; Peru 14,953; Greece 12,170.
Ash and residue containing zinc	10,463	10,019	West Germany 4,608; Switzerland 3,562; France 430.
Metal, including alloys:			
Scrap	3,758	3,585	West Germany 1,183; France 1,160; Switzerland 1,065.
Blue powder	3,746	3,912	Belgium-Luxembourg 3,691; France 78; Norway 60.
Unwrought	56,289	40,044	West Germany 9,716; Yugoslavia 7,404; Belgium-Luxembourg 5,925.
Semimanufactures	3,782	3,364	Belgium-Luxembourg 2,454; Canada 259; West Germany 258.
Zirconium:			
Ore and concentrate	35,290	17,380	Australia 16,880; West Germany 270; Netherlands 61.
Oxides	550	504	West Germany 320; United States 59; United Kingdom 56.
Metals, including alloys, all forms—kilograms	7,293	6,843	United States 3,055; France 2,161; United Kingdom 975.
Other:			
Ore and concentrate	r 1,492	466	France 160; Canada 157; People's Republic of China 114.
Ash and residue containing nonferrous metals	r 29,713	30,274	Canada 20,883; Yugoslavia 2,967; Austria 2,736.
Base metals, including alloys	r 36	67	West Germany 35; Sweden 16; Finland 11.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, etc	2,805	2,755	West Germany 1,170; Greece 635; Republic of South Africa 415.
Dust and powder of precious and semi-precious stones—kilograms	367	278	Zaire 86; Netherlands 57; Switzerland 52.
Grinding and polishing wheels and stones	4,587	4,264	West Germany 1,061; Austria 906; United Kingdom 714.
Asbestos	62,402	64,257	Republic of South Africa 33,507; Canada 14,881; U.S.S.R. 13,376.
Barite and witherite	24,772	19,745	Spain 9,669; People's Republic of China 6,500; France 3,358.
Borates, crude, natural	126,667	103,332	Turkey 84,757; United States 14,080; West Germany 3,863.
Cement	216,629	58,195	France 46,303; Greece 5,347; Tunisia 3,182.
Chalk	7,532	8,325	France 7,325; Austria 759; West Germany 189.
Clays and clay products:			
Clay:			
Bentonite	14,528	25,595	Greece 18,529; United States 2,095; West Germany 1,903.
Kaolin	562,457	463,789	United Kingdom 217,071; United States 155,360; West Germany 25,414.
Other	792,357	1,035,021	France 306,351; West Germany 210,352; United Kingdom 97,148.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Clays and clay products—Continued			
Products:			
Refractory	119,937	129,560	West Germany 46,904; Austria 18,249; France 15,050; United States 15,002.
Nonrefractory	20,148	22,462	West Germany 19,037; Switzerland 2,134.
Cryolite and chiolite	639	627	Denmark 575; West Germany 52.
Diamond:			
Gem, not set or strung--troy ounces	129	1,093	Belgium-Luxembourg 868; West Germany 193.
Industrial--do	1,318	643	Belgium-Luxembourg 257; United Kingdom 129.
Diatomite and other infusorial earths	6,092	3,865	West Germany 1,336; France 910; Hungary 720.
Feldspar	19,270	14,790	Portugal 4,070; West Germany 3,952; Republic of South Africa 2,176.
Fertilizer materials:			
Crude:			
Phosphatic--thousand tons	2,102	1,886	United States 1,132; Morocco 522; Israel 100.
Potassic	44,963	38,016	France 27,051; East Germany 7,004; West Germany 3,552.
Manufactured:			
Nitrogenous	73,253	109,894	United States 66,974; Romania 13,349; Bulgaria 6,101.
Phosphatic	255,114	264,234	Belgium-Luxembourg 76,613; Tunisia 60,949; United States 50,065.
Potassic	283,939	292,496	France 93,097; Israel 74,136; West Germany 37,915.
Other	150,369	293,821	United States 158,719; Yugoslavia 49,232; Greece 21,483.
Fluorspar	59,816	98,368	Tunisia 45,600; Mexico 19,700; France 14,008.
Graphite	14,041	10,052	Austria 6,723; West Germany 2,388; France 299.
Gypsum and plasters	1,736	1,825	United States 909; West Germany 734; France 140.
Lime	368	177	Austria 92; United Kingdom 57; France 28.
Magnesite	55,677	52,907	Yugoslavia 14,902; Greece 13,262; Ireland 8,388.
Mica:			
Crude, including splittings and waste	1,503	1,504	Republic of South Africa 343; United Kingdom 206; India 187.
Worked, including agglomerated splittings	214	200	France 67; Belgium-Luxembourg 47; Czechoslovakia 39.
Pigments, mineral, iron oxides	14,554	16,025	West Germany 10,850; France 2,216; Canada 805.
Precious and semiprecious stones, except diamond:			
Natural--kilograms	85,255	122,811	Brazil 73,327; Republic of South Africa 17,430; West Germany 7,472.
Manufactured--do	19,142	14,213	Switzerland 6,359; France 4,438; Spain 1,460.
Pyrite, gross weight--thousand tons	846	549	U.S.S.R. 412; Cyprus 122; Yugoslavia 6.
Salt	7,525	5,667	West Germany 4,550; Netherlands 608; France 106.
Sodium and potassium compounds	15,092	12,651	France 10,367; West Germany 1,671; Sweden 241.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble	178,625	172,273	Yugoslavia 72,805; Portugal 40,209; Greece 13,394.
Slate	3,859	3,770	West Germany 2,875; France 589; Norway 305.
Other	90,931	115,739	Republic of South Africa 31,640; Norway 18,805; Sweden 12,040.
Worked, all types	2,171	2,426	West Germany 746; France 551; Norway 399.
Dolomite	1,243	2,445	Switzerland 1,236; France 555; Norway 217.
Gravel and crushed rock	19,147	12,266	France 8,889; West Germany 960; Austria 926.
Quartz and quartzite	78,635	86,779	Portugal 48,257; Switzerland 22,830; West Germany 11,279.
Sand, excluding metal bearing	1,169,704	1,042,497	France 468,892; Belgium-Luxembourg 445,270; Netherlands 64,498.

See footnotes at end of table.

Table 3.—Italy: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Sulfur:			
Elemental, all forms	298,737	284,551	Canada 112,393; Poland 108,548; United States 26,480.
Sulfur dioxide	1,044	481	All from West Germany.
Sulfuric acid	26,945	42,693	Poland 18,952; Yugoslavia 6,129; Netherlands 4,819.
Talc, steatite, soapstone and pyrophyllite	17,983	18,484	Austria 10,572; France 3,975; Belgium-Luxembourg 1,272.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	2,729	2,498	United States 2,451; Austria 36.
Carbon black	26,136	27,724	France 10,955; United States 4,387; United Kingdom 4,133.
Coal and briquets:			
Anthracite and bituminous thousand tons	11,773	10,604	West Germany 3,225; Poland 2,825; United States 2,680.
Briquets of bituminous coal and anthracite do.	56	62	Poland 27; France 23; West Germany 11.
Lignite and lignite briquets do.	234	172	West Germany 95; Yugoslavia 60; East Germany 14.
Coke and semicoke do.	164	154	United States 71; West Germany 43; France 34.
Peat, including briquets do.	32	20	West Germany 12; Poland 2; Switzerland 2.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 837,032	793,897	Libya 226,935; Saudi Arabia 155,440; Iraq 110,210.
Refinery products:			
Gasoline do.	360	4,917	U.S.S.R. 1,799; Tunisia 970; Algeria 466; France 374.
Kerosine and jet fuel do.	254	904	U.S.S.R. 339; Trinidad and Tobago 294; Spain 131.
Distillate fuel oil do.	4,146	4,041	U.S.S.R. 1,397; Yugoslavia 1,088; Spain 431.
Residual fuel oil do.	14,126	12,168	Spain 2,810; U.S.S.R. 2,100; France 1,951; Venezuela 672.
Lubricants do.	1,046	959	United States 280; West Germany 154; France 119.
Other:			
Mineral jelly and wax do.	390	336	West Germany 116; United States 58; People's Republic of China 30.
Petroleum coke and pitch coke do.	r 2,333	2,492	United States 1,774; U.S.S.R. 287; West Germany 248.
Bitumen and other residues do.	1,652	1,695	United States 1,024; Albania 445; Netherlands Antilles 115.
Liquefied petroleum gases do.	807	2,609	Libya 747; Yugoslavia 380; Venezuela 204; Spain 193.
Bituminous mixtures, n.e.s. do.	19	19	France 8; United Kingdom 5.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	50,338	32,195	Czechoslovakia 8,945; West Germany 6,526; France 4,672.

r Revised. NA Not available.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—Domestic production of primary aluminum increased nearly 10% compared with that of 1971. Most of the increase was due to a full year's operation of the Montecatini Edison S.p.A. (Montedison) Venice-Fusina smelter.

Domestic output of bauxite dropped to about one-half of that produced in 1971. As in previous years, the decrease in production was mainly due to declining reserves, lower grade of ore, and availability of low-cost imported bauxite. Also, many of the nation's bauxite deposits reportedly are small in size, hence not amendable to low-cost large-volume mining.

Imports of bauxite increased over 23% in 1972 to make up for the nation's declining output. Yugoslavia remained the principal supplying country. Other countries

exporting bauxite to Italy were, in order of quantity, Australia, Sierra Leone, and Guyana.

Several aluminum metal production plants were in various stages of construction during the year.

Alluminio Sardo S.p.A. (ALSAR) was building a smelter near Porto Vesme, Sardinia, to produce 80,000 to 100,000 tons of primary aluminum metal annually.

An electrochemical complex was under construction near Mazara del Vallo, Sicily, by the Italian Government and Montedison. The joint venture, costing $578 million, will result in adding 100,000 to 150,000 tons annually to the supply of primary aluminum metal. In addition to aluminum, an estimated 30,000 tons of magnesium and phosphorus would be produced annually. Employment was expected to be provided for 4,000 workers.

ALSAR also was in process of construction and/or expansion of a plant producing semifinished aluminum products. An estimated $320 million were authorized for construction of an aluminum sheet and foil facility near Porto Vesme, Sardinia. Designed capacity of the facility was reported at 25,000 tons of aluminum products including aluminum foil, prevarnished panels, and standard aluminum sheets. Raw aluminum metal would come from a nearby smelter operated by Societa Mineraria Chimica per l'Industria dell'Aluminio Sardinia.

Eurallumina, a consortium that includes Commonwealth Aluminum Co. Ltd., Australia; Metallgesellschaft A.G., West Germany; ALSAR; and Montedison, was building a high-purity alumina plant having a capacity of 700,000 tons annually.

Upon completion of these facilities, Italy was expected to be self-sufficient as well as a net exporter of, aluminum metal. The Government was taking considerable initiative in implementing these expansonary projects through its state holding corporation Ente Partecipazione Finanziamento Industria Manifatturiera (EFIM).

Antimony.—Production of antimony increased 2% compared with that of 1971. The rise in output was due to increased production at the Tafone open pit mine near Manciano, Tuscany. The mine was operated by Azienda Minerali Metallici Italiane S.p.A. (AMMI), a State agency. Reserves at the Manciano deposit were estimated at 20,000 tons of metal, sufficient to meet the nation's requirements for several years.

Copper.—Domestic mine production of copper ore declined for the third consecutive year necessitating greater imports in 1972. Italy's copper resources are small and low grade. Some copper concentrate was produced as a byproduct of lead, zinc, and other metal mines in Sardinia and northern Italy. AMMI was conducting an intensive exploration program for copper resources over a 50,000-acre area near Gadoni, Sardinia. Imports of copper concentrate rose nearly 40%, mostly from Canada and Australia.

Iron and Steel.—Italian raw steel output rose 2.4 million tons in 1972 and was about 14% more than that in 1971. The increase in production ranked second among European Economic Community (EEC) countries; only Belgium's output rose at a higher percent.

Electric furnaces accounted for about 41% of all steel produced in 1972; Linz-Donawitz (LD) converters supplied 39%, and open-hearth furnaces, the remaining 20%. A recovery in the domestic manufacturing and transportation industries and higher exports accounted for the increased production of iron and steel.

At yearend, steel production capacity was reported at 24.6 million tons, an increase of 1.7 million tons over that of 1971. The iron and steel industry was operated at about 80% of its theoretical capacity.

Steel consumption totaled 20 million tons, an increase of 12% compared with that of 1971. The increase was principally due to an 11% increase in the manufacturing sector of the economy.

Italy was both an exporter and importer of steel. Exports in 1972 totaled 4.9 million tons, and the 1972 steel imports were 5.7 million tons. Both exports and imports rose in 1972, exports by 20% and imports by 16% compared with that of 1971.

Per capita steel consumption in Italy was 369 kilograms in 1972 compared with 332 kilograms in 1971 and an average of 500 kilograms for EEC countries.

Finanziaria Siderurgica S.p.A. (Finsider), a State steel agency, accounted for 10.95 million tons of Italy's steel output, or 55%.

Pig Iron.—Output of pig iron increased 10% and amounted to about 94% of total capacity compared with 88% in 1971. Blast

furnaces were the principal sources of pig iron accounting for nearly all of the output. A small amount was produced in electric furnaces. Italsider S.p.A. remained the largest producer of pig iron in Italy, accounting for 90% of the output. At yearend, total pig iron production capacity was about 10 million tons annually.

Imports of pig iron increased in 1972 and amounted to over 1 million tons; U.S.S.R. & West Germany were the principal sources and accounted for 42% of imports. Pig iron also was imported from Yugoslavia, East Germany, and Hungary.

Iron and Steel Scrap.—Iron and steel scrap imports rose 4% in 1972. The scrap resources totaled 12.8 million tons, of which 40% originated within industry, 16% derived from home market, and the remaining 44% was imported. The steel scrap consumption and distribution by source for the last 2 years was as follows:

Source	Quantity (thousand metric tons)	
	1971	1972
Own arising	4,386	5,148
Home supplies	2,080	1,743
Imports:		
From ECSC [1] countries	r 4,166	3,919
From other countries	r 1,314	1,760
Yearend stocks	1,050	750

r Revised.
[1] European Coal and Steel Community.

Special Steel.—Production of carbon and alloy steel in 1972 was 2.8 million tons, approximately 2% of the total output of finished steel. The principal producing companies were Fiat S.p.A. A.F.L. Falck, Terni, and Breda Siderurgica. The national output of special steels, by type, in the last 2 years was as follows:

	Quantity (thousand metric tons)	
	1971	1972
High-carbon steel:		
Structural	1,309	1,325
Tool	2	2
Total	1,311	1,327
Alloy steel:		
Structural	938	1,078
Tool	26	28
Bearing	107	107
Stainless	224	266
High speed	1	1
Other	2	2
Total	1,298	1,482
Grand total	2,609	2,809

Acciaierie di Alto Adriatico was building a 250,000 ton-per-day flat product steel works near Monfalcone. The facility, producing sheet and plate, was scheduled for completion in 1974.

Fiat S.p.A. (Sezione di Ferrieri) was replacing an open-hearth plant near Turin with electric steelmaking equipment consisting of three arc furnaces, each having a capacity of 135 tons per cast, and new antipollution equipment. Environmental problems and high operating costs were the reason for rebuilding the old plant. The project was scheduled for completion in 1975. Steelmaking will not be interrupted during construction of the new plant.

Italy's fifth integrated steel center, costing $1.5 billion, was in the engineering and design stages of development. Italsider S.p.A., the future operating company, announced that the facility would utilize large electric furnaces instead of blast furnaces. The basic burdens (feed material) would consist principally of iron ore pellets. Company steel mill designers have determined that such operations would result in reduction of 40% in construction costs for plant and infrastructure, a 10% reduction in operating costs, lower air pollution, and a reduction in completion time.

Italsider S.p.A. continued with a $2 billion expansion of production capabilities at the Taranto steel complex. Steel production reached 5 million tons in 1972 and was expected to double by 1975. A new hot strip and hot plate production line will commence operating during 1973. Port facilities being improved and/or expanded include new raw material receiving docks capable of unloading boats of the 150,000-deadweight-ton class, and loading docks for handling shipments for export. At midyear, two production lines started manufacturing longitudinal and spiral welded pipe of 56 and 100 inches in diameter for use in transmission of natural gas. Taranto's pipe-producing capacity was at 1 million tons at yearend. Most of the production was exported to U.S.S.R. and also used for development of the Ekofisk oilfield in the North Sea by Azienda Generale Italiana Petroli (AGIP).

The $50 million expansion of the Bagnoli steel complex was reportedly at the midpoint of completion. Work started on building of a beam mill costing $20 million to compliment the Blaw-Knox mill now in operation. The mill was expected to pro-

duce 230,000 tons annually of parallel-wide flange, parallel flange, and normal flange beams. In addition, a continuous casting machine for slabs to feed the narrow strip mill was under design and construction. The unit will produce 400,000 tons annually and cost $7 million.

Lead and Zinc.—Output of lead contained in concentrate rose 12%, but that of zinc declined 3% compared with 1971 figures. Virtually all lead and zinc mined in Sardinia was under State control and in process of verticalization.

Societa Pertusola S.p.A. modified its beneficiation plant at the Salafossa mine located in the Province of Belluno. A dense media section was discontinued, and all ore was concentrated by flotation only. As a consequence, lead and zinc output rose 24% and 3%, respectively. The company was expanding metal-refining facilities near Crotone, Province of Calabria. The additional equipment will increase annual capacity to 90,000 tons of zinc, 170,000 tons of sulfuric acid, and 60,000 pounds of germanium. An increase in cadmium, copper, and silver recovery also was expected. In addition to the Salafossa mine and the Crotone facility, the company operates the Argentiera mine near Cadore and metal refineries at La Spezia, Genoa-Sampierdarena, and Cigliano. The mineral reserves at the two mines were reported to be large enough to produce at the current production rate for 6 years. In 1972, the company reportedly obligated $200 million for lead and zinc exploration projects in the Italian Alps and other areas of Italy.

AMMI reported that the zinc-lead integrated complex at Porto Vesme consisting of a Waelz kiln, Imperial smelting furnace (ISF), a sinter plant, an acid plant, and a zinc refinery was completed at yearend. The rated capacity of the Waelz kiln was reported at 45,000 tons of zinc annually. Bipromet of Katowice, a mineral engineering firm of Poland, designed and built the Waelz kiln plant. The ISF unit has a shaft area of 17 square meters and employs the latest automated equipment. The output was estimated at 100,000 tons of metal annually; of which, 60,000 tons would be zinc, the remaining 40,000 tons lead. The sinter machine, with a 70-square-meter area, supplies sulfur dioxide gas to an acid plant that produces about 40,000 tons of sulfuric acid. The firm, Lurgi Chemie Hüttentechnik G.m.b.H., built the ISF, sinter and acid plant, and provided the equipment and machinery. The capacity of the refinery unit was reported at 66,000 tons per year of special high-grade zinc.

Cadmium will be recovered at a rate of 450,000 to 550,000 pounds annually from flue gases and solids. Provisions have been made in the design of the various plant units for future expansion. All gaseous and liquid effluents will be treated to comply with current environmental regulations.

Construction of a dense media beneficiation plant (Dyna Whirlpool method) was underway at AMMI's mining facilities in the Iglesias region of Sardina. A sulfide and oxide concentrate will be recovered from the ores, the former processed directly in the new ISF unit completed at yearend near Porto Vesme, the latter in a Waelz kiln now in operation. The capacity of the beneficiation plant was reported at 500,000 tons of ore annually. Most of the zinc deposits in Sardinia contain oxide and sulfide minerals.

Manganese.—Output of manganese ore dropped sharply for the fourth consecutive year. The nation's resources of economically minable manganese ores are limited to those produced currently at the Italsider's Gambatesa mine. Exploration was underway to locate new sources of manganese. In recent years, operating costs at the Gambatesa mine have been rising, hence production was becoming less competitive with foreign imports. Italy's declining production was balanced by increased imports from the Republic of South Africa, Gabon, Brazil, and Ghana.

Mercury.—Output of cinnabar ore declined 7% compared with that of 1971. Italy was the leading mercury ore and metal producer in EEC and the third largest in the world following Spain and U.S.S.R. The nation's mines are located in the Provinces of Siena and Grosseto. Pollution control standards established in various industrialized countries have reduced mercury uses drastically; this has had a disquieting effect on the Italian mercury mining industry.

Output of mercury was curtailed at mines operated by Stabilimento Minerario del Siele and Societa Monte Amiata S.p.A., Italy's two major producers. The reduction in output reportedly was due to low demand, declining prices, and high inventories. Mercury in producer stocks was estimated to exceed Italy's annual consumption

of mercury. Exports of mercury totaled 10,797 flasks compared with 15,197 flasks in 1971, a decline of over 29%.

Titanium.—Montedison's pure titanium oxide plant near Scarlino reportedly commenced operation in 1972 following the resolution of a dispute with the Government over water pollution from discharging acid residues into the adjacent Tyrrhenian Sea. The facility was expected to supply Italy's future requirement of titanium for many years.

NONMETALS

Asbestos.—Italy's output of asbestos totaled 132,778 tons and was 11% higher than that in 1971. The highly mechanized San Vittore open pit mine near Belangero was the principal source of the nation's production. A small quantity of asbestos fiber and powder was produced at the Cima Franscia mine near Sondria and the Auriol mine near Sampeyre. Societa Amiantifera del Balangero completed modernization and expansion of its processing plant to improve recovery of short-fiber material.

Barite.—Production of ground barite decreased for the third consecutive year. A drop in exports and domestic requirements by the chemical industry accounted for the lower production. Italy exported only 6,000 tons in 1972 compared with 34,968 tons in 1971. United States and the Netherlands received most of the shipments. The barite industry in Sardinia was expanding operations and will remain a significant factor in the island economy.

Cement.—Italy's production of 33.5 million tons of cement was 5% over 1971 figures. The industry ranked second to West Germany among Western European countries. The nation's cement industry comprises 120 plants, of which one-half are in northern Italy.

The Italian cement industry was having financial problems because of reduced consumption and increased production costs. The recession in the building industry continued through 1972 and resulted in closing of a number of small cement plants and deficit financial operations in many others.

Unione Cementerie Marchino Emiliane e di Augusta (UNICEM) completed expansion of its cement plant near Augusta, Sicily. The facility was designed to produce 280,000 tons of AR 425 and 460,000 tons of NR 325 cement annually.

Fluorspar.—Italy's output of fluorspar decreased for the second consecutive year. Over 65% was mined in Sardinia, the remainder, at mines in the Alp Mountains.

Italy's fluorspar output was dominated by two companies; namely, Montedison and Mineraria Silius S.p.A. Mineraria Silius S.p.A. is the world's largest producer of acid-grade fluorspar.

Societa Ricerche Coltivazione Mineraria (Soricom) continued development of the Pianciano fluorspar-barite deposit near Rome. The deposit occurs in a 5-foot bed of pyroclastic rock near the surface and contains an estimated 8 million tons of ore averaging 55% fluorspar and some by-product barite. Soricom was expected to build a fluorspar facility consisting of a mine, concentrator, and a pelletizing plant having a capacity to produce 200,000 tons of pellets annually. Approximately 20,000 tons of barite per year also was expected to be produced. The product was expected to be marketed to the aluminum, steel, and chemical industries.

Magnesium.—Compagnia Generale del Magnesio S.p.A. was building a seawater magnesia recovery and pelletizing plant near Syracuse, in the southeastern part of Sicily. The capacity of the plant was reported at 60,000 tons of magnesium oxide pellets and chemical magnesia for use in the basic refractory industry, chemical industry, and other related industries.

Phosphates.—Italy depends heavily on importation of phosphates for its requirements. In 1972, imports totaled nearly 2.2 million tons; Morocco, United States, and Israel supplied over 90% of the imports.

Potassium Salts.—Output of potassium salts approximated that produced in 1971. Italy's potash deposits are located in the central and southwestern part of Sicily. These potash minerals, principally kainite, associated with sulfur and salt in Miocene sediments, were discovered by exploratory drilling for sulfur.

The two principal Sicilian producers-Industria Sali Potassici e Affini S.p.A. (ISPEA), with mines at Pasquasia and Corvillo, and Montedison, with mines at Palo and Recalmuto—were expected to merge their activities to strengthen the industry. Montedison reportedly discovered a new deposit in the Nicosia area, Sicily.

Ente Minerario Sicilano (EMS) in a joint venture with Montedison was developing a potassium ore deposit in Sicily and building a sulfate production plant at a

cost of $40 million. The facility was expected to mine 1.5 million tons of potash ore from which three-quarter million tons of potassium sulfate would be produced annually. The mine and processing unit was expected to be one of the largest in Europe.

Pyrite.—Pyrite output declined 122,000 tons in 1972 and was 8% lower than that in 1971. This was the first significant drop in production since 1966 and resulted from a worldwide oversupply of recovered sulfur. Italy's pyrite production was consumed in the manufacture of sulfuric acid.

The nation was the largest producer of pyrite in the EEC and ranked fiifth in the world. Pyrite was obtained mostly from a few large modern mines operated by Montedison in the Province of Grosseto.

Montedison closed the Bocchegiano mine in Tuscany because of a weak market and depletion of ore reserves. Startup of the company's new mine near Companio was delayed until the demand for pyrite increased.

Salt.—Rock salt output approximated that produced in 1971. Most of the salt came from mines near Agrigento, Sicily, operated by EMS. The salt was consumed to manufacture pure sodium chloride. EMS reportedly discovered a large salt deposit near Racamulto, Sicily.

Production of marine salt dropped nearly 39% compared with 1971 figures. Lower demand by the chemical industry accounted for the reduced output.

Montedison continued with development of a marine salt deposit near Timpa del Salto. The salt brine will be pumped via a 35-mile pipeline to the Ciro marina works for processing and packaging.

The Trapani salt flat works, the center of Italy's salt industry for 2,000 years, was closed because of high operating costs. Employment of the remaining 200 workers was terminated in August. Salt recovery methods remained unchanged since the middle ages when brines were pumped by windmill and salt was carried by a long bucket brigade of workers to makeshift silos.

Stone—Marble.—Output of block marble (white and colored) approximated that produced in 1971. Production was affected by the continued stagnation of the construction industry and the trend to substitute marble with less expensive ornamental material, such as wood, ceramics, plastics, and metal. More than 80 types and/or grades of marble were produced in Italy in 1972, mostly from Tuscany metamorphic stone. Numerous other varieties of metamorphic rock were quarried in many parts of the country.

The marble industry of Italy initiated a promotional campaign to attract new markets for the world-renowned Tuscany marble. The promotional effort included a greater participation in world trade and industrial fairs. Currently, Italian marble is exported to 120 countries of the world.

Sulfur.—Production of sulfur ore rose significantly to 830,279 tons from the 573,789 tons mined in 1971. However, the average grade of the ore dropped from 22% to 20%. As in 1971, most of the increased sulfur ore was produced at the open pit Comero mine near Pomezia operated by Societa Mineraria Roma.

The chronic difficulties of the inefficient Sicilian sulfur mining industry continued in 1972. Five mines and the Trabonella flotation plant, employing over 3,500 workers, remained in operation at yearend; 8 mines were closed because of high operating costs. It was reported that operating losses from active mines averaged from $3 to $4 million annually. EMS objectives remain to provide some effective economic stability in the depressed Agrigento region until the workers can be relocated to other areas for employment. The EEC authorized $4.2 million to assist in relocating sulfur miners.

MINERAL FUELS

Consumption of energy increased about 16% to 126.4 million tons of standard coal equivalent.[3] Liquid fuels continued to be the principal energy source supplying 74% of the nation's energy requirements. Solid fuels accounted for about 7% of the energy, a decline of 1% from 1971 figures. The following tabulation shows the share of different sources of energy in tons of standard coal equivalent:

	1970	1971	1972
Solid fuels	9.4	9.1	9.6
Liquid fuels	73.7	77.5	93.5
Natural gas	10.7	10.9	12.5
Nuclear, geothermal, and hydroelectric powder	12.0	11.2	10.8
Total	105.8	108.7	126.4

[3] At 10,000 calories per kilogram.

Coal.—Ente per L'Energia Elettrica (ENEL), operator of Italy's two remaining coal mines, reported a drop of over 40% in output compared with 1971 figures. Production declined for the sixth consecutive year, and the trend was not expected to change because of high production costs and low thermal value of sulcis coal.

Coal continued to remain high on the list of imports of mineral commodities in 1972. Although coal imports amounted to over 10 million, those from the United States again declined, accounting for about 30% of the total imports compared with 42% in 1971. Other countries exporting coal to Italy, in order of quantity, were West Germany, Poland and U.S.S.R.

Lignite.—Output of lignite at the Le Carpinete (Valdarno) Mecure, Pietrafitta mines decreased about 487,000 tons in 1972 and was more than 37% below 1971 figures. Production has been on the decline since 1967 because of high operating costs. Lignite was used exclusively in thermoelectric powerplants near the mines. ENEL was gradually substituting liquid fuel for lignite in the powerplants, hence the nation's lignite output was expected to continue declining in the years ahead.

Coke.—Production of coke rose over 7% because of increased demand by the iron and steel industry. Metallurgical coke accounted for nearly all the output; only a small amount was for gaswork. Italy's entire output of coke was produced from imported coal, principally from West Germany, United States, U.S.S.R., and Poland.

Italsider S.p.A. remained the largest coke producer, accounting for over 60% of the total output. At the Bagnoli steel facility near Naples, a fifth coke oven was expected to be completed at yearend. The unit, having a capacity of 220,000 tons annually, represents a major part of the $20 million cost of modernization of the coke plant.

Natural Gas.—Increased production of natural gas in the eastern Po Valley gasfields and offshore Adriatic and Ionian gasfields was responsible for a 6% rise in the national output for 1972. However, domestic production was not sufficient to meet the nation's demand. A total of 1,400 million cubic meters of natural gas was imported from Libya to keep supply and demand in balance. Imports were in the form of liquefied natural gas that was regassified at Società Nazionale Metanodotti Progetti's (SNAM) Panigaglia plant near La Spezia.

Development of the Luna gasfield 5 miles offshore from Crotone in the Ionian Sea was continued in 1972. AGIP was expected to drill 10 to 12 directionally controlled wells from a fixed platform in 230 feet of water. Natural gas was expected to be pumped via a submarine pipeline to a shore terminal and dehydration unit and thence to the Ente Nazionale Idrocarburi (ENI) gas transmission network on the mainland. Recoverable reserves in the Luna gasfield were tentatively estimated at 15 billion cubic meters with a production potential of 1 billion cubic meters annually.

Petroleum.—Output of crude oil principally from Sicilian fields of Gela and Ragusa totaled 1.2 tons in 1972 and was 10% below that produced in 1971. The downward trend was expected to continue because of progressive depletion of reserves in the oilfields. Yearend reserves reportedly totaled 220 million barrels, more than 2% below yearend 1971 figures.

Exports of petroleum products in 1972 approximated that of 1971 and accounted for about 22% of the nation's refinery production. Exports were valued at $800 million in 1972. Gas oil, the most important product in past years, declined 11% compared with 1971 because of expanding domestic demand. The loss was balanced by a significant rise in exports of fuel oil. European countries remained Italy's principal export markets.

Imports of petroleum increased by 2.2 million tons and was 2% higher than that in 1971. The principal sources, in order of quantity, were Saudi Arabia, Libya, Iran, and Kuwait.

ENI contracted to purchase 20 million tons of crude oil over a 10-year period from Iraq National Oil Co. The agreement represented an effort by the Italian agency to diversify its sources of petroleum.

Pipelines.—At yearend, the nation's pipeline network totaled 6,700 miles, an increase of over 10%. Over 300 miles of pipeline were in various stages of construction during 1972.

Trans-Austria Gasleitung (TAG) commenced construction of a 240-mile pipeline from the Italian border city of Tarvisio to Bratislava, Czechoslovakia, early in the fourth quarter after some delay in acquiring right-of-ways. The project, costing $30

million, was scheduled for completion in May 1974. TAG will deliver 6 billion cubic meters of natural gas to Italy's natural gas pipeline distribution system. From Tarvisio, the pipeline will continue into Italy, passing through the Venetian plains, the Po Valley, and thence to a terminal at Sergnano. The connecting pipeline near Bratislava from the U.S.S.R. gasfields in Tyumen, Siberia, having a capability of delivering 28 billion cubic meters of natural gas annually, was completed at yearend.

Constructon of the 506-mile pipeline through West Germany and Switzerland, which will link Italy's gas distribution network with the Netherland's Groningen gasfield, was making good progress. Completion of the project was scheduled for late 1973. A total of 6 billion cubic meters of natural gas will be transported annually by the pipeline of which Switzerland will receive 500 million cubic feet, and Ruhrgas, an undisclosed amount. Transeuropa Naturgas Pipeline G.m.b.H. (TENP), in a joint venture with SNAM and Ruhrgas, was constructing a 290-mile section of the pipeline in West Germany, passing through Aachen, Karlsruhe, and thence to the Switzerland border city of Basel. Transitgas A.G. fuer Erdgas was building a 160-mile section through Switzerland. The final section of the pipeline, from the border of Switzerland through northern Italy and to a distribution terminal near Milan, was being installed by SNAM.

SNAM, in a joint venture with Austrian and German natural gas distribution companies, initiated construction of a liquefied natural gas (LNG) regasification plant near Trieste and a 275-mile pipeline transmission system to Munich, West Germany. LNG will be purchased for processing at the plant from Société Nationale pour la Recherche la Production, la Transport, la Transformation et la Commercialisation des Hydrocarbures (Sonatrach), Algeria, and pipelined to Austrian, Swiss, French, and West German markets. Completion of the project was scheduled for early 1976. ENI will not purchase any of the gas for Italian markets but will act as a service agency for regasification and transportation. The pipeline's transmission capacity was reported at 8.5 billion cubic meters annually, of which 6.5 billion will be obtained from the LNG regasification plant, and the remainder, from Russian sources. The pipeline will join with the trans-Austrian line at Tarvisio, Italy, and receive 2 billion cubic meters of natural gas for delivery to France through the West German pipeline network.

Construction of the 16-inch pipeline through Calabria by SNAM was continued during 1972. The 260-mile line was expected to connect the current grid system at Pisticci and service the cities and outlying areas of Policora, Santa Eufemia, Reggio Calabria, Cantanzaro, and Crotone. The Pisticci to Santa Eufemia section was expected to be in operation in 1973, and the remaining section of the pipeline, in 1974.

Refining.—Refinery throughput in 1972 increased 3% to 123.5 million tons annually. Domestic markets consumed 85 million tons of processed crude. Consumption of petroleum products increased 5% compared with 1971 figures. Fuel oil accounted for 57% of total consumption, followed by motor oil 23%, gasoline 11%, and the remaining 9% for miscellaneous products.

ENI formed a new subsidiary to specialize in research, engineering, and production of air pollution abatement and waste water treatment equipment. During the year, new technology and equipment were in various stages of development and/or installation at many refineries. The general program of improving the environment include research in noise abatement, air pollution control, and other measures for improving health, safety, and working conditions at refineries.

Crude oil distillation capacity of Italy's 36 refineries reached an average of nearly 3.6 million barrels per standard day (150 million tons annually). Expansion projects underway will add 10 new refineries and increase capacity to over 5.4 million barrels per standard day by 1980. Italy ranked third among nations in the world in crude oil refining capacity.

Sangro Chimica S.p.A. commenced construction of a petroleum refinery near Fossacesia, 40 miles from Chieti. The facility, costing an estimated $120 million, will have the capacity to process 7 million tons of crude oil annually.

Azienda Nazionale Idrogenazione Combustibili S.p.A. (ANIC) was expanding capacity of the Sannazzarro refinery to 10 million tons annually. Also, storage tank capacity was being increased by 120,000 cubic meters.

Construction was underway to increase capacity of Stanic Industria Petrolifera S.p.A. (SIP) petroleum refinery at Bari. SIP was increasing production to 122,000 barrels per standard day. In addition, company officials reported that engineering and design were completed and building contracts assigned for pollution abatement facilities at the refinery and a desulfurization plant that will recover 500,000 tons of sulfur annually.

Industria Raffinazione Oli Minerali S.p.A. (IROM) was building additional storage tank capacity totaling 116,500 cubic meters for crude oil, fuel oil, and light petroleum products at its Porto Marghera refinery. Also, a 12,000-barrel-per-standard-day-catalytic reformer was being added.

A sea-island terminal was under construction, 2 miles offshore from Genoa in 150 to 160 feet of water, capable of unloading tankers of up to 500,000 deadweight tons. The terminal will be connected to shore facilities by a submarine pipeline, having a transmission capacity of 14,000 tons per hour. Completion of the project was scheduled in late 1973.

Exploration.—A total of 21 exploration leases covering 1.2 million acres were granted for the Sicilian Channel during 1972.

At yearend, Forest Oil and the Natural Resource Development Corp. were drilling in the Adriatic, near the Italy-Yugloslavia boundary. The companies were expected to drill wells at 500-foot water depths.

At yearend, offshore acreage under lease for exploration purposes totaled 13.8 million acres, an increase of 14% over that of 1971.

The corresponding onshore acreage under lease declined to 6.5 million acres, or 30% below that of 1971. The apparent shift from onshore to offshore exploration reflects greater prospects for discovery of hydrocarbon resources.

At midyear, Mineraria Texas Italiana S.p.A. (MTI) commenced seismic exploration on two leases adjacent to the Bomba gasfield north of Foggia. During the year, MTI discovered natural gas near Palmori west of Foggia in Miocene sediments. The well tested 1.4 million cubic feet of natural gas per day from a sandstone formation at depths of 1,039 to 1,050 meters and 2.6 million cubic feet of natural gas at depths of 1,068 to 1,079 meters, through a 3/8-inch choke and at pressures of 412 and 854 pounds per square inch, respectively. Late in November, the company started drilling 25 miles southeast of Palmori to test a sandstone formation at 3,800 meters.

MTI was expected to conduct offshore seismic exploration in an area covering about 200 kilometers of shallow water in the Adriatic Sea near Foggia.

Pan Canadian Petroleum Ltd., in a joint venture with Societa Italiana Resine (SIR), was conducting seismic exploration in the Adriatic and Tyrrhenian Seas and onshore areas in the Po Valley. SIR owns exploratating permits covering over 2 million acres in the area. The joint venture corporation was expected to obtain additional permits in southern Italy and other areas in the Adriatic Sea.

In summary, there was some indication of offshore success in discovering new hydrocarbon resources in the Adriatic and Ionian Seas; however, Italy continued to expand exploration activities in foreign countries and at the same time, was seeking contracts for foreign oil and natural gas supplies. The nation has negotiated long-term purchases of natural gas from the U.S.S.R. and north African countries and crude oil contracts with Middle East nations, and this trend was expected to continue.

The Mineral Industry of Japan

By K. P. Wang [1]

After a temporary slowdown in 1971 caused by an economic recession and an upward evaluation of the Japanese yen,[2] Japan's mineral industry was again on the move. For most basic minerals and metals, the country ranked second to fourth in 1972 as a processor and consumed 5 to 15% of the world supply. To feed an increasing number of modern, large metallurgical plants and refineries with imported raw materials, Japan strengthened its position as an international developer, trader, and shipper of minerals. In fact, possibly an oversupply for the Japanese market has been developed. Modification of future production plans meant that acquisition of raw materials from abroad had to be reduced in 1972 and delivery schedules moved back. These actions caused considerable dislocation of new mineral enterprises worldwide and forced various major projects in Australia and elsewhere to be cancelled or postponed indefinitely.

Japan's 1972 gross national product (GNP) was estimated at about ¥90 trillion, as compared with ¥79 trillion in 1971. The growth rate of 13% was less than the 16% average annual increase achieved during 1966–71. At yearend 1972, the economy was strong and Japan's foreign exchange balances were large so that pressure was being built up for another round of upward evaluation of the yen.

Whereas output of most minerals and metals roughly doubled between 1966 and 1971, the 1972 levels turned out to be only 5 to 10% higher than a year earlier. However, by yearend, this sluggish trend had been reversed and rapid growth in industrial production and GNP appeared probable. The President of Nippon Steel Corp. even suggested that Japan's long-range objective for annual steel output should be raised to 180 million tons annually, nearly twice the 1972 tonnage.

Mineral processing in Japan, led by iron and steel manufacturing, nonferrous metal production, and fuel treatment, continued to gain ground on reported mining which it outweighed by at least six to one in value. Although some important mineral discoveries have been made in Japan in recent years, dependence upon foreign ores by the mineral processors has clearly increased. Using the index of 1965=100, the production trend for the major mineral-related sectors was as follows, in terms of value added:

	Average 1969	Average 1970	July 1971	July 1972
Mining	104.6	100.5	94.4	82.3
Iron and steel	202.9	230.9	224.6	224.6
Nonferrous metals	191.1	211.4	224.4	250.1
Ceramics	158.3	175.8	182.3	191.6
Chemicals	179.5	204.0	219.7	224.1
Petroleum and coal products	187.4	216.7	229.6	222.6

In May 1972 the Natural Resources Research Committee of the Prime Minister's Economic Council published a complementary document to a white paper released by the Ministry of International Trade and Industry (MITI) on October 4, 1971, entitled "New Policy on Mineral Resources for the 1970's." (See Bureau of Mines 1971 Minerals Yearbook, V. III The Mineral Industry of Japan) The new document was the first important mineral policy statement issued after the devaluation of the U.S. dollar; it embodied concepts to assist Japanese industry in coping with the economic dislocations caused by devaluation and in preventing similar future difficulties. More important, the Economic Council urged global cooperation

[1] Physical scientist, Division of Nonmetallic Minerals.

[2] The exchange rate during 1972 of Japan Yen (J¥) was about J¥308=US$1.00.

in developing resources and stabilizing supply, recognizing that Japan's massive mineral requirements greatly affect the economies of countries supplying materials and competitors for these materials as well.

Specifically, the Council proposed the following guidelines with regard to Japan's future mineral policy:

1. Increase efforts to stabilize world supply and demand, so as to avoid undue economic dislocations. Emphasize international cooperation to achieve steady economic growth in harmony with scarce resources.

2. Establish a buffer stockpiling program to help stabilize prices, thereby enabling countries with resources to develop minerals in an orderly manner.

3. Utilize its technical and financial resources to the utmost in all fields of mineral endeavor, from exploration, development, and production to transport, processing, and construction, to contribute toward expanding world mineral supply.

4. Stress technology and planning with a view toward maximum utilization of resources, investigate substitutes and regeneration of materials, develop new energy sources, adopt more efficient processes, control pollution hazards, cooperate with other countries in large projects, and render aid to developing countries.

5. Develop integrated approaches toward resource development and utilization in contrast to a purely project basis. In addition to acquiring minerals, the basic goal should be to help developing countries perform as efficiently as possible, participate increasingly in profitmaking opportunities, and maximize economic growth. Involvement should be from the beginning and broad in scope, covering areas like mapping, initial surveying, business consultation, building infrastructure, financial and technical assistance, joint ventures, and improving the investment climate.

Various specific steps were taken by the Japanese in late 1972 to encourage exploration abroad and to stabilize mineral imports. MITI through the Mineral Resources Exploration Promotion Fund will loan Japanese nonferrous companies working abroad foreign currencies amounting to 35% of all needed exploration funds. A budget of ¥2.8 billion ($9.1 million) was being requested by MITI for Japanese fiscal year 1973.[3] A similar fund had already been established under MITI for uranium and oil exploration in foreign countries with the stipulation that the loans will be repaid only when successful discoveries are made. Since two other Japanese Government agencies (Overseas Economic Cooperation Fund and The Japan Export-Import Bank), had already decided to advance foreign currencies to cover part of the funds required for developing overseas mineral projects, ranging from prospecting to mining, beneficiation, and even refining, overall risks placed upon mining companies stemming from any further revaluation of the yen would be greatly lessened.

The stockpiling program for stabilizing imports suggested early in the year was temporarily shelved in late 1972, partly because of Japan's large exchange holdings. Instead, a foreign currency loan program amounting to $322.6 million for Japanese fiscal year 1973 was being readied, whereby the Japanese Government would provide low-interest loans (4.5% rate with 3-year grace period) of 6 years duration to nonferrous refiners who are committed to take delivery of foreign ores beyond their immediate requirements. The MITI plan is to furnish loans covering up to 70% of the value of the ores in excess of the tonnage needed for smelting during the year. The breakdown would be $218.8 million for copper ore (estimated excess during Japanese fiscal year 1973 is 321,000 tons of contained copper), $14.0 million for lead ore (excess 95,000 tons of lead), $35.4 million for zinc ore (excess 233,000 tons of zinc), and $54.2 million for nickel ore.[4] The reasoning behind this measure is that many developing nations and various suppliers in Australia and Canada would encounter serious financial difficulties and might well seek other outlets if Japan does not continue to take delivery of ores according to agreed upon tonnages. At yearend, the proposed stockpiling program was still being considered for future implementation.

Japan's diplomatic recognition of the People's Republic of China (PRC) on September 28, 1972 ushered in a new era of commercial relations. Although PRC is

[3] The Japanese fiscal year is from April of the year stated to March of the following year.

[4] Japan Metal Bulletin (Tokyo). Sept. 28, 1972, p. 4.

but one of many markets and raw material sources for Japan, the potential for developing trade in minerals, metals, and related equipment is great. The President of Nippon Steel Corp. visited PRC even before Prime Minister Tanaka. In early October, the Chinese made a firm request for Japan to fill a $300-million order for a 3-million ton hot strip mill, a 2-million ton cold tandem mill, and a Sendzimer mill. Various other requests have followed. A five-man team from PRC's Metals and Minerals Export-Import Corporation was sent to Japan late in the year to investigate what Japan needed in the way of minerals that PRC could supply.

PRODUCTION

Japan's mineral and metal production showed significant gains in most categories over that of 1971 when the first upward evaluation of the yen took place. Increases were particularly apparent for the second half of 1972. The notable exception to overall increases was the coal industry which has been scaling down operations sharply in recent years; output declined about one-sixth compared with 1971 figures.

Japan broke records in almost every category of petroleum activity during 1972. Cement production was a good one-tenth higher than that of 1971. In chemical fertilizers, output rose sharply for most of the major items. Among the metals, crude steel went up a reported 9%, refined copper 13.6%, primary zinc 12.4%, primarly lead 4%, nickel 6%, and primary aluminum 14%.

Japan's world ranking in certain major mineral and metal products during 1972 was as follows: Pyrite and slab zinc (first); chemical fertilizers (second); cement, refined copper, steel, aluminum, and refined oil products (third); coke (fourth); and refined lead (fifth).

Table 1.—Japan: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
METALS				
Aluminum:				
Alumina, gross weight		1,285	1,603	1,644
Metal:				
Primary:				
Regular grades		728	887	1,009
High purity		5	6	6
Total		733	893	1,015
Secondary		322	349	412
Antimony:				
Mine output, metal content	tons	6	3	NA
Oxide	do	2,828	2,449	3,639
Metal	do	4,954	4,789	3,206
Arsenic, white (equivalent of arsenic acid)	do	884	955	525
Bismuth	do	678	812	895
Cadmium	do	2,541	2,675	3,029
Chromium:				
Chromite, gross weight	do	32,980	31,642	24,819
Metal	do	1,596	2,082	2,320
Columbium and tantalum, tantalum metal	do	25	15	19
Copper:				
Mine output, metal content		125	121	114
Metal:				
Blister		606	703	778
Refined:				
Primary		603	713	810
Secondary		102		
Germanium:				
Oxide	tons	27	16	12
Metal	do	29	19	22
Gold:				
Mine output, metal content	thousand troy ounces	255	255	243
Metal	do	709	772	846

See footnotes at end of table.

Table 1.—Japan: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Indium metal—thousand troy ounces	585	529	498
Iron and steel:			
Iron ore and ore sand concentrate	1,574	1,422	1,347
Roasted pyrite concentrate (50 percent or more Fe)	1,906	1,510	1,075
Pig iron and blast furnace ferroalloys	68,048	72,745	74,055
Electric furnace ferroalloys:			
Ferrochrome	362	403	303
Ferromanganese	444	534	553
Ferronickel	265	286	189
Ferrosilicon	302	322	309
Silicomanganese	270	325	343
Other [1]	24	95	32
Crude steel	93,322	88,557	96,900
Semimanufactures, hot rolled:			
Ordinary steel	68,552	65,171	74,924
Special steels	7,381	6,906	7,175
Lead:			
Mine output, metal content	64	73	63
Metal, refined:			
Primary	209	215	223
Secondary	46	43	e 43
Magnesium metal:			
Primary—tons	10,337	9,693	10,949
Secondary—do	9,179	7,074	4,844
Manganese:			
Ore and concentrate, gross weight	270	285	261
Oxide	40	42	39
Metal—tons	9,444	9,965	7,871
Mercury:			
Mine output, metal content—76-pound flasks	5,170	5,564	5,018
Metal—do	5,862	6,620	5,163
Molybdenum:			
Concentrate output, metal content—tons	r 264	278	374
Metal—do	285	188	272
Nickel metal, primary—do	13,393	15,492	16,501
Platinum-group metals:			
Palladium metal—troy ounces	4,610	5,375	5,659
Platinum metal—do	3,296	3,451	4,240
Rare earth metals:			
Lanthanum oxide—tons	124	95	107
Cerium metal—do	153	114	166
Selenium, elemental—do	212	238	335
Silicon metal—do	200	159	190
Silver:			
Mine output, metal content—thousand troy ounces	11,300	11,293	10,021
Metal, primary—do	29,582	31,056	31,057
Tellurium, elemental—tons	35	36	35
Tin:			
Mine output, metal content—long tons	780	777	859
Metal, primary—do	r 1,412	1,355	1,329
Titanium:			
Concentrate, gross weight—tons	3,145	2,376	2,115
Slag—do	7,877	5,531	3,328
Metal—do	9,230	6,777	4,658
Tungsten:			
Mine output, metal content—do	854	1,058	1,131
Metal—do	1,785	1,176	1,411
Uranium:			
Oxide—kilograms	169	NA	NA
Metal—do	190	86	NA
Zinc:			
Mine output, metal content	280	293	281
Oxide	17	27	62
Metal:			
Primary	676	716	805
Secondary	27	11	27
Zirconium metal—kilograms	17,460	24,378	65,296
NONMETALS			
Asbestos	21	18	14
Barite	66	57	60
Bromine, elemental	9,532	9,401	10,745
Cement, hydraulic	57,189	59,463	60,637
Clays:			
Fire clay	2,315	2,136	2,022
Kaolin	221	381	323

See footnotes at end of table.

Table 1.—Japan: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NONMETALS—Continued			
Feldspar [2]	r 535	501	514
Fertilizer materials:			
Crude potassic (potassium carbonate)—gross weight	20	19	23
Manufactured:			
Nitrogenous [3]	2,152	NA	NA
Superphosphates	852	712	716
Fluorspar, all grades	8	12	8
Graphite (crystalline)—tons	1,465	1,054	853
Gypsum	539	529	465
Iodine, elemental—tons	5,898	6,748	7,493
Lime (quicklime)	9,172	9,919	10,130
Pyrite and pyrrhotite (including cupreous):			
Gross weight	2,764	2,343	1,579
Sulfur content	1,289	1,109	767
Salt, all types	961	946	687
Stone, sand and gravel, n.e.s.:			
Crushed and broken stone:			
Dolomite	2,575	2,706	2,722
Limestone	116,230	124,701	134,258
Sulfur, elemental:			
Native, other than Frasch [4]	103	65	17
By product (recovered from petroleum refinery)	239	344	482
Sulfuric acid	6,928	6,659	6,692
Talc and related materials:			
Pyrophyllite	1,539	1,434	1,377
Talc	138	137	130
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	295	308	341
Coal:			
Anthracite	1,039	33,431	457
Bituminous [5]	42,611		27,641
Lignite	438	133	102
Total	44,088	33,564	28,200
Coke:			
Metallurgical	36,374	36,881	36,146
Gashouse	4,778	4,793	4,421
Fuel briquets, all grades	2,978	1,423	920
Gas, natural:			
Gross production—million cubic feet	83,311	85,937	87,406
Marketed—do	[6] 82,682	85,509	86,320
Natural gas liquids:			
Natural gasoline—thousand 42-gallon barrels	33	27	30
Liquefied petroleum gas from natural gas (from field plats only)—do	120	123	136
Peat e	70	70	70
Petroleum:			
Crude oil—thousand 42-gallon barrels	5,656	5,511	5,241
Refinery products:			
Gasoline:			
Aviation—do	496	442	401
Other—do	130,892	142,189	152,359
Jet fuel—do	15,074	16,907	21,328
Kerosine—do	110,053	110,494	106,792
Distillate fuel oil—do	136,012	158,706	180,184
Residual fuel oil—do	578,982	645,707	657,568
Lubricants—do	15,104	15,651	15,442
Other:			
Asphalt and bitumen—do	21,703	25,302	27,744
Liquefied petroleum gas—do	39,807	43,012	45,581
Naphtha—do	137,500	156,916	169,315
Paraffin—do	1,058	1,148	1,084
Petroleum coke—do	914	1,191	1,100
Refinery fuel and losses—do	44,341	52,650	43,529
Total—do	1,231,936	1,370,315	1,422,427

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Includes (but not limited to) ferromolybdenum, ferrotungsten, ferrovanadium, and silicochromium.

[2] Includes aplite as follows in thousand tons: 1970, 467; 1971, 443; 1972, 455, and saba as follows in thousand tons: 1970, 10; 1971, 5; 1972, 1.

[3] Year ended June 30 of that stated.

[4] Includes a small quantity of byproduct sulfur recovered from sulfide ores as well as sulfur content of sulfur ores.

[5] Includes a small amount of natural coke.

[6] Includes gas reinjected, if any.

TRADE

Japan's overall trade in 1972 totaled $52.1 billion; exports totaled $28.6 billion; and imports, $23.5 million. Mineral and related products were an important part of the total. Mineral exports during the year comprised about 17% of all exports, and mineral imports about 43% of all imports. The leading mineral export was iron and steel, accounting for more than 75% of the value of all mineral exports and 12.6% of total commodity exports.

The most important minerals imported in 1972 were as follows: Crude oil, iron ore, coal, nonferrous metal ores, nonferrous metals, refined petroleum, and nonmetallics. Details on mineral exports and imports are given in the following tabulations in million of U.S. dollars:

Exports	1971 [1]	1972 [1]
METALS		
Iron and steel	3,447	3,610
Iron and steel scrap	21	12
Nonferrous metals:		
Copper	88	121
Aluminum	49	40
Zinc	22	43
Other	41	39
NONMETALS		
Inorganic chemicals	158	180
Cement	31	23
Chemical fertilizers	152	201
Nonmetallic manufactures	390	458
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	50	59
Other	11	10
Total:		
Mineral commodities	4,460	4,796
All commodities	24,085	28,590

[1] All mineral and metal data converted from reported yen values at Y360 = US$1.00 for 1971 and Y308 = US$1.00 for 1972.

Imports	1971 [1]	1972 [1]
METALS		
Iron and steel:		
Iron ore	1,296	1,275
Scrap	121	109
Metal	109	104
Nonferrous metals:		
Ores and concentrates:		
Copper	438	519
Lead	36	35
Zinc	100	118
Nickel	168	125
Bauxite	46	52
Manganese	72	67
Other	122	95
Scrap	59	87
Metal:		
Copper	309	340
Silver and platinum group	114	219
Aluminum	115	167
Tin	97	119
Nickel	34	44
Other	24	33
NONMETALS		
Inorganic chemicals	89	99
Salt	65	59
Phosphate rock	61	58
Manufactured fertilizers (mainly potassic)	59	59
Other crude fertilizers and minerals	180	246
Nonmetallic manufactures	190	340

See footnotes at end of table.

Imports—Continued	1971 [1]	1972 [1]
MINERAL FUELS AND RELATED MATERIALS		
Coal and Coke	948	1,080
Petroleum:		
Crude	2,963	3,928
Refinery products	561	539
Other	120	169
Total:		
Mineral commodities	8,532	10,085
All commodities	19,695	23,470

[1] All mineral and metal data converted from reported yen values at Y360 = US$1.00 for 1971 and Y308 = US$1.00 for 1972.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal destinations, 1971
METALS				
Aluminum:				
Bauxite and concentrate---tons	110	319	7,905	Taiwan 150; Australia 105.
Oxide (alumina) and hydroxide	126	250	220	U.S.S.R. 109; United States 60; Republic of Korea 33.
Fused alumina---tons	3,234	3,695	5,223	Taiwan 1,772; Republic of Korea 1,321.
Metal, including alloys, all forms	54	107	45	United States 47; People's Republic of China 16; Hong Kong 6.
Arsenic trioxide, pentoxide and acids---tons	8	210	9,395	Australia 125; Republic of Korea 38; Taiwan 30.
Bismuth metal, including alloys, all forms---do	290	460	613	Netherlands 289; United Kingdom 41.
Cadmium metal, including alloys, all forms---do	945	1,190	1,018	Netherlands 498; United States 197; Belgium 181.
Chromium:				
Chromite---do	--	30	--	All to Taiwan.
Oxides and hydroxides---do	3,569	4,693	2,405	United States 2,516; Republic of Korea 488.
Cobalt oxides and hydroxides---do	5	6	5	Republic of Korea 5.
Columbium and tantalum: tantalum metal, including alloys, all forms---do	2	1	2	Mainly to People's Republic of China.
Copper:				
Ore and concentrate---do	--	--	4,550	
Copper sulfate---do	445	1,045	1,754	People's Republic of China 800; Republic of Korea 179.
Metal, including alloys, all forms	86	67	60	United States 21; Taiwan 10; Hong Kong 9.
Iron and steel:				
Ore and concentrate---tons	5	3	210	All to Thailand.
Roasted pyrite---do	12,794	--	--	
Metal:				
Scrap---do	82,804	373,133	221,588	Republic of Korea 145,133; Taiwan 130,277; Thailand 33,465.
Pig iron, including cast iron---do	48	432,747	381,744	People's Republic of China 298,714; Republic of Korea 49,398; Pakistan 34,939.
Sponge iron, powder and shot---do	5,884	6,501	8,038	Australia 1,415; United States 974; Brazil 898.
Ferroalloys:				
Ferromanganese	8	19	50	Australia 8; Turkey 4; United States 2.
Other	8	49	56	United States 31; Australia 5; Singapore 2; India 2.
Steel, primary forms	1,988	3,053	1,789	Argentina 538; Republic of Korea 473; United States 397.
Semimanufactures:				
Bars, rods, angles, shapes and sections	2,334	3,448	3,132	United States 1,163; People's Republic of China 392; Singapore 208.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal destinations, 1971
METALS—Continued				
Iron and steel—Continued				
Semimanufactures—Continued				
Universals, plates and sheets:				
Plates and sheets, uncoated	7,770	10,055	9,665	United States 1,993; People's Republic of China 625; Taiwan 426; Italy 409.
Tinned plates and sheets	611	786	832	United States 212; U.S.S.R. 87; Taiwan 76.
Other coated plates and sheets	1,190	1,375	1,476	United States 646; Australia 57; Italy 44; Canada 33.
Hoop and strip	392	518	557	United States 88; Canada 43; Malaysia 35; Thailand 35.
Rails and accessories	66	98	37	Australia 55; Taiwan 14.
Wire	475	550	463	United States 287; Indonesia 34; Thailand 29.
Tubes, pipes and fittings	2,686	3,211	2,911	United States 983; People's Republic of China 392; Canada 160.
Castings and forgings, rough	6	15	16	United States 10; People's Republic of China 3.
Lead:				
Ore and concentrate—tons	--	1,053	1,466	All to Republic of Korea.
Oxides—do	122	84	64	Singapore 41; Indonesia 15; Taiwan 15.
Metal, including alloys, all forms	7	6	6	Republic of Korea 3; Taiwan 2.
Magnesium metal, including alloys, all forms—tons	77	49	89	Republic of Korea 20; Taiwan 19.
Manganese:				
Ore and concentrate—do	2,947	3,142	3,350	Republic of Korea 969; Taiwan 601; Pakistan 491.
Oxides	34	34	41	United States 3; United Kingdom 3; Hong Kong 3.
Mercury—76-pound flasks	366	968	370	Australia 225; Republic of Korea 194; Thailand 191.
Molybdenum metal, including alloys, all forms—tons	17	23	22	West Germany 7; People's Republic of China 6; Republic of Korea 3.
Nickel metal, including alloys, all forms—do	1,231	843	744	India 152; People's Republic of China 120; Hong Kong 114.
Phosphorus, elemental (red)—tons	655	616	340	India 334; United States 58; People's Republic of China 51.
Platinum-group metals:				
Waste and sweepings (including silver waste and sweepings)—do	988	2	--	All to United Kingdom.
Metal—thousand troy ounces	47	19	175	United States 16; Taiwan 1.
Selenium, elemental—tons	26	65	213	United States 13; United Kingdom 9; India 8.
Silver metal, including alloys—thousand troy ounces	257	685	522	United Kingdom 356; Taiwan 184; Republic of Korea 102.
Tin:				
Ore and concentrate—long tons	--	--	16	
Oxides—do	32	6	37	New Zealand 2; Australia 2.
Metal, including alloys, all forms—do	1,556	955	581	Philippines 261; Taiwan 174; Colombia 149.
Titanium:				
Oxides	37	14	15	United States 9; Republic of Korea 2.
Metal, including alloys, all forms—tons	5,022	3,191	3,600	United States 2,457; France 244.
Tungsten metal, including alloys, all forms—do	51	92	81	West Germany 28; India 19; U.S.S.R. 15.
Uranium and thorium:				
Oxides, including rare-earth oxides—do	97	116	65	United Kingdom 71; West Germany 34.
Metal, including alloys, all forms—kilograms	--	--	160	
Zinc:				
Ore and concentrate—tons	--	--	880	
Oxides—do	726	1,384	128	United States 344; Taiwan 217; Thailand 207.
Metal, including alloys, all forms	80	70	112	India 21; Taiwan 9; Philippines 5.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal destinations, 1971
METALS—Continued				
Other:				
Ore and concentrate:				
Of titanium, molybdenum, tantalum, vanadium, and zirconium—tons	53	709	295	Republic of Korea 708.
Of base metals, n.e.s.—do	122	--	46	
Ash and residues, containing nonferrous emtals—do	3,489	4,318	1,092	Ryukyu Islands 3,500; United Kingdom 515.
Oxides, hydroxides and peroxides of metals, n.e.s.—do	2,045	3,155	3,974	United States 1,141; Thailand 355; United Kingdom 219.
Metals, including alloys, all forms:				
Phosphorus and other metalloids—do	261	50	113	Republic of Korea 19; United States 13.
Alkali, alkaline-earth and rare-earth metals—do	149	130	47	India 117; Taiwan 10.
Pyrophoric alloys—do	114	137	106	United States 32; Hong Kong 26; Singapore 25.
Base metals, including alloys, all forms, n.e.s.—do	6,672	8,202	8,800	United States 1,937; West Germany 1,428; Netherlands 1,115.
NONMETALS				
Abrasives, natural, n.e.s.:				
Emery—do	672	924	1,180	Taiwan 541; Hong Kong 149; Republic of Korea 127.
Natural abrasives, n.e.s.—do	4,253	279	366	Ryukyu Islands 107; U.S.S.R. 70.
Dust and powder of precious and semiprecious stones—thousand carats	410	6,922	8,871	United States 4,843; Republic of Korea 2,014.
Grind and polishing wheels and stones—tons	2,800	2,999	2,962	Thailand 417; United States 323; Taiwan 290.
Asbestos—do	169	493	758	Republic of Korea 142; South Vietnam 85; Indonesia 72.
Barite and witherite—do	--	210	390	Philippines 200; Indonesia 10.
Boron oxide and acid—do	61	85	107	Taiwan 39; Republic of Korea 26.
Cement	2,112	2,322	1,544	Indonesia 490; Singapore 364; Ryukyu Islands 309; Kuwait 284.
Chalk—tons	700	2,621	3,675	Hong Kong 1,065; Malaysia 465; Singapore 464.
Clays and products (including all refractory brick):				
Crude, n.e.s.—do	63,719	44,376	54,027	Philippines 14,968; Taiwan 11,369; Republic of Korea 3,668.
Products:				
Refractory (including nonclay bricks)—do	55,690	77,361	113,818	Australia 11,324; Thailand 9,720; Philippines 8,721.
Nonrefractory [2]—do	80,195	85,122	71,976	United States 37,044; Australia 9,306; Hong Kong 5,738.
Cryolite and chiolite—do	300	341	2	Brazil 200; Netherlands 130.
Diamond:				
Gem, not set or strung—carats	330	4,415	5,590	Hong Kong 4,305.
Industrial—thousand carats	80	148	103	United States 79; United Kingdom 52.
Diatomite and other infusorial earths—tons	1,021	1,414	1,414	Ryukyu Islands 308; Singapore 252; Australia 239.
Feldspar and fluorspar—tons	4,968	10,085	3,210	U.S.S.R. 6,201; Taiwan 1,917.
Fertilizer materials:				
Crude—do	--	9	36	All to Ryukyu Islands.
Manufactured:				
Nitrogenous [3]	1,147	1,338	1,537	People's Republic of China 837; Philippines 102; Ceylon 82.
Phosphatic	40	32	87	Ceylon 6; Ryukyu Islands 6; Republic of Korea 3.
Potassic	26	9	6	Ryukyu Islands 6; Malaysia 2.
Other, including mixed	178	171	228	Thailand 79; Ryukyu Islands 28; Indonesia 18.
Ammonia	92	104	99	Philippines 81; Republic of South Africa 15.
Graphite—tons	758	801	420	Thailand 276; Indonesia 174.
Gypsum and plasters	28	7	3	Ryukyu Islands 4; Taiwan 1.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal destinations, 1971
NONMETALS—Continued				
Iodine----------tons--	4,653	5,637	6,551	United States 2,192; West Germany 856; United Kingdom 670.
Kyanite and related materials--do----	4,122	3,995	5,204	Taiwan 2,730; Ryukyu Islands 578.
Lime----------do----	5,904	8,780	7,164	South Vietnam 4,491; Bismarck Archipelago 2,756.
Magnesite----------do----	742	408	68	United Kingdom 138; Taiwan 132.
Mica----------do----	80	199	390	Taiwan 118; Ceylon 15.
Pigments, mineral, including processed iron oxides----------do----	1,482	1,165	2,088	Taiwan 868; Republic of Korea 86.
Precious and semiprecious stones, except diamond--thousand carats--	63,101	225,131	275,061	Republic of Korea 87,403; Hong Kong 57,469; United States 37,308.
Salt and brine----------tons--	344	1,018	311	Taiwan 480; Ryukyu Islands 178.
Sodium and potassium compounds, n.e.s.:				
Caustic soda----------	205	289	186	Australia 259; Republic of Korea 7; Indonesia 6.
Caustic potash, sodic and potassic peroxides----------	2	4	5	People's Republic of China 1; United States 1.
Stone, sand and gravel:				
Dimension stone----------	3	2	1	Ryukyu Islands 1.
Dolomite, chiefly refractory grade-	5	3	4	Philippines 2.
Gravel and crushed rock--------	1	4	4	Ryukyu Islands 2.
Limestone (except dimension)----	826	674	881	Australia 647; Hong Kong 19.
Quartz and quartzite------tons--	241	270	160	Taiwan 150; Thailand 110.
Sand, excluding metal bearing----	11	14	3	Republic of Korea 7; Philippines 3.
Sulfur:				
Elemental, all forms----------	2	13	48	Taiwan 12.
Sulfur dioxide----------tons--	115	219	387	Australia 132; Philippines 75.
Sulfuric acid----------do----	1,081	886	462	Ryukyu Islands 408; Republic of Korea 277; Hong Kong 55.
Talc and steatite----------do----	825	1,854	765	Thailand 1,027; Malaysia 330.
Other nonmetals, n.e.s.:				
Crude----------	11	8	5	Singapore 3; Taiwan 1.
Slag, dross and similar waste, not metal bearing----------	14	32	20	Republic of Korea 30.
Oxides, hydroxides and peroxides of magnesium, strontium and barium (including magnesia clinker)----------	61	84	87	Australia 38; Venezuela 17; Republic of South Africa 14.
Fluorine and bromine_kilograms--	919	1,350	2,500	Taiwan 700; Republic of Korea 600.
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s---------	107	27	19	United States 13; Ryukyu Islands 4; Canada 2.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural--tons--	3	3	6	All to Taiwan.
Carbon black----------	19	26	28	Taiwan 6; Thailand 6; Singapore 3.
Carbon, gas----------kilograms--	61	--	3	
Coal, all grades, including briquets----	16	18	9	Republic of Korea 16; France 1.
Coke and semicoke----------	94	259	394	Venezuela 119; Malaysia 43; Republic of Korea 37.
Gas, manufactured only-------tons--	7	3	301	Indonesia 1; Saudi Arabia 1.
Hydrogen and rare gases (helium, neon, argon, krypton and xenon)--do----	307	275	278	Singapore 39; Iran 38; Republic of Korea 30.
Peat, including peat briquets and litter----------do----	70	90	20	All to Taiwan.
Petroleum:				
Crude and partly refined thousand 42-gallon barrels--	720	684	7,610	Republic of Korea 683.
Refinery products:				
Nonbunker:				
Gasoline--------do----	472	483	349	Australia 270; Ryukyu Islands 166.
Naphtha--------do----	37	31	479	Mainly to Ryukyu Islands.
Kerosine and jet fuel do----	1,188	3,016	3,107	United States 1,067; India 1,024.
Distillate fuel oil_do----	204	884	519	Thailand 609; Hong Kong 152; Mexico 73.
Residual fuel oil--do----	275	531	189	Indonesia 280; Taiwan 144; Ryukyu Islands 101.
Lubricants------do----	2,227	2,472	3,188	Republic of Korea 736; Taiwan 487; Singapore 379.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products—Continued				
Nonbunker—Continued				
Mineral jelly and wax thousand 42-gallon barrels	244	301	329	Republic of South Africa 61; Republic of Korea 43; Brazil 28.
Bitumen do	1,035	482	211	Indonesia 116; U.S.S.R. 69; Ryukyu Islands 69.
Liquefied petroleum gas do	500	696	527	Ryukyu Islands 461; Taiwan 157; Hong Kong 61.
Other do	440	136	129	Taiwan 46; Republic of Korea 32; United States 27.
Bunker:[4]				
Kerosine and jet fuel do	8,072	9,813	NA	NA.
Distillate fuel oil do	8,133	8,639	NA	NA.
Residual fuel oil do	91,757	98,966	NA	NA.
Other do	208	255	NA	NA.

NA Not available.

[1] Excludes exports under Japanese-United States Mutual Defense Agreement or for account of United States military forces.

[2] Excludes mosaic tile valued at (thousand yen): 1970, 13,461,658; 1971, 15,119,569; 1972, 20,666,571.

[3] Excludes exports of following amounts of urea containing more than 45% nitrogen: 1970, 1,416,665 tons; 1971, 1,797,950 tons; and 1972, 2,511,128 tons.

[4] Source: Ministry of International Trade and Industry. Yearbook of Petroleum Statistics for 1970 and 1971.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal sources, 1971
METALS				
Aluminum:				
Bauxite and concentrate	3,660	4,669	4,997	Australia 2,632; Indonesia 1,103; Malaysia 835.
Oxide and hydroxides	351	506	548	Australia 498; Netherlands 5; United States 1.
Fused alumina (artificial corundum) tons	1,028	2,213	201	Canada 1,643.
Metal, including alloys:				
Scrap	11	12	37	United States 5; Australia 2; Hong Kong 1.
Unwrought	258	226	325	Canada 86; Australia 47; United States 22.
Semimanufactures	3	4	8	United States 2; France 1.
Antimony:				
Ore and concentrate tons	17,344	10,197	13,312	Bolivia 5,272; People's Republic of China 3,083; Thailand 1,036.
Metal, including alloys, all forms do	20	(2)	262	NA.
Arsenic:				
Natural sulfides do	57	10	2	All from People's Republic of China.
Trioxide, pentoxide and acids do	933	605	1,442	People's Republic of China 495; France 109.
Beryllium metal, including alloys, all forms kilograms	2,710	3,276	9,084	All from United States.
Bismuth metal, including alloys, all forms tons	32	1	1	Mainly from United Kingdom.
Cadmium metal, including alloys, all forms kilograms	--	52	4	United Kingdom 30; United States 22.
Chromium:				
Ore and concentrate	1,150	1,162	875	Republic of South Africa 720; India 144; Philippines 98.
Oxide and hydroxides tons	520	739	737	West Germany 452; U.S.S.R. 249.
Cobalt:				
Oxide and hydroxides do	729	580	684	Belgium 552; Canada 15.
Metal, including alloys, all forms do	4,638	1,470	2,952	Zaire 922; Belgium 258; United States 178.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal sources, 1971
METALS—Continued				
Columbium and tantalum:				
Tantalum:				
Ore and concentrate tons	115	105	59	Brazil 37; Australia 26.
Metal, including alloys, all forms do	43	23	23	United States 21.
Copper:				
Ore and concentrate	1,565	1,926	2,170	Philippines 768; Canada 650; Chile 168.
Matte	24	9	8	Taiwan 4; Philippines 3.
Metal, including alloys:				
Scrap	66	54	70	United States 32; Hong Kong 5; Canada 3.
Unwrought	313	282	303	Zambia 135; Chile 62; Zaire 16.
Semimanufactures	2	2	2	Mainly from United States.
Germanium:				
Dioxide tons	26	15	20	Belgium 9; West Germany 5.
Metal, including alloys, all forms do	1	1	(2)	Mainly from U.S.S.R.
Iron and steel:				
Ore and concentrate (including roasted pyrites)	102,090	114,951	111,520	Australia 46,287; India 16,795; Chile 9,036.
Metal:				
Scrap	5,793	2,552	2,499	United States 1,758; Australia 351; U.S.S.R. 330.
Pig iron, including cast iron	2,854	1,183	1,004	Republic of South Africa 330; India 326; Australia 240.
Sponge iron, powder and shot	41	15	13	Sweden 10; North Korea 3.
Ferroalloys	149	48	60	Republic of South Africa 33; United States 4; India 2.
Steel, primary forms	80	29	64	India 27; Spain 1.
Semimanufactures	38	23	39	United States 9; Sweden 3; Taiwan 3; Republic of Korea 2.
Lead:				
Ore and concentrate	210	225	199	Canada 154; Peru 27; Republic of Korea 19.
Oxides tons	75	176	350	United States 141.
Metal, including alloys:				
Scrap do	2,639	1,759	4,133	Ryukyu Islands 917; South Vietnam 534.
Unwrought	2	4	5	North Korea 2; Territory of South-West Africa 1.
Semimanufactures tons	38	42	8	United States 37; West Germany 3.
Magnesium metal, including alloys, all forms do	2,280	1,005	3,221	U.S.S.R. 464; United States 427.
Manganese ore and concentrate [3]	2,584	3,243	2,921	Republic of South Africa 1,133; India 995; Australia 578.
Mercury 76-pound flasks	36,103	15,045	13,005	Mexico 5,958; Philippines 4,339.
Molybdenum:				
Ore and concentrate tons	15,121	12,814	10,235	United States 7,011; Canada 3,504; Chile 2,097.
Trioxide do	241	20	123	United States 19.
Metal, including alloys, all forms do	144	44	143	West Germany 20; United States 20.
Nickel:				
Ore and concentrate	4,670	4,903	3,152	New Caledonia 3,950; Indonesia 818; Australia 107.
Matte, speiss, and similar materials	18	16	13	Canada 10; New Caledonia 5.
Metal, including alloys:				
Scrap tons	1,425	912	1,828	Taiwan 314; United States 304.
Unwrought do	11,430	9,356	12,310	U.S.S.R. 4,054; Canada 1,721; Norway 1,273.
Semimanufactures do	1,519	1,337	1,629	United Kingdom 627; United States 311; West Germany 242.
Platinum-group metals:				
Metals, including alloys, all forms:				
Platinum thousand troy ounces	465	646	1,121	U.S.S.R. 293; United Kingdom 135; Republic of South Africa 114.
Paladium do	633	699	929	U.S.S.R. 611; Republic of South Africa 28; United Kingdom 28.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal sources, 1971
METALS—Continued				
Rare-earth metals:				
Oxides and crude chlorides tons	2,420	2,471	2,235	India 1,685; Brazil 670.
Metals (yttrium and scandium) kilograms	52	148	204	France 101; West Germany 20.
Selenium, elemental do	5,848	1,915	190	All from United States.
Silicon tons	4,285	809	7,792	United States 538; Canada 270.
Silver:				
Ore and concentrate do	5,840	6,376	5,485	Peru 3,094; Republic of Korea 2,950.
Metal, including alloys, all forms thousand troy ounces	13,282	9,950	18,582	Peru 3,310; Australia 2,326; United States 2,098.
Tellurium kilograms	4,101	1,280	1,099	U.S.S.R. 1,000; United States 270.
Tin:				
Ore and concentrate long tons	245	18	26	All from Australia.
Oxide do	1	5	14	Australia 3; United States 1.
Metal, including alloys, all forms do	26,468	27,274	30,585	Malaysia 23,167; Indonesia 3,225.
Titanium:				
Ore and concentrate	588	554	446	Australia 202; Malaysia 156; India 90.
Slag	--	15	52	All from Canada.
Oxides (includes slag) tons	6,155	6,167	3,359	United States 3,664; United Kingdom 1,048; Belgium 801.
Tungsten:				
Ore and concentrate do	6,160	2,756	2,436	Republic of Korea 1,165; Peru 459; Thailand 355.
Metal, including alloys, all forms do	125	59	60	West Germany 31; United States 14; France 9.
Uranium and thorium:				
Ore and concentrate do	50	180	65	Zaire 59; Thailand 49.
Oxides (compounds of thorium or uranium depleted in U-235) kilograms	83,407	37,461	50,924	United States 18,906; France 17,933.
Metal, including alloys, all forms do	2,745	1	202	All from United States.
Vanadium pentoxide tons	2,807	2,317	2,039	Republic of South Africa 1,407; West Germany 720.
Zinc:				
Ore and concentrate	973	1,076	1,116	Canada 370; Peru 339; Australia 118.
Oxide tons	383	264	1,084	West Germany 90; Denmark 53; U.S.S.R. 47.
Metal, including alloys, all forms	22	14	8	North Korea 9; Canada 2; Australia 2.
Zirconium ore and concentrate (including zircon sand) tons	94,275	76,588	117,175	Australia 73,577; Malaysia 2,710.
Other:				
Ore and concentrate:				
Of base metals, not elsewhere specified (including niobium) do	3,132	3,150	2,795	Australia 1,585; Nigeria 707; Brazil 651.
Ash and residue containing nonferrous metals do	15,941	14,911	14,229	Australia 2,801; United States 2,174; Philippines 1,471.
Oxides, hydroxides and peroxides of metals, n.e.s.[4] do	1,509	1,201	1,427	United States 800; U.S.S.R. 200; West Germany 109.
Metals, including alloys, all forms:				
Metalloids [5] do	2,835	4,954	10,171	U.S.S.R. 4,554; West Germany 400.
Alkali and alkaline-earth metals [6] do	602	29	23	United States 23; Canada 3.
Pyrophoric alloys (ferro-cerium) do	13	7	7	Australia 4; United Kingdom 1.
Base metals, including all forms, n.e.s.[7] do	761	1,209	606	United States 872; U.S.S.R. 224; United Kingdom 100.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal sources, 1971
NONMETALS				
Abrasives natural except diamond n.e.s.:				
Crude tons	4,347	2,755	2,702	United States 1,328; People's Republic of China 713; Italy 661.
Dust and powder of precious and semiprecious stones kilograms	13,133	18	131	Mainly from United States.
Grinding and polishing wheels and stones tons	261	308	302	United States 143; Canada 67; Taiwan 34.
Asbestos	298	274	279	Canada 111; Republic of South Africa 99; U S.S.R. 56.
Barite and witherite	29	9	20	People's Republic of China 5; India 2.
Boron materials:				
Crude natural borates	28	24	42	Turkey 19; United States 4.
Oxide and acid	15	r 14	15	United States 10; U.S.S.R. 3.
Cement	3	5	5	United States 2; West Germany 2.
Clays and products:				
Crude, n.e.s.:				
Kaolin	243	249	276	United States 136; Republic of Korea 75; U S.S.R. 26.
Kyanite, andalusite and sillimanite	39	26	19	Republic of South Africa 16; India 8.
Other	351	498	259	United States 241; Republic of South Africa 110; People's Republic of China 55.
Products:				
Refractory (including nonclay bricks) tons	6,852	7,032	8,107	United States 2,228; Republic of South Africa 1,563; Taiwan 1,231.
Nonrefractory do	2,273	1,578	6,291	Italy 1,001; United States 189.
Cryolite and chiolite	9	8	1	Denmark 7.
Diamond:				
Gem, not set or strung thousand carats	266	384	534	Israel 161; Belgium 101; United States 36.
Industrial stones do	772	672	814	United States 220; Belgium 164; United Kingdom 115.
Powder and dust do	5,446	5,118	6,525	United States 2,782; United Kingdom 793; Ireland 676
Diatomite and other infusorial earths tons	2,944	2,104	3,249	United States 1,998; Republic of Korea 70.
Feldspar, leucite, nepheline, and nepheline syenite do	5,915	2,468	2,508	India 1,473; Republic of Korea 300; People's Republic of China 300.
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrate)	15	1	2	All from Chile.
Phosphatic	3,125	2,985	3,040	United States 2,015; Morocco 482; Nauru 202.
Other tons	63	79	91	France 49; United States 18.
Manufactured:				
Nitrogenous	11	7	20	Chile 4; Norway 2.
Phosphatic	13	r 10	16	All from United States.
Potassic	1,333	1,271	1,176	Canada 583; United States 193; U.S.S R. 182.
Mixed	49	67	49	Mainly from United States.
Ammonia tons	50,181	1	3	All from United States.
Fluorspar	521	678	490	Thailand 291; Republic of South Africa 135; People's Republic of China 97.
Graphite, natural	77	56	40	Republic of Korea 25; North Korea 18.
Gypsum and plasters	77	89	138	Morocco 60; Mexico 28.
Kyanite and related materials	39	26	19	Republic of South Africa 16; India 8.
Lime tons	19	2,500	--	All from Pakistan.
Magnesite and magnesia clinker	59	37	27	North Korea 24; U S.S.R. 7.
Mica, all forms	11	7	7	India 4; Republic of Korea 1.
Pigments, mineral, including processed iron oxides tons	2,546	2,398	3,148	West Germany 1,978; United States 228.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1971	1971	1972	Principal sources, 1971
NONMETALS—Continued				
Precious and semiprecious stones, except diamond:				
Natural——tons	899	883	1,049	Brazil 561; Republic of South Africa 89; Malagasy Republic 47.
Manufactured——do	9	11	12	United States 10; Switzerland 1.
Pyrite (gross weight)	184	[2]	3	NA.
Salt	6,490	7,254	6,875	Australia 2,924; Mexico 2,846.
Sodium and potassium compounds, n.e.s.:				
Caustic soda——tons	5,757	186	108	United States 105; West Germany 80.
Caustic potash, sodium peroxide——do	40	10	10	All from West Germany.
Stone, sand and gravel:				
Dimension stone	115	159	203	Republic of South Africa 57; India 24; Sweden 18.
Dolomite, including agglomerated dolomite	27	24	20	Republic of Korea 23.
Gravel and crushed rock	24	21	40	France 7; Republic of Korea 5; People's Republic of China 4.
Quartz and quartzite	208	155	110	Republic of Korea 131, North Korea 6.
Sand excluding metal bearing	186	185	262	Australia 184.
Sulfur, colloidal, sublimed or precipitated——kilograms	44,224	275,998	153,473	United States 273,145.
Talc, steatite, soapstone and pyrophyllite	158	173	220	People's Republic of China 90; North Korea 31, Republic of Korea 24.
Other nonmetals, n e s.:				
Crude:				
Meerschaum, amber and jet——kilograms	100	10	--	All from U.S.S.R.
Other	137	157	201	Republic of Korea 58; Philippines 36; Australia 19.
Slag, dross and similar waste and ash, including kelp, not metal bearing	137	146	122	India 80; Republic of Korea 55.
Oxides, hydroxides and peroxides of magnesium, strontium and barium——tons	224	120	178	United States 78; France 19.
Bromine and iodine——do	125	273	1,324	All from Israel.
Fluorine——kilograms	53	228	28	All from United States.
Building materials of asphalt, asbestos-cement, cellulose fibre-cement or the like——tons	4,587	5,366	5,790	Canada 4,208; Australia 587.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	2	2	Mainly from United States.
Carbon black	5	4	4	Do.
Coal and briquets:				
Anthracite	1,405	1,584	756	North Vietnam 410; People's Republic of China 344; Republic of Korea 323.
Bituminous:				
Heavy coking coal, less than 8% ash	21,838	20,174	20,459	United States 14,649; Australia 2,423; Canada 1,196.
Heavy coking coal, more than 8% ash	16,960	15,969	17,136	Australia 8,271; Canada 4,516; United States 1,972.
Other coking coal	9,970	9,197	10,927	Australia 5,901; United States 1,858; Canada 902.
Lignite and lignite briquets	14	13	9	All from Australia.
Coke and semicoke	146	41	15	Australia 40.
Gas, hydrocarbon (liquefied natural gas)—thousand 42-gallon barrels	9,839	11,390	11,040	All from United States.
Hydrogen, helium and rare gases——kilograms	71,859	92,476	82,085	United States 60,953; Canada 23,954.
Peat, including peat briquets and litter——tons	547	1,455	4,277	U.S S.R. 858; Denmark 306; United Kingdom 138.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum:				
Crude and partly refined:				
Crude thousand 42-gallon barrels	1,142,173	1,332,516	1,447,835	Iran 603,404; Saudi Arabia 201,273; Indonesia 161,444.
Partly refined ——do——	97,597	66,918	119,541	Saudi Arabia 34,975; Saudi Arabia-Kuwait Neutral Zone 12,649; Kuwait 10,740.
Refinery products:				
Naphtha ——do——	41,317	37,436	37,684	Kuwait 11,047; Singapore 8,911; United States 4,300.
Kerosine and jet fuel ——do——	2,103	2,063	1,835	Singapore 1,068; Kuwait 783; United States 127.
Distillate fuel oil ——do——	15,713	15,787	15,813	Kuwait 4,275; Singapore 3,743; U.S.S.R. 2,851.
Residual fuel oil ——do——	142,857	129,146	98,626	Indonesia 23,874; Kuwait 22,566; Saudi Arabia 19,903.
Lubricants ——do——	2,337	2,782	1,363	United States 2,198.
Liquefied petroleum gas ——do——	31,126	38,394	49,472	Kuwait 13,375; Saudi Arabia 11,380; Iran 5,836.
Petroleum coke ——do——	14,150	9,016	9,781	United States 8,318; People's Republic of China 308.
Other ——do——	302	369	807	United States 272.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	10	24	25	United States 12; U.S.S.R. 6.

r Revised. NA Not available.

[1] Excludes imports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces.

[2] Less than ½ unit.

[3] Includes ferruginous manganese and manganese dioxide.

[4] Includes lithium hydroxide, beryllium oxide, mercury oxide, antimony trioxide, cuprous oxide and nickel oxide, inorganic bases and metallic oxides, hydroxides and peroxides, n.e.s., and silicon dioxides.

[5] Includes phosphorus, boron and arsenic.

[6] Includes lithium, sodium, alkali-metals, n.e.s., and alkaline-earth metals.

[7] Includes base metals and scrap of base metals.

COMMODITY REVIEW

METALS

Aluminum.—Aluminum continued its upward surge, with primary output surpassing the 1 million-ton level for the first time. In addition, 412,000 tons of secondary aluminum was produced in 1972. Although still far below U.S. production, Japan was pressing the Soviet Union and had left Canada behind. Nonetheless, growth in output was far short of ultimate plans. Because of economic difficulties, most aluminum producers in Japan deferred expansion schedules during 1971 and 1972. By yearend 1972, overall conditions in the country had greatly improved and demand was picking up. It can be expected, therefore, that most of the companies will again invest in new production facilities.

Like the aluminum industries of many other countries, Japan's aluminum industry is international in nature and has commercial ties with name companies abroad. Because of specific relationships, large quantities of alumina are both imported and exported and sizable tonnages of aluminum are imported. However, all the bauxite must come from foreign countries and imports totaled 4.7 million tons in 1971 and 5.0 million tons in 1972.

Australia has steadily improved its position as the main supplier of bauxite and alumina to Japan, shipping more than the second- and third-ranked suppliers, Indonesia and Malaysia, combined in the last 3 years. During 1972, Australia supplied 2.8 million tons of bauxite to Japan. Bauxite from the Weipa deposits, owned by a consortium headed by Comalco (Australia)

Co., Ltd. went mainly to Sumitomo Chemical Co., Ltd. and Showa Denko Co., Ltd., each of which were scheduled to receive 1.1 million tons during fiscal year 1972; these two Japanese firms were also shareholders of the Comalco joint venture. Bauxite from Darling Range, owned by Alcoa (Australia) Ltd., was shipped mainly to Nippon Light Metal Co., Ltd. Alumina from Pinjarra (also owned by Alcoa) went to the Naoetsu and Sakaide reduction plants of Mitsubishi Chemical Co., Ltd. Mitsui Aluminum Co., Ltd., the newest aluminum producer in Japan, was scheduled to get its bauxite long term from the Gove project owned by Napalco Pty., Ltd. Whereas overall shipments from Australia to Japan should further increase, one potential deal of major consequence has been indefinitely postponed. This is the Kimberly alumina project organized by a consortium headed by the American Metal Climax, Inc. (AMAX) and including Showa Denko, Sumitomo Chemical, two other Japanese firms, plus European and other U.S. interests. The AMAX plan to produce 1.2 million tons of alumina annually, which seemed feasible in 1971, was discarded in the fall of 1972.

Japan has acquired 1.5 to 2 million tons of bauxite yearly from Bintan, Indonesia, and Johore, Malaysia in recent years, with the three older aluminum companies, Nippon Light Metal, Sumitomo Chemical, and Showa Denko, importing the bulk. Whereas Malaysia will remain a major source as long as the present high grade ores last, a new twist may develop in the Indonesian supply. Bintan which now supplies Japan with about a million tons of bauxite annually may be able to provide more raw materials from a new deposit on Enam Island. In late 1972, the three older Japanese aluminum companies were discussing a joint plan with the Indonesians to build a $120-million, 400,000-ton alumina plant based upon Enam ores. However, since this project may ultimately be related to a proposed aluminum reduction and powerplant at Asahan, Indonesia, its implementation may be some time in the future. The Japanese primary aluminum producers were jointly searching for bauxite worldwide through a new organization called Aluminum Resources Development Co. (ARDECO). During 1971–72, ARDECO made a survey of bauxite resources in Ghana and evaluated the possibilities on Samar Island, Philippines.

Data on Japan's existing and projected alumina and aluminum facilities, as of December 31, 1971, with details on individual companies and plants, were tabulated in the 1971 Minerals Yearbook, V. III, The Mineral Industry of Japan. The general situation has not changed greatly since that time. Details on the structure and problems of the Japanese aluminum industry were described in a recent article,[5] as well as the interrelationships between Japanese and international firms and aluminum producers and fabricators.

Nippon Light Metal, the largest and oldest of Japanese aluminum firms and half owned by Alcan Aluminium Ltd., finally put its No. 2 potline at Tomakomai, which was completed in January 1971, into full operation in the fall of 1972. The two potlines had a combined annual capacity of 130,000 tons of aluminum. Because of increased demand, Nippon Light Metal placed its half-worked Niigata plant of 143,000 tons a year capacity once more into full-scale production in December. Nippon has been the principal Japanese company exporting alumina; during September 1972 to March 1973, plans were to export 100,000 tons.

At yearend 1972, Sumitomo Chemical's total aluminum capacity remained at 262,000 tons a year. Expansion of the Toyama Works from 112,000 tons to 168,000 tons by the end of March 1974, which represents the principal construction activity of the company, calls for building an additional 224 units of 100,000-ampere cells. Meanwhile, completed facilities at the Toyama Works had not been worked full scale during much of 1972, and the old No. 1 Kikumoto Works was down all year and may be closed permanently. Sumitomo hopes to build Japan's first integrated aluminum plant near Sakata in Yamaguchi Prefecture. Plans are also underway to enlarge the 580,000-ton alumina plant at Kikumoto by 100,000 tons.

Showa Denko encountered financial difficulties in 1972. Sluggish demand prevented operation of 25,000-ton-per-year equipment which was newly installed at the Chiba No. 2 Works. Plans to enlarge

[5] The Industrial Bank of Japan, Ltd. (Tokyo). The Aluminum Industry. Survey of Japanese Finance & Industry. V. 24, No. 4, October–December 1972, pp. 36–49.

this plant from 80,000 to 130,000 tons of aluminum capacity have been postponed for at least 3 years. Reduction in personnel was also underway. Showa Denko's business in special alumina—about 80,000 tons a year on top of 540,000 tons of the type for making aluminum—was one of the few lucrative lines.

Mitsubishi Chemical, which buys alumina from Alcoa Australia, began an expansion program late in the year that was more ambitious than original plans. The older 155,000-ton Naoetsu plant will not be affected. All work is centered at the newer Sakaide plant in Shikoku. About ¥15 billion will be spent to raise Sakaide's annual capacity to 200,000 tons through the installation of 288 units of 138,000-ampere cells. The project is slated to be completed by the spring of 1974. One-tenth of the new investment will go into pollution-control equipment and petroleum will be used as fuel.

Mitsui Aluminum, with an agreement with the Australians to use high-grade but hard-to-treat pisolitic bauxite from the Gove area, completed a 200,000-ton-a-year alumina plant at Wakamatsu, Kyushu in the summer of 1972 at a cost of ¥14 billion. No time schedule has been set to double this capacity. A 75,000-ton aluminum plant was also completed at Miike, Kyushu, late in 1972 to complement the nearby alumina plant. Miike is scheduled to be expanded to 162,000 tons by December 1975 at a cost of ¥33 billion. This means a second coal-fired, electric power-plant with a capacity of 175,000 kilowatts (the first was rated at 156,000 kilowatts) and 256 units of 125,000-ampere cells. Mikke happens to be the site of the best coal mine in Japan.

Sumitomo Chemical and Showa Denko, each with a quarter of the shares, are in a joint venture with Comalco Australia in an aluminum plant at Bluff, New Zealand. Before the end of 1971, 73,000 tons of reduction capacity had already been completed; a year later, an additional 27,000 tons of capacity was being built. Initial contracts called for shipments of about 28,000 tons annually each to Sumitomo Chemical and Showa Denko. Because of depressed markets, the Japanese partners were not particularly anxious to receive the aluminum.

A proposed reduction plant in Okinawa was postponed indefinitely in 1972, because of strong opposition by local people who fear the hazards of pollution.

Japan's aluminum output for 1970–72, by company, is shown below, in tons:

Company	1970	1971	1972
Nippon Light Metal	215,361	238,736	272,053
Sumitomo Chemical	185,808	234,767	241,170
Showa Denko	181,849	217,251	212,451
Mitsubishi Chemical	144,880	160,305	211,789
Mitsui Aluminum	--	36,058	71,221

Copper.—Despite financial difficulties during the first half of the year, brought about by the upward evaluation of the yen, reduced demand for copper products coupled with renegotiation of ore supply contracts, a prolonged seaman's strike that did not end until July 14, and surplus smelting capacity, Japan's copper industry established a record in 1972 with an output of electrolytic copper exceeding 810,000 tons, nearly 100,000 tons more than the quantity produced in 1971. The refined metal was extracted from approximately 2,170,000 tons of imported copper concentrate, also an alltime high, plus a half million tons of domestic concentrate. In 1972 Japan also imported about 300,000 tons of crude and refined copper ingot along with nearly 100,000 tons of scrap. Domestic consumption of copper for the year was some 900,000 tons. Producer stocks, which stood at more than 60,000 tons at the end of November, declined to 17,000 tons a month later. The phenomenal rise in sales during December was due in part to the recovery in demand for copper mill products and wire and cable plus speculative demand in anticipation of a sharp increase in copper selling price by January 1973. MITI expected bullish conditions to carry over to all of 1973, with projected increases in production and consumption at more than 10% in both cases.

As shown in the 1971 Minerals Yearbook, V. III, The Mineral Industry of Japan, Japan's copper refining capacity was 877,000 tons a year in July 1971. Official projections indicate that total copper refining capacity will increase to 1,018,000 tons by March 31, 1973, and 1,163,000 tons by March 31, 1974. Japan retires inefficient facilities as new ones are built so that reported capacities automatically exclude obsolescent facilities. After adjusting to the

economic crisis, the country's copper smelters were once more operating at full capacity by September 1972.

Mitsubishi Metal Corp. made a profound impact on the world copper scene during 1972. A pollution-free continuous copper smelter of 4,000 tons monthly was being built at Naoshima at a cost of ¥2.3 billion; construction was ahead of schedule with the smelter nearly completed by yearend 1972. This revolutionary process adopted at Naoshima was developed and pilot-plant-tested at Onahama by a subsidiary of Mitsubishi. At the turn of 1973 Onahama itself was on the threshhold of becoming the largest copper smelter in the world, with refinery capacity raised to 19,300 tons monthly at a cost of ¥15.3 billion. When fully operable in April 1973, Onahama will have two autogenous furnaces, five converters, three refining furnaces and corresponding electrolytic facilities, and 43,800 tons of sulfuric acid capacity a month.

Nippon Mining Co.'s contribution was nearly as impressive. At the Saganoseki Works in Kyushu, a second 10,000-ton-a-month autogenous smelting furnace was being readied for completion by August 1973 at a cost of ¥4 billion. Saganoseki's refining capacity of 14,000 tons a month will be cut down by 3,000 tons with the closure of the No. 1 electrolytic plant. Meanwhile, the Hitachi Works was being built up. A 7,000-ton-a-month autogenous furnace, which was practically completed at yearend 1972, will replace the existing 6,000-ton blast furnace. A new 5,000-ton-a-month copper refinery will also be built at Hitachi before 1974 to replace the old refinery at Saganoseki. Nippon Mining will be rated at 27,000 tons in both smelting and refining capacities by 1974, split between the two works.

Sumitomo Metal Mining Co. was in the process of building up its Toyo facilities in Ehime Prefecture, Shikoku into a large, integrated plant. The autogenous smelting furnace in existence was producing at 10,000 tons of blister monthly, one-fourth higher than designed capacity. A 4,000-ton-a-month copper refinery was being readied for startup by July 1973, with a second 5,000-ton electrolytic refinery scheduled for completion some time in 1974; these two refineries have been budgeted at a combined ¥2 billion. Sumitomo has plans to build another autogenous furnace and additional refining capacity by 1977.

To match its 7,000-ton-a-month smelter at Tamano, the Hibi Smelting Co., Ltd. brought a refinery of similar capacity and at the same location into full-scale operation in mid-1972.

Mitsui & Co. together with Furukawa Electric Co. decided in 1972 to jointly build a 125,000-ton-per-year smelter and refinery at Ilo, Peru. This facility is scheduled for completion in 2 to 3 years, and will use copper ores furnished by the U.S. firm, Southern Peru Copper Corp.

Japans local copper mining industry underwent significant changes during 1972. Sumitomo Metal Mining closed the most famous of Japanese copper mines—Besshi in Ehime Prefecture—in the spring. Furukawa Mining was about to shut down another old copper mine—Ashio with a 420-year history—by yearend.

Mitsubishi Metal Corp. increased the capacity of its Shimokawa mine in the Kamikawa district of Hokkaido to 1,200 tons of 2- to 2.3%-copper ore daily or 720 tons of mine copper monthly. Mitsubishi also uncovered a new "400-meter" ore body at a location 2,500 meters from the center of the Shimokawa mine. Mitsubishi's Matsuki "black ore" mine in Akita was being readied for full-scale production by April 1973 through a subsidiary Osarusawa Mining Co. The 3-million-ton deposit analyzing 3.7% copper, 2% zinc, and 0.8% lead will be worked at a rate to yield about 5,000 tons of mine copper annually.

Dowa Mining Co., by far the leader in "black ore", has spent about ¥2 billion a year in the last decade in exploring ores of this type in Akita Prefecture. Three major deposits discovered, namely Matsumine, Uchinotai, and Fukazawa, have yielded a total of some 50 million tons of "black ore" analyzing on an average of perhaps 2.5% copper and 5% combined lead-zinc. In 1972, Dowa embarked on a program to reevaluate the deposits and concessions, believing that other major ore bodies remain to be discovered.

Although concentrates have been the main source of copper raw materials, metal and scrap have also been of significance in recent years. During 1972, 173,392 tons of refined copper (including 99,671 tons from Zambia) and 120,160 tons of blister copper (including 51,516 tons from Zambia) were

imported, along with 39,000 tons of copper scrap and 49,813 tons of brass and bronze scrap. Since Japan currently is considering building copper smelters abroad, in order to obtain copper, imports in metallic forms may become more important in the future.

For some time to come, Japan's main thrust in obtaining copper will continue to be long-term supplies of concentrates. Considering materials already contracted, imports of copper-in-concentrates will probably rise from about 600,000 tons in 1972 to perhaps a million tons by 1975.

In 1972, Canada took over the leadership from the Philippines as the foremost supplier of mine copper to Japan. During 1972, out of a total of 2,170,409 tons of copper concentrate imported, Canada furnished 813,427 tons as compared with 715,146 tons for the Philippines. About a dozen Canadian copper mines will be shipping to Japan shortly, including four of the newest and largest projects—Lornex, Valley Copper, Port Hardy, and Ingerbelle. The following example concerning the Lornex contract illustrates one of the problems brought about by the reevaluation of the yen: A 12-year contract had been signed for 150,000 tons of wet concentrate containing 49,000 tons of mine copper annually to be delivered to Japan beginning in July 1972. Subsequent negotiations cut the tonnage down by 10% for the first 2 years, at Japan's request; the treatment charge was raised in line with the higher value of the yen which meant that Lornex's receipts would be slightly lower on a unit basis.

Sumitomo Metal Mining, major owner of Bethlehem Copper Corp., headed the list of Japanese mining companies involved in Canadian projects. In 1972, Sumitomo sold 22% of its shares of Bethlehem to Newmont Mining Co. (Bethlehem is part owner of the Valley Copper and Highland Valley projects).

The Philippine supply of mine copper to Japan did not show great change from 1971, as most of the producers have stabilized their output. Atlas Consolidated Mining and Development Corp. was the only important producer to raise output in 1972. Meanwhile, several new projects such as Dizon and Batong Buhay, which potentially could supply more than 10,000 tons each of mine copper annually, were dropped because of the depressed copper market. There was serious talk about building copper smelters in the Philippines which could mean less concentrate to Japan.

The Bougainville project in the Australian-administered Territory of Papua–New Guinea came onstream in April as scheduled. The original 15-year contract was to ship 95,000 tons of mine copper annually (out of a total of 150,000 tons) to Japan. Japanese companies wanted to cut down the supply temporarily and were successful in renegotiating an agreement to smelt 10% of the total supply on a toll basis for Bougainville to sell itself; also, the treatment charge will be raised slightly to cover pollution control expenses.

Freeport Mineral Co.'s Ertzberg project in West Irian, Indonesia, started production at yearend 1972, slightly ahead of schedule. About two-thirds of the output or roughly 40,000 tons of copper-in-concentrate was scheduled to go to Japan under long-term contract. Again, the Japanese were seeking to temporarily cut the delivery tonnage and raise the smelting charge. The Mamut project in Sabah, Malaysia, presented a slightly different problem since it is 51% owned by the Japanese and will not be in production until 1974 or 1975; in October 1972, an agreement was reached to produce about 30,000 tons of mine copper annually for the Japanese market, down about 10,000 tons from the original plan.

The Musoshi project in Zaire, owned 85% by the Japanese and the rest by the Zaire Government, started production late in 1972. When in full operation, it will supply 53,000 tons of mine copper a year to Japan from a 110-million-ton deposit of 3.3% ore. Musoshi will not have any cutbacks, since it is a Japanese company. Under the same management, additional drilling has been done in the Rubenbe area, also in Katanga, with promising results of similar high grade ore.

Nippon Mining's project in the Debarwa area of Ethiopia moved ahead to a point whereby specific plans were made to build a concentrator with a capacity of 5,000 to 6,000 tons of copper concentrates a month beginning in late 1974. Another high-grade prospect was found at Adi Nefas north of Asmara and 50 kilometers from Debarwa; however, detailed drilling has not yet been done.

A joint venture, owned two-thirds by the Iranian firm Societe Mardenlute and one-third by a Japanese consortium headed by Nittetsu Mining Co., was formed in 1972 with plans to produce 18,000 tons of copper concentrate annually beginning in early 1975 from the Lalezari mine. The deposit has reserves of less than 1 million tons of 4% copper ore with high gold and silver values. A beneficiation plant that can handle 10,000 tons of ore a month will be constructed to produce 25% grade copper concentrate.

The Peruvian Government asked Japanese nonferrous firms to help develop the Michiquillay deposit which has reserves of more than one-half billion tons of 0.6 to 0.7% copper ore. This deposit is capable of supporting an annual output of 100,000 tons of mine copper and would require an investment of more than $200 million. Late in 1972, the Japanese sent a survey team to investigate the project. However, development may not start until the late 1970's.

Iron and Steel.—Despite economic dislocations in late 1971, Japan quickly reversed the trend in crude steel production by establishing a record of 96.9 million tons in 1972, up 8.3 million tons over output in 1971. The sharp gain the last quarter of 1972 is expected to continue in the ensuing quarter so that Japan's steel production during fiscal year 1972 could well top 102 million tons, the first time the 100 million ton barrier will have been surpassed.

Japan strengthened its position as the world's third largest steel producer, following the Soviet Union with 125.5 million tons and the United States with 120.7 million tons. Japan continued to be the world's foremost steel exporter, despite a 9.7% decline in exports to 22.0 million tons in 1972; because of higher prices the value of steel exports reached $3.75 billion in 1972 a 1.6% gain over that of 1971. Japanese steel producers operating under a temporary cartel program made a special effort to control exports in order not to flood world markets. Meanwhile, domestic demand rose sharply.

Four Japanese steel companies, headed by Nippon Steel Corp. with output of about 33.0 million tons, were among the world's top 10 in 1972. This was roughly 5 million tons ahead of the output of U.S. Steel Corp. and 10 million tons ahead of British Steel Corp., the next two ranking steel firms, and about twice as much as the production of Bethlehem Steel Corp. Japan's Nippon Kokan Co. was fifth with 13.4 million, followed by West Germany's August Thyssen. In seventh and eighth places were Sumitomo Metal Industries with 11.26 million tons and Kawasaki Steel Corp. with 11.33 million tons. Ester (Dutch-W. German joint venture) and Italy's Finsider Enterprises rounded out the first 10. Kobe Steel Ltd., with 5.8 million tons output was 20th.

Japan has long had the world's largest blast furnaces. The present Japanese and world leader is Nippon Kokan's Fukuyama Works No. 4 furnace blown in April 26, 1971, followed by Nippon Steel's Oita Works No. 1 furnace blown in April 19, 1972, both capable of producing more than 10,000 tons daily. Most of the furnaces are located at new steel bases, which generally are designed for four big blast furnaces so that the degree of completion can be measured by the number of furnaces blown in. As of yearend 1972, Japan's ten largest blast furnaces were as follows:

Company and blast furnace	Cubic meters
Nippon Kokan's Fukuyama Works No. 4	4,197
Nippon Steel Oita Works No. 1	4,158
Nippon Steel's Kimitsu Works No. 3	4,063
Nippon Steel's Yawata Works Tobata No. 4	3,799
Kawasaki Steel's Mizushima No. 3	3,367
Sumitomo's Kashima Works No. 1	3,159
Nippon Kokan's Fukuyama Work No. 3	3,016
Nippon Steel's Nagoya No. 3	2,924
Nippon Steel's Kimitsu Works No. 2	2,884
Kawasaki Steel's Mizushima No. 2	2,857

As of yearend 1972, Japan already had the two largest steel bases in the world—Nippon Steel's Yawata Works (Tobata is a subsection) at 13 million tons per year and Nippon Kokan's Fukuyama Works at 12 million. The Soviet Magnitogorsk Works came next, followed by Sumitomo Metal Industries' Wakayama Works at 9.5 million. August Thyssen's Duisberg-Hamborn Works was fifth at 9 million tons, and Bethlehem Steel's Sparrows Point Works sixth at 8.2 million tons. Nippon Steel's Kimitsu Works will join the 10-million ton club in the near future. Kawasaki Steel started to construct the No. 4 blast furnace at its Mizushima Works in 1972 and when completed, will be the largest

blast furnace in the world at 4,300 cubic meters; Mizushima is projected to top 10 million tons of steel yearly by a wide margin.

The Fukuyama Works of Nippon Kokan reportedly set a world record in crude steel production for a single integrated plant in December 1972.[6] Output of crude steel reached 1,013,000 tons, continuous cast steel 243,000 tons, blooms 766,700 tons, and pig iron 871,000 tons. During December, pig iron output by the No. 4 blast furnace at the Fukuyama Works also set a monthly record, reaching 313,500 tons or 10,113 tons a day.

At yearend 1972, about 57 blast furnaces were in operation. Two new furnaces were blown in during 1972: Nippon Steel's Oita No. 1 (4,158 cubic meters) in April; and Nippon Steel's Yawata Works Tobata No. 4 (3,799 cubic meters) in July. When Nippon Steel started Tobata No. 4, three older and smaller furnaces were abandoned, namely Higashida No. 1 (892 cubic meters), Kukioka No. 2 (934 cubic meters), and Kukioka No. 3 (1,273 cubic meters). Japan has done away with almost all open-hearth furnaces and installed only oxygen converters or basic-oxygen furnaces (BOF's) in new plants. There was a slowdown in steel industry investment, but the total still came to about 700 billion yen during 1972.

In conjunction with producing a reported 96.9 million tons of crude steel in calendar year 1972, Japan also produced 74.1 million tons of pig iron and 74.9 million tons of hot rolled steel. The high ratio of pig to steel shows the importance of iron ore and large blast furnaces to the industry. Japan's crude steel output in 1972 by furnace type, was as follows in million tons: BOF's, 77.0; electric furnaces, 18.0; and open hearth furnaces, 1.9.

Japan made significant advances in iron and steel technology and operations. For example, possibly half the blast furnaces were consuming less than 400 kilograms of coke per ton of pig iron, through employing the fuel injection method. Sumitomo Metal Industries developed a new kind of formed coke from noncaking coal. Computer control has become widespread in the iron and steel industry and particularly advanced in BOF operations.[7] Nippon Steel's Oita Works, "nearly a manless operation" designed to use less than two man-hours per ton of steel, was being built just slightly behind schedule. Steel firms decided to set up an experimental steelmaking plant using nuclear energy, a method Oita will eventually adopt. With environmental considerations becoming increasingly important, steel companies were spending 5 to 10% of their capital expenses for pollution control. In this regard, a 50-meter-wide, 5-kilometer-long "green belt" of trees has been planted at the Oita Works. Late in 1972, Nippon Steel developed a process to continuously roll H-shaped steel for the first time in the world. In the ore transport area, Japan launched the 160,000-deadweight ton ore carrier, Kohsho Maru, and the 144,000-deadweight ton ore/oil carrier, Naess Ambassador, during the year, both world records in size.

Many developments in 1972 point to greatly expanded steel consumption by Japan in the future. Premier Tanaka's concept of "Remodeling the Japanese Archipelago," involving relocation of industries, diffusion of industrial plants to sparcely-populated areas, establishing a national highway network together with expanding rapid-speed trunk rail lines, and development of new modern cities, means that large additional quantities of steel would be needed. For the decade beginning in 1973, some people have estimated that 50 million tons of steel would be required for roads and bridges alone. Another major new thrust is "Ocean Development"—ocean floor space, offshore minerals, marine environment, fisheries, and recreation—which may also consume about 50 million tons of steel in a decade. Meanwhile, demand in the more conventional markets also was expected to increase steadily.

The importance of exports to Japan's steel industry is such that approximately one-third of steel products output in 1971 and 30% in 1972 were exported. Japan's exports of steel products in 1972 dropped about 2 million tons as compared with 1971. Asia stood first on the list of destinations in 1972, supplanting the United States for the second year in a row. However, the United States was still by far the

[6] Japan Metal Bulletin (Tokyo). Jan. 18, 1973, p. 4.

[7] Japan Iron and Steel Monthly (Tokyo). Kawata Publicity Inc., No. 212, September 1972, pp. 8–9.

most important single recipient country, with exports to that market totaling 6.22 million tons. Next came PRC, with Japanese steel exports at 1.76 million tons, down 0.17 million as compared with 1971. Regionally, Asia accounted for 8.37 million tons, down 0.9% from 1971, North America 7.26 million tons, down 3.3%; Europe 3.10 million tons, down 15.3%; and South America 1.80 million tons, down 25.9%. MITI's plan for steel exports in Japanese fiscal year 1973, made in late February 1973, was for 24 million tons during Japanese fiscal year 1973.

Basic to the whole steel production and export program is the matter of raw materials from abroad. Scrap is the least important in this regard, since domestic sources have furnished over 90% of recent annual requirements of more than 40 million tons, half by steelmakers themselves and half by other suppliers in Japan. However, the 2.5- to 4-million-ton annual shortage that must be imported each year can create a marketing problem. For example, near yearend 1972, U.S. scrap suppliers raised prices to more than $80 per ton c.i.f. Japan, which is considerably higher than usual. The Japanese have estimated that scrap import requirements in Japanese fiscal year 1972 would amount to 3.1 million tons and in Japanese fiscal year 1973, 3.8 million tons.[8]

Japan's modern blast furnaces depend upon a steady, long-term supply of foreign ore, a situation that has made the country prominent in world iron ore trade. During 1972, Japan imported 111 million tons of iron ore, as compared with 115 million tons for 1971. The 1972 pattern of imports by country shows that approximately 43% came from Australia, 16% from India, 9% from Brazil, 6% each from Peru and Chile, and the rest from many lesser sources. Iron ore imports are projected to increase substantially in the coming year, and plans of individual companies are as follows, in thousands of tons:

Company	Japanese fiscal year 1972	Japanese fiscal year 1973
Nippon Steel	49,000	60,000
Nippon Kokan	18,000	20,000
Kawasaki Steel	15,500	18,500
Sumitomo Metal	15,500	18,000
Kobe Steel	8,000	11,000
Total	106,000	127,500

Source: Japan Metal Bulletin (Tokyo). Jan. 27, 1973, p. 2.

The 1971 upward evaluation of the yen and an imminent second upward evaluation in early 1973, with resultant impact on the economies of iron ore suppliers, made matters most uncertain for the Japanese steel industry. Estimates and forecasts of requirements varied greatly, depending on the part of the year in which they were made. In early 1972, difficult economic conditions forced Japanese ore consumers to start to renegotiate terms with foreign suppliers with regard to price, quality, tonnages, and delivery dates. By fall, business conditions greatly improved and steel demand went up accordingly. This favorable trend took a downturn late in the year as the yen grew stronger vis-a-vis the dollar and Japan's foreign exchange reserves accumulated. Nevertheless, expanded steel and iron ore requirements were imminent, in view of the fact that four large blast furnaces were scheduled to be blown in during 1973, in part to replace older and smaller furnaces.

Japan's efforts to secure future iron ore supplies and make the necessary contractural readjustments continued unabated. In November, Hamersley Iron Pty., Ltd. was negotiating with Japanese steelmakers for increased shipments from Australia to Japan; on the other hand, the Japanese were worried about the Palabado Mine whose development seems to be behind schedule. Commercial production of iron ore pellets started at the $275 million Robe River project in Australia, with first shipments scheduled for yearend and subsequent annual shipments at 4.2 million tons.

Talks were started with the operators of the Rio Doce mine in Brazil with regard to building the No. 4 and No. 5 pelletizing plants under joint auspices for delivering pellets to Japan. Contractural agreements on supplying pellets had previously been signed with Marcona Corp. regarding Peruvian ores and operators of Angora Mine regarding Chilean ores. Kawasaki Steel was ready to sign a contract at yearend with Ohman interests to take over the management of the Capanema Iron Mine in Brazil and work it as Japan's first captive iron mine abroad. Iron ore prices were being negotiated with the major companies in South Africa. Nippon Kokan

[8] Japan Metal Bulletin (Tokyo). Jan, 20, 1973, p. 1.

made a comprehensive survey in Guinea on the Nimba and Shimando Mines plus the transport system; this overall project would cost more than $600 million. A survey team was preparing in late 1972 to look over the Kluk Kwan Iron deposit in Alaska once owned by U.S. Steel Corp.

Lead and Zinc.—Japan's position in zinc has always been far stronger than that in lead, since local ores contain much more zinc than lead. Japanese output of refined or slab zinc, based upon both foreign and indigenous ores, has risen fourfold during the last decade. The only recent interruption in growth took place in 1970 when two major refineries were forced to curtail operations sharply, in order to install additional pollution-control equipment. 1972 was a record year for primary zinc, with output of 805,000 tons surpassing the 1971 level by a wide margin. In fact, Japan became the world's foremost slab zinc producer, ahead of the United States and the U.S.S.R. by 90,000 tons and about 170,000 tons, respectively. Japan's zinc output was headed for only a slight increase in 1973 and most probably will not attain the 1-million-ton plateau until after 1974.

Zinc is one of the few minerals of which Japan has resources of some significance. Indigenous ores still constitute the raw material for more than a third of the country's slab zinc, and local production has steadily grown. Two factors contributed to this favorable situation. At Japan's premium zinc mine—Kamioka owned by Mitsui Mining and Smelting—about 16 million tons of conventional high-grade zinc-lead ore containing 15% of these two metals combined have been discovered recently. The "black ore" of the north has also improved the overall potential. Nearly a half dozen of such deposits are already worked, and various new ones are being developed. Dowa Mining Co. owns two of the new discoveries: Fukazawa in Akita with a measured 3 million tons of ore analyzing 15% combined lead-zinc and 1% copper; and Sankei in Hokkaido with much larger reserves of similar grade ore. Nippon Mining owns two other discoveries: Toyoha in Hokkaido with one ore body of 8.2 million tons analyzing 2.6% lead and 6.7% zinc (plus copper) and another ore body of at least 6 million tons of unknown ore grade; and Nakanogawa with at least 20 million tons of ore even though the ore body has not yet been carefully delineated.

Imports of zinc concentrates were 1,075,660 tons in 1971 and 1,115,675 tons during 1972. Converting at an estimated 53% zinc in concentrates, Japan's annual imports were between 550,000 and 600,000 tons. Peru and Canada ranked first and second, respectfully, in the last 2 years, together furnishing about two-thirds of the total. Australia and Mexico were next. Unlike iron ore and copper, most of the zinc concentrates acquired from foreign countries were from established local producers rather than new mines developed for the Japanese market.

However, Japan was moving into joint-venture projects. At the request of the Mexican Government, Dowa Mining Co. together with Marubeni Corp. became involved in a program of exploration and making a feasibility study on the construction of a zinc smelter in Mexico with a view of exporting zinc to the United States and Japan. The Japanese also became interested in oxide ore abroad, since such ores are less hazardous in terms of pollution than sulfide ores; in 1972, missions were sent to Australia and Iran to investigate possibilities in developing oxide zinc ores.

Whereas most zinc produced in Japan was consumed locally, exports became sizable in 1972; approximately 100,000 tons were exported in that year with nearly two-fifths going to the United States where certain smelters were encountering difficulties.

Related to zinc and the "black ores", Japan's mine output of lead has also been rising, having attained the 70,000 to 75,000-ton level during the last 2 years. This compares with imports of lead concentrates of 225,427 tons in 1971 and 198,948 tons in 1972, with concentrates usually analyzing 60% to 70% lead. Canada supplied two-thirds of the concentrates, followed by Peru and Australia. Japan does not import nor export much lead.

Japanese zinc and lead smelting facilities, particularly zinc, are very modern and large by world standards. The yearend 1971 situation, in terms of companies and facilities is shown in detail in the 1971 Minerals Yearbook V. III, The Mineral Industry of Japan. No new smelters and re-

fineries were added in 1972 and some older facilities were shut down. The net result is that the zinc and lead annual capacities are quoted at about 900,000 tons and 250,000 tons, respectively, for yearend 1972. Japan has three zinc smelters of more than 100,000 tons a year and five others at between 55,000 and 90,000 tons. Nine of 10 lead smelters were rated at between 20,000 and 54,000 tons a year. Japan has two Imperial Smelting Process (ISP) lead-zinc smelters—Hachinohe and Harima. Two other smelters also produce both lead and zinc on a large scale, namely Kamioka of Mitsui and Hosokura of Mitsubishi.

Japan's largest zinc smelter, Annaka of Toho Zinc Co., continued to have trouble with regard to satisfying pollution standards determined by MITI. Only about 140,000 tons a year or two-thirds of its designed capacity was utilized at yearend 1972, even though a request was made to raise output to approximately 180,000 tons. Local residents had complained about cadmium pollution.

The Iijima zinc smelter of Akita Zinc Co., more than half owned by Dowa Mining Co., came onstream in 1972 with an annual capacity of 78,000 tons of zinc, 130,000 tons of sulfuric acid, and 310 tons of cadmium. Second phase construction will commence in July 1973 at a cost of ¥8 billion with a view toward doubling capacity by June 1974. Management is particularly interested in expanding capacity, so as to be able to treat ores slated to be mined at Dowa Mining's Fukazawa deposit.

The only other operation with major expansion plans is the Hikoshima smelter of Mitsui Mining and Smelting Co. Hikoshima is a modern nearly pollution-free plant specializing in super grade zinc. Present capacity is 5,000 tons of zinc, 100,000 tons of sulfuric acid, 15,600 tons of zinc sulfate, 380 tons of cadmium oxide, 11,700 tons of zinc oxide, 6,600 tons of zinc dust, and 280 tons of ferroboron a year. The second stage plan is to double zinc capacity to 10,000 tons by the summer of 1974 at a cost of ¥5 billion.

Magnesium.—During the first half of Japanese fiscal year 1972 the Japan Light Metal Association reported primary magnesium output at 5,438 tons or a 13.2% increase over the corresponding period in 1971 and secondary magnesium output at 2,373 tons, a 35% decrease. In November, the corresponding figures were 935 and 488 tons, respectively. These results reflect the booming conditions of the aluminum rolling industry and the depressed situation of the titanium industry, which reuses spent magnesium. The magnesia utilized for making primary magnesium comes from seawater facilities owned by firms like Ube Chemical Industries Co. and Shin Nihon Chemical Industries Co., whose annual capacities are rated at 400,000 and 200,000 tons, respectively. Japan supplements local production of magnesium with small imports. For example, 3,221 tons were imported during 1972, mainly from the U.S.S.R., the United States, and Norway.

Manganese.—Although Japan produces several hundred thousand tons of low-grade manganese ore annually, virtually all requirements for high-grade ores have been met by imports. In 1972, imports of high-grade manganese ore amounted to 1.6 million tons, with Australia supplying one-third, the Republic of South Africa 29%, and Gabon 15%. Groote Eylandt Mining Co., Pyt., Ltd. and Longgreach Manganese Pty., Ltd. in Australia, South African Manganese Ltd. in Cape Province, and Compagnie Minière de l'Ogooue of Gabon were the main suppliers. A lesser quantity of ferruginous manganese ore, used for charging directly into blast furnaces, was also imported; the supply came mainly from India and the Republic of South Africa.

Japan has been producing 380,000 to 550,000 tons of ferromanganese and 230,000 to 350,000 tons of silicomanganese annually in recent years. Exports are no longer important, and production is geared to the needs of the Japanese steel industry.

Japan ranked second to the United States as a producer of electrolytic manganese and manganese dioxide; respective annual capacities total just over 12,000 tons and about 40,000 tons. Tekkosha Co. has been prominent in both products. This firm was in the process of looking for plant site abroad for making electrolytic manganese, because of land difficulties within Japan and the fact that much of the output is exported. Mitsui Mining and Smelting also has a project abroad, in manganese dioxide.

Molybdenum.—The bulk of Japan's molybdenum requirements come from abroad, primarily the United States and secondar-

ily, Canada and Chile. American Metal Climax, Inc. (AMAX), by far the principal individual supplier, has formed a joint venture with 10 Japanese ferromolybdenum producers, by the name of Japan Molybdenum Co., to build a $5.5 million, 9,000-ton-a-year molybdenum trioxide plant at Ishinomaki, Miyaki Prefecture. Surplus ferromolybdenum may be sold back to AMAX. According to a report in October, AMAX, the principal owner of the new firm, was having some difficulty in acquiring the necessary loans from the First National City Bank of New York; this in turn may delay completion of the project by 1975 as scheduled.[9]

In September, AMAX also set up a 100% subsidiary AMAX JAPAN in Japan. This new firm will handle Japan's import business originating from AMAX enterprises, involving annually 5 to 6 million pounds of contained molybdenum, 50,000 tons of electrolytic copper, 35,000 tons of blister copper, 16 to 17 million tons of iron ore from Mt. Newman, Australia, 60,000 tons of potash, and large quantities of nonferrous ores.[10]

Nickel.—For lack of resources, Japan imports all its nickel needs. During 1972, 11,980 tons of nickel metal (4,423 tons from the U.S.S.R., 3,380 tons from Canada, and 2,536 tons from Norway), 3.2 million tons of 1.8 to 2.5% nickel ore (2.2 million from New Caledonia and 0.8 million from Indonesia), and 13,196 tons of nickel matte (10,243 tons from Canada and 2,953 tons from New Caledonia) were imported. From these raw materials, Japan produced 16,501 tons of nickel and 189,000 tons of ferronickel in 1972. Production of nickel metal went up slightly, whereas production of ferronickel declined considerably, as compared with 1971 output. Cutbacks in ferronickel output and large stocks of ore resulted in a 36% reduction in ore imports. Based upon contracts made in 1972, ore imports in 1973 should be somewhere between those in 1971 and 1972. Imports of nickel matte were also much smaller than that of 1971, in fact a drop of 2,560 tons. The Japanese had been negotiating with the Soviets to import additional matte in the future, but these plans were indefinitely postponed in mid-1972.

The trend in ferronickel consumption in Japan followed steel production, which showed a significant increase in 1972. Measured in nickel content, ferronickel was about five times as important as nickel metal. However, nickel as metal is used in many diversified areas. In November MITI estimated that demand for nickel during Japanese fiscal year 1972 would amount to 28,000 tons, 13,000 tons in making iron and steel, 8,000 tons in plating, 2,700 tons in electric machines, 2,200 tons in brass products, 800 tons in coinage, and 600 tons in catalysts.[11]

As of yearend 1972, Japan had six ferronickel plants, two nickel plants, and two nickel oxide plants. The three larger ferronickel plants were owned by Sumitomo Metal Mining (Hyogo plant, capacity 26,000 tons of contained nickel per annum), Taiheiyo Metal (Hachinohe plant, capacity 24,000 tons), and Nippon Mining (Saganoseki plant, capacity 18,000 tons). Sumitomo also owned the larger of the two nickel plants (Niihama, capacity 12,000 tons per annum), and Shimura Kako Co., the other one in Tokyo. Tokyo Nickel (Matzusaka plant) and Nippon Nickel own the two nickel oxide plants.

Shimura Kako Co. made news on two counts. MITI approved the application of International Nickel Co. (INCO) to take over 30% of Shimura's stock in mid-1972. Late in the year, Shimura announced plans to raise the capacity of its Tokyo plant to 9,000 tons of nickel annually. Nippo Mining indicated its intention to enter the nickel refining field by 1974, in cooperation with Freeport Minerals Co., drawings ores from the Greenville Nickel Mining Co. of Australia. Tokyo Nickel was in the process of expanding its Matzusaka nickel oxide plant to 10,000 tons of contained nickel annually.

After 6 months of negotiations, an agreement was reached with New Caledonia to import 2.7 million tons of nickel ore during Japanese fiscal year 1972. This figure compares with actual imports of 2,246,000 tons from that source in 1972 and 3,950,000 tons in 1971. A price reduction was also successfully negotiated.

Japan's involvement in Indonesia has been more complex. The initial agreement

[9] Japan Metal Bulletin (Tokyo). Oct. 14, 1972, p. 4.
[10] Japan Metal Bulletin (Tokyo). Sept. 28, 1972, p. 4.
[11] Japan Metal Journal (Tokyo). Nov. 13, 1972, p. 7.

for Japanese fiscal year 1972 was to import 600,000 tons of 2.4% nickel ore from Pomola, Sulawesi (Celebes) where ore reserves are on the order of 10 million tons; subsequently, 200,000 tons were added because of drawn-out negotiations with New Caledonia. In mid-1972, Taiheiyo Metal made a separate agreement with Indonesia's state corporation Ankatanban Co. to build a ferronickel plant in Sulawesi of 4,000 tons (contained nickel) annual capacity, based upon low-grade (1.8%) ores from Pomola. Taiheiyo, the Japanese Government (loans), and the Indonesian Government will supply the approximately $30 to $40 million needed for the project. Output will be sold in Japan.[12]

The Nonoc nickel project in the Philippines, being built by the Marinduque Mining and Industrial Co. with the help of Kobe Steel to supply nickel to Japan, made significant headway during the year. A second project in the Philippines, on Palawan Island, was being considered by the Japanese for joint development.[13] The proposal is to invest approximately $26 million to develop the mine and build sintering kilns so as to export about 1 million tons of 2.2% to 2.4% sintered nickel ore (upgraded from 1.7%) to Japan annually. Elsewhere, Sumitomo Metal Mining and Mitsui Mining and Smelting were investigating two separate deposits in Australia.

Tin.—Japan's 1972 tin consumption was close to that of the U.S.S.R. and more than half that of the United States, the only countries which used more tin. By far the bulk of the 30,585 long tons needed annually of late has been imported, with Malaysia furnishing 75% to 80% and Indonesia and Thailand most of the rest. The tin is imported as such. Japanese efforts to smelt tin in Malaysia a few years back were unsuccessful. Japan does have a small local tin base, consisting of two mines—Akenobe and Ikuno—and one smelter Ikuno, all owned by Mitsubishi Metal Corp. With age and ore-grade problems piling up, both mines were on the verge of shutdown. Nonetheless, Japan produced 859 long tons of tin-in-concentrate and 1,329 long tons of refined tin during 1972.

Titanium.—Japan's well established titanium and titania industries went through a very difficult period in 1972, principally because of selling problems abroad. In sponge titanium, Osaka Titanium Co., Ltd., and Toho Titanium Co. each have a monthly capacity of 450 tons. The third firm, New Metals Industries Co., was rated at 180 tons a month, but it employs a process other than the standard Kroll process and utilizes sodium rather than magnesium to produce titanium. With available surplus capacity, Japan's problem was to produce what the combined domestic and export markets could stand, and it happened in 1972 that demand worldwide and particularly in the United States was bad. Japan's sponge titanium output declined from 9,230 tons in 1970 and 6,777 tons in 1971 to 4,658 tons during 1972. The only encouraging note was that domestic demand picked up slightly in the second half of 1972 and production was returning to the 6,000-ton annual level at yearend.

Japan has also been prominent as a world producer of ingot titanium, titania pigments, and synthetic rutile. Kobe Steel headed the field in producing ingot titanium and was the principal fabricator of titanium and alloy products. Ishihara Sangyo Kaisha Ltd. retained its position as the foremost producer of titania pigments, although only slightly ahead of Sakai Chemical Industry Co. During the fiscal year April 1971 to March 1972, the country as a whole produced only about 150,000 tons of titanium dioxide, as a result of reduced foreign demand. Using ilmenite from India as raw material, Ishihara was also prominent in synthetic rutile. This firm had already completed such a plant in March 1971 at Yokkaichi; in the fall of 1972, it announced plans to expand capacity from 27,000 tons a year to 40,000 tons.[14]

Tungsten.—Japan produced 706 tons of tungsten-in-concentrate and imported 1,516 tons in 1971. Production of tungsten concentrate in 1972, mainly by Awamura Mining Co., was perhaps slightly lower, and imports considerably lower. Actual imports in 1972 totaled 2,436 tons of concentrates, half from South Korea. Japan's average annual consumption of tungsten was about

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[12] Japan Metal Bulletin (Tokyo). June 29, 1972, p. 4.
[13] Japan Metal Bulletin (Tokyo). Oct. 26, 1972, p. 5.
[14] Engineering and Mining Journal. Japanese Firm May Expand Synthetic Rutile Plant; Reveals Process Flowsheet. V. 173, No. 10, October 1972, p. 72.

3,150 tons of contained metal. Because of the importance of steel as a market for tungsten, it might be estimated that Japan consumed approximately 3,500 tons of contained tungsten in 1972. As a matter of fact, imports varied greatly from year to year, because of price and other factors, as for example 3,390 tons of contained tungsten in 1970 that was more than double the 1971 and 1972 tonnages.

Awamura Mining has also been the leading producer of ferrotungsten. At least four tungsten metal producers were in existence—Tokyo Tungsten, Tokyo Shibaura, Nihon Tungsten, and the Mitsubishi Metal Corp. Total output of tungsten metal in 1972 was 1,411 tons, or a 20% increase over that of 1971.

Uranium.—The Atomic Energy Commission of Japan (JAEC) made public its annual report for 1972 on July 13. As of midyear, four reactors with a combined capacity of 1.323 million kilowatts were in operation, while an additional 14 reactors totaling 10.547 million kilowatts were under construction and three more were awaiting approval. The nuclear fuel inventory was reported at 381.3 tons of natural uranium, 484.9 tons of enriched uranium, and 1.04 tons of plutonium.

Along with stressing safety and the prevention of pollution, acquisition of adequate fuels was considered fundamental. Japan's cumulative needs for uranium concentrate were expected to reach about 15,500 metric tons of U_3O_8 by fiscal year 1975, 43,000 tons by fiscal year 1980, and 90,000 tons by fiscal year 1985. JAEC established the Committee on Uranium Resources Procurement Policy to cope with this problem. In addition to long-term contracts with foreign producers, Japanese firms were urged to develop Japan-controlled output overseas, so as eventually to furnish one-third of the country's entire needs. As an incentive, loans would be given to Japanese prospectors and these would not be paid back unless successful discovery were achieved. Japan also signed nuclear energy treaties with France and Australia so as to diversify uranium supply sources.

In early 1972, Japan's long-term contracts for uranium oxide was about 30,000 tons annually or less than one-third of requirements by 1985. Major contracts already signed included the ones with Canada's Denison Mines Ltd., Rio Tinto Zinc Corp., and the U.S. firm Kerr-McGee Corp. On October 9, the Queenland Mines Ltd. of Australia signed a contract with Shikoku Electric Power Co. of Japan to furnish about 2,000 tons of uranium oxide annually during the 1975 to 1985 period from the Nabarlek deposit in Northern Territory. Another Australian contract, stipulating 1,800 tons of uranium oxide annually during 1977–86, was signed in November between Peko-Mines NL jointly with Electrolytic Zinc Co. and the Kyushu Electric Power Co. of Japan. Australian firms previously had agreed to two other contracts totaling about 2,200 tons annually.

JAEC estimated that 2,700 tons of enriched uranium would be needed annually by 1975 and 7,200 tons by 1985. The policy was to obtain a steady supply of enriched uranium from the United States, study the possibilities of participating in the international uranium enrichment program proposed both by the United States and France, and develop an indigenous uranium enrichment technology aimed at domestic production by the 1980's.

Japan entered into an agreement with the United States in the fall for the latter to "fuel Japan's nuclear industry."[15] Reportedly, this involves the sale to Japan over the next decade of $1.8 billion of uranium fuel for 26 Japanese nuclear powerplants. An offer was also made to the Japanese to become part owner of a $1 billion gas diffusion plant to be built in the United States.

Mitsubishi Atomic Fuel Corp., a joint venture of Mitsubishi Metal and Westinghouse Electric Co, was about to complete a 240-ton-per-year uranium conversion plant at Tokai Mura near Tokyo at yearend.[16] Mitsubishi was also in the process of increasing forming capacity of uranium fuel from 100 tons annually to 420 tons.

In the fall of 1972 the Japanese Government announced a 6-year program to develop a nuclear-powered, direct reduction integrated steel plan.[17] The key seems to be a high-temperature gas-cooled reactor (HTGR), which the Japan Atomic Energy

[15] Washington Post. Oct. 2, 1972, pp. A1 and A3.

[16] Japan Metal Bulletin (Tokyo). Oct. 21, 1972, p. 4.

[17] Engineering and Mining Journal. Japanese Outline Atomic Reactor Research and Development Plans. V. 173, No. 10, October 1972, p. 28.

Research Institute will attempt to design. Once a 1,000° C temperature is attained, various nonsteel industries could very well reap benefits through utilizing cooler gases.

Other Metals.—During 1972 Japan produced 845,600 troy ounces of gold and 31,057,000 ounnes of silver. The gold figure was nearly 10% higher than that in 1971, and the silver figure, virtually the same. The bulk of these two precious metals was recovered from the smelting of nonferrous ores. The Japanese Government announced its intention to liberalize imports of gold by April 1973, before gold prices soared. Japan relied totally on imports for its growing platinum needs, mainly from the U.S.S.R., Republic of South Africa, and the United Kingdom. Imports topped 30,000 kilograms in 1972, about 50% more than in 1971, most probably on account of increased industrial demand coupled with speculation in anticipation of higher prices.

Japan was pushing the United States as the leading world producer of cadmium, the byproduct of zinc smelting. Japan's cadmium output apparently exceeded 3,000 tons. Domestic consumption rose sharply in 1972, owing mainly to increased demand by the cosmetics industry and battery makers. Prices, which also moved upwards sharply to about $2.50 per pound in the fall and more than $3.00 at yearend, were still rising. Exports in 1972, mainly to Europe, jumped one-fifth, to possibly 1,500 tons or half the country's total output.

Japan was involved in all phases of chrome operations. Domestic output of low-grade chromite continued to be just over 30,000 tons a year, corresponding to a fraction of imports. Ferrochrome production in the country declined by perhaps 20% from the roughly 400,000 tons produced in 1971. It happens that all of the ferrochrome producers were interested in smelting overseas where ore is produced. Meanwhile, high grade ores are imported, amounting to more than 1 million tons on the average during 1971–72, primarily from the Republic of South Africa and, to a lesser extent, India, the U.S.S.R., and the Philippines. Early in 1972, eight prominent Japanese industrial companies entered a joint venture with the Brazilian firm Cia. de Ferro Ligas da Bahia S.A. to mine chromite in Brazil from a deposit in Bahia with a 100 million ton ore reserve. The plan is to produce 100,000 tons annually by mid-1974 and 200,000 tons eventually. Japan also produced over 2,000 tons of high purity chrome metal during 1971 and 1972, annually.

Japan also produces many other metals, often as byproducts, usually of high purity, and generally in quantities prominent by world standards. Output for some of these during December 1972 was as follows, in metric tons: bismuth, 81; cerium, 20; germanium, 2; lanthanum oxide, 15; mercury, 13; selenium, 34; hyperpure silicon, 18; and zirconium, 9.

In June 1972, MITI initiated studies on so-called "new metals" and their ores, such as tantalum, beryllium, columbium, zirconium, and rare earths, with a view toward stabilizing demand, supply, and prices and creating adequate emergency stockpiles. Necessary funds for this program would be obtained in the form of loans from the Japanese Government's foreign currency reserves. Since the electronics and related industries are very much dependent upon imports for many of these metals, MITI felt that stockpiles equivalent to a half-year or 1-year supply would be vital. Stockpiling would be handled by the Japan Rare Metals Co., established in December 1967 by the steel, ferroalloy, and nickel producers, which can also buy up nickel, tungsten, cobalt, and molybdenum. By midyear this company had already stockpiled 1,300 tons of ferronickel and 120 tons of tungsten ore.[18]

NONMETALS

Cement.—Japan's cement output attained another record in 1972, topping the 1971 production of 59.5 million tons by 1.2 million tons. Despite difficult economic conditions, Japan's cement output in the first half year was close to the 1971 annual rate and that in the second half was much greater. In November and December 1972, consecutive records of 6.3 million tons and 6.6 million tons were established for a single month. In fact, December 1972 sales were reported at 7.07 million tons. The sharp gain in the second half of 1972 probably was stimulated by a government program to step up construction works.

Japan's cement industry continued to be basically domestically oriented. Govern-

[18] Japan Metal Bulletin (Tokyo). June 17, 1972, p. 4.

ment and private programs underway or being planned indicate that cement consumption as well as production will rise steeply during the next few years. Exports have become less important—2.3 million tons in 1971 and 1.5 million tons in 1972. Although Japanese cement goes to many countries, most goes to Indonesia and Singapore.

The Japanese cement industry holds many records in performance and size. Late in the year, Ube Industries, Ltd. completed the world's largest cement kiln, with suspension preheaters at the Isa plant. This kiln is rated at 215 tons an hour or 150,000 tons a month. Ube also has 10 small shaft-type kilns at the Isa plant that have a combined monthly capacity of 60,000 tons.

Chichibu Cement Co. and Ishikawajima-Harima Heavy Industries Co. jointly announced development of a process for cement calcination.[19] The new process reportedly can more than double production capacity compared with the conventional kiln; also, fuel requirements for cement calcination are said to be reduced by 5% to 10%.

Fertilizer Materials.—Japan's fertilizer industry, the third largest in the world, went through a difficult period during the second half of 1971 and the first half of 1972 when prices were low, sales slow, stocks high, production low, and plant investments minimal. This prompted MITI to suggest a radical plan to scrap ammonia plants smaller than 500 tons a day in size and to concentrate on building 1,000-ton plants or larger. By mid-1972, however, the oversupply situation suddenly gave way to a worldwide shortage brought about by factors like the natural gas squeeze in the United States, unusually heavy rainfall in the southern hemisphere, and abnormal drought in the northern hemisphere. The international business in chemical fertilizers picked up so much that Japan could afford not to be overly concerned with PRC—by far the biggest customer of late.

Japan's fertilizer industry has long been very much export oriented. During 1972, production and exports (in parentheses) of various chemical fertilizers were as follows, in thousands of tons: ammonium sulfate, 2,106 (1,499); urea, 3,189 (2,518); ammonium chloride, 923 (726); calcium superphosphate, 756 (72); and complex fertilizers, 3,406 (230). Total value of all fertilizer exports in 1972 were on the order of ¥60 billion or just under $200 million; approximately two-thirds of this was in the form of urea. Aside from the conventional fertilizers, Japan also exported small quantities of anhydrous ammonia to Malaysia, South Korea, and Republic of South Africa and aqueous ammonia to the Philippines.

The largest fertilizer export market is the PRC. During January-November 1972, 73% of Japan's urea exports, 42% of the ammonium sulfate, and 93% of the ammonium chloride went to the PRC. On August 10, 1972, a Japanese trade mission concluded negotiations with PRC to export 600,000 tons of ammonium chloride by the end of July 1973. On September 5, 1972, a separate contract was signed for ammonium sulfate and urea, after 4 months of negotiations over prices and the formula of settlement. In terms of ammonium sulfate equivalent, the contract called for 406 million tons to be delivered before the end of July 1973. Comparing fertilizer years July to the following June, 1972–73 shipments would be 1 million tons of ammonium sulfate equivalent as compared with 1971–72 shipments of 3.7 million tons.

In contrast to adequate supplies of nitrogen and sulfur, Japan continued to be virtually totally dependent upon foreign sources for phosphates and potash. During 1971–72, phosphate rock imports were about 3 million tons annually, about two-thirds from the United States and one-sixth from Morocco. Potash needs were roughly 1.2 million tons a year, nearly one-half from Canada, 15% to 20% from the U.S.S.R., 10% to 15% from the United States and 10% each from Israel and West Germany.

Fluorspar.—Japan's output of fluorspar generally provides only a few percent of the overall supply. Consumption surpassed the one-half-million-ton mark for the fourth year in a row. About two-thirds of the fluorspar went into steel smelting, and most of the rest into aluminum reduction and the production of chemicals. Fluorspar is particularly essential in oxygen converter or BOF steel smelting as a fluxing material to remove impurities, and demand has been steadily increasing in Japan. Fluor-

[19] Japan Chemical Week (Tokyo). The Chemical Daily Co., Ltd. Aug. 3, 1972, p. 7.

spar prices have fluctuated considerably. After reaching a peak in mid-1971, they have since declined as a result of the recession created by the first devaluation of the dollar. Although the steel industry picked up momentum in the second half of 1972, fluorspar prices had not risen accordingly.

Meanwhile, the steel industry had been looking into the use of red mud derived from the alumina plants as a substitute for fluorspar. Nikkei Sangyo, a subsidiary of Nippon Light Metals Co., worked with the Nippon Steel Corp. to develop a product called "Alblack" from red mud.[20] A 3,000-ton-a-month commercial plant was scheduled to start operations in September at Shimizu. Nippon Steel had also been working with mixtures of fluorspar and red mud and other synthetic fluxes to substitute for fluorspar.

The thrust continued to be toward securing a stable, long-term supply of fluorspar. Japanese imports of flurospar reached a record 677,950 tons in 1971, only to fall back to just under one-half million tons in 1972. During these 2 years, Thailand was by far the leading supplier, furnishing about 45%. The Thai supply to Japan can increase somewhat when demand rises. In September, the first modern flourspar beneficiation plant in Thailand, with a 50,000-ton capacity, came onstream at Baan Laat, Petburi Province. During the year, the Japanese firm Toyoda Tsusho Co. opened a small fluorspar mine in Lamphun Province, Thailand. The PRC has long supplied Japan with about 100,000 tons of metallurgical-grade fluorspar annually. A 1972 contract reaffirmed this tonnage and indicated that the quantity may rise to 150,000 tons by 1980. The Republic of South Africa furnished 135,316 tons in 1971 and more than 100,000 tons in 1972. A new joint enterprise in Mexico moved ahead on its program to build an aluminum fluoride plant at Torreon with plans to commence shipments to Japan by 1974; Torreon is scheduled to become an important source and its product will replace crude fluorspar to some extent.

An important new source of fluorspar came onstream in the fall of 1972 for the Japanese market—Rift Valley in Kenya which is 51% owned by the Kenyan Government. Equipment with a modern beneficiation plant, Rift Valley's annual capacity of 72,000 tons of product as of yearend 1972 can be doubled in 2 or 3 years if market warrants it. A Japanese steel mission went to Kenya to confirm the potential; a trial order of 12,000 tons was made as a result of the visit.[21]

ARDECO of Japan had looked into possible supplies elsewhere. One of these was the properties of the Brise Company of Brazil in the Santa Catarina district. ARDECO also investigated two other projects and subsequently decided to abandon them because of inferior ores, namely Lost River in Alaska and Emford in Queensland, Australia. Resource conditions of these two projects were obviously far less favorable as compared with the Kenyan project.

Salt.—Japan's salt production of just over a million tons in 1972 was but a small part of overall supply. Domestic output has been declining, whereas imports have been steadily increasing, except for 1972 when there was an oversupply in many kinds of raw materials caused by Japan's economic recession early in the year. During 1971–72, Japan imported an annual average of about 6.8 million tons of salt, approximately 43% from Mexico, 37% from Australia, and 14% from the PRC.

Mexico has been the leading supplier to Japan for many years, with the salt originating from area of Baja, Calif. In 1968 Australia's salt production, from three small producers, was less than 1 million tons. Two large projects have since been completed, and another is underway. All are in West Australia, and each has a financing and/or marketing arrangement with one of the famous Japanese trading companies. Dampier Salt Ltd. started to work its 2-million-ton-a-year operation in early 1972 and Exmouth Salt Pty., Ltd., was deliberating what to do in the light of world and Japanese surpluses. The Australian salt industry, aimed primarily at supplying the Japanese market, has been overdeveloped. Meanwhile, Japan continues to import from the PRC, with the latest contract in early 1972 calling for 1.1 million tons of salt in 1973.

Salt is needed in Japan by the steadily expanding chloralkali industry, headed by firms like Nippon Soda Co., Toyo Soda Co., Tokuyama Soda Co., Central Glass

[20] Industrial Minerals (London). Metal Bulletin Ltd. No. 60, September 1972, pp. 34–35.
[21] Mining Magazine (London). November 1972, p. 439.

Co., Toa Gosei Kagaku Kogyo, Ltd., and Kanto Denka Kogyo, Ltd. In 1972, Japan produced approximately 3 million tons of caustic soda, 1.3 million tons of soda ash, and 2.5 million tons of chlorine. Growth in demand for these products has been estimated at 5% to 8% annually. In mid-1972, the Asahi Chemical Co. announced the development of a new caustic process based upon salt electrolysis using the ion exchange membrane to compete with the conventional mercury and diaphram processes.[22]

Sulfur.—Japan's sulfur supply has changed drastically in recent years, from an indigenous ore base to a petroleum refining byproduct base. Elemental sulfur production from domestic ores dropped from 204,000 tons in 1969 to less than 40,000 tons in 1972. In the same span, recovered elemental sulfur production at oil refineries rose from 144,000 tons to more than 430,000 tons. Actually, byproduct sulfur output was considerably below the projected rate, causing unexpected shortages and prompting MITI to cut the sulfur tariff and Mitsui & Co. to arrange for supplementary imports from Canada near yearend.

The sulfur supply-demand situation fluctuated violently during 1972. Large surpluses early in 1972 gave way to uncomfortable deficiences at yearend. The oil industry was indecisive in its plans to expand in general and to install the necessary desulfurization facilities in particular, because of the general business recession and operational difficulties in recovering sulfur. Some refineries were selling sulfur as sulfuric acid on account of shortages developed in this area also. Meanwhile, demand was higher than expected in the second half of 1972. Since consumption is projected to increase another 10% to 533,000 tons in fiscal year 1973 (approximately 55% of which will be used by the carbon disulfide, synthetic fiber, and paper and pulp industries), a continued shortage can be expected.[23] In a long-range forecast, the sulfur shortage undoubtedly will change to surpluses, judging from the ambitious plans of expansion by the oil refining industry.

Japan does not have a resource problem in the sulfur needed for making sulfuric acid, as it has long been one of the world leaders in output of pyrites. Dowa Mining's Yanahara Mine, the largest pyrite mine and one of the best mines in the country, was however embarking upon a program of retrenchment coupled with improved mechanization, with plans to cut the labor force from 1,200 to 400. Japan also imports very large quantities of sulfur in copper and other nonferrous sulfides. With all such materials plus the imported crude oil, Japan produced approximately 560,000 tons of 100% sulfuric acid during November 1972.

MINERAL FUELS

Coal.—Japan's domestic coal industry continued to contract. The approximately 28 million tons of coal produced in 1972 was only about half the output a decade ago. Compared with 1971, the decline was about 6 million tons. The downward trend was expected to continue and could eventually approach the 15-million-ton annual level. Efforts were being made by the Japanese Government to prevent coal production from dropping below the 20-million-ton level by fiscal year 1975, according to MITI's Coal Mining Council in a report entitled "On Long-term Coal Policy" dated June 29, 1972.[24]

The new coal mining policy will span the fiscal years 1973 through 1976 and calls for funds totaling ¥470 billion to ¥500 billion. The Council believes that demand for domestic coal might drop to 15 million tons but that a minimum of 20 million tons of demand should be created in order to prevent serious adverse effects of a too rapid contraction of the coal industry. Also, from a security viewpoint, it was felt that the nation's future coal supply should not slip to too low.

A variety of measures will be taken. The Government will take over long-term debts of coal enterprises. No-interest loans or outright grants will be given to high-efficiency mines. Subsidies will be given for mine modernization and safety. Price subsidies will be increased from the present ¥300 to ¥600 a ton. The Government will help mining companies to raise part of their operating funds. Large-scale users are

[22] Japan Chemical Week (Tokyo). The Chemical Daily Co, Ltd. July 27, 1972, p. 1.
[23] Japan Chemical Week (Tokyo). Feb. 15, 1973, p. 1.
[24] The Institute of Energy Economics (Tokyo). Coal Industry. Energy in Japan, Quarterly Report No. 18, September 1972, pp. 11–12.

urged to purchase definite tonnages of domestic coal as follows: electric power, 8.5 million tons in fiscal year 1975; iron and steel, 8.0 million tons; and city gas, 0.9 million tons. Coal prices will be adjusted, and large-scale coal consumers may be given subsidies to counteract high prices. Labor policies and safety standards will be strengthened. Help will be given with regard to mine shutdowns, welfare of discharged workers, and establishment of new industries in coal districts. A supply-demand adjustment committee will be formed to regulate the flow of coal. These measures help the coal producers, but make the consumers unhappy since coal is relatively expensive and creates pollution problems. In line with the experiences gained, new policies will be developed for 1977 and thereafter.

Even though coal has been losing ground to other energy sources, particularly petroleum, and constituted only about 8% of all energy used in 1972, it is indispensable to steel manufacture where demand has been increasing. Imports have had to take care of not only the rising consumption in steel but also the decline in domestic coal production. During 1972, less than 10 million tons of domestic coal was used in steel making, and much of this had to be blended with high-grade, imported coal before use. In the first 11 months of 1972, imports of coking coal totaled about 43 million tons. Thus, coal used by the steel industry was approximately 55 million tons as compared with perhaps 20 million tons used in other areas. Based upon estimates of pig iron and steel production, consumption of coking coal will surpass 65 million tons in fiscal year 1973 and could top 85 million tons in fiscal year 1978. The first upward evaluation of the yen held back growth in steel production approximately a year; a second upward evaluation may have similar effect, but the trend is clear. Based upon yearend 1972 information, it appears that Japan must obtain roughly 20 million tons a year of new supply of coking coal in the next 5 to 7 years, in order to meet the projected new demand.

Japan's coal imports averaged $1 billion annually during 1970–71, and roughly $1.1 billion during 1972, at exchange rates of ¥360=US$1.00 in 1970–71 and ¥308=US$1.00 in 1972. In terms of tonnage, it was about 50 million tons in 1970, 47 million tons in 1971, and 49 million tons in 1972. The high-quality U.S. coking coal is much preferred in Japan and much higher prices are paid. However, U.S. coal has been losing ground to lower quality Australian and Canadian coals. Japanese imports of U.S. coals have declined from 25.2 million tons in 1970 to 18.5 million tons in 1971 and 16.5 million tons in 1972. Meanwhile, imports from Australia rose fron 16.5 million tons in 1970 and 1971 to 20.6 million tons in 1972; correspondingly, imports from Canada also rose from 3.4 million tons in 1970, to 6.8 million in 1971, and 7.8 million tons in 1972. Poland and the U.S.S.R. were also involved in 1971–72, each supplying about a million tons annually of good quality coking coal. Thus, dependence upon the United States has declined as Japan diversifies its resource base for coal.

The devaluation of the U.S. dollar brought about readjustments in coal prices. Most U.S. suppliers requested and were granted price increases of $0.80 and $1.00 per ton above the existing prices of $21.50 to $24.50 f.o.b. The worldwide freight rate decline did not help Japan much because of its own economic recession. Australian coal producers negotiated much smaller price increases but got concessions from the Japanese in terms of coal quality, such as raising ash content from 8.5 to 9%. The Canadians received price increases of $1.00 to $2.50 a ton to about $17 in some cases. However, this did not solve the basic problem of development costs that were much higher than anticipated.

In Australia, Nippon Steel Corp. and Kawasaki Steel Corp. signed a long-term contract with the Central Queensland Coal Associates in the fall of 1972 to import coal from Salagy, Queensland. The contract calls for 2.7 million tons of Salagy coal annually over a 10-year period beginning in January 1975; the actual tonnage is smaller than what was originally discussed. Thiess Peabody Mitsui Coal Pty. (TPM and formerly Theiss Peabody Co.), which has a contract to ship Moura coal to Japan until fiscal year 1977, has proposed a long-term contract to develop the Riverside Coal Mine in Queensland for 3 million tons annually over 15 years; the Japanese were receptive to Riverside as an alternative to Moura after 1977 if the

price is reasonable. Broken Hill Pty. Ltd., which took over six Wollondilly coal mines in New South Wales from Clutha Development Pty. Ltd., was negotiating for a continuing contract to ship 3 million tons to Japan annually.

Canada has become a problem area for Japan in terms of supplying coking coal. A potential for delivering in excess of 15 million tons annually by 1975 was first thought to exist. However, the Japanese became concerned about production difficulties in Canada and proceeded to send a technical mission there in August. The mission was scheduled to visit the Balmer, Lus-Car, Fording River, Vicary Creek, and Smoky River mines. During fiscal year 1972, these mines were scheduled to deliver, respectively, 4.5 million tons, 1 million tons, 2.5 million tons, 1.5 million tons, and 2 million tons, but had fallen behind schedule. As in the case of Balmer belonging to Kaiser Resources Co., the Japanese were trying to help it over the hump with the following types of measures price concessions, additional loans: advance of special funds at the rate of $1.85 for each ton exported, increasing the ash content from 8.7 to 9.5%, and honoring the escalator clause with regard to rail freight.

Petroleum.—Despite difficulties created by reevaluation of the yen and a 3-month seamen's strike that did not end until mid-July, Japan still broke the record in almost every petroleum industry category. Crude oil imports during 1972, even though held back by the strike, reached 230 million kiloliters (or 1.45 billion barrels), up 8.7% over that of 1971. Refinery output also registered a significant gain, attaining 220 million kiloliters (1.4 billion barrels).[25] Heavy withdrawals from stocks sustained the crude input requirements during the strike. Reportedly 688,000 barrels a day of refinery capacity was added in 1972, including 202,000 barrels credited to three Okinawa refineries newly transferred to Japanese sovereignity. Investments in refining facilities was on the order of $1 billion during 1972. These investments were slightly higher than in 1971, and the largest increment of increase was in building pollution control facilities. Increasing stress was placed on building oil storage facilities capable of holding 60 days of stocks by March 1975.

Japan took many bold initiatives during 1972 to acquire more oil for the future, so as to satisfy a rapidly expanding market that is already third largest in the world. The country was being considered in oil circles as the next big money market for international petroleum.

Many Japanese banks and brokerage houses have already started to finance oil projects worldwide, particularly refineries. In a major policy decision during the spring, the Japanese Government decided to commit $3 billion from accumulated foreign exchange reserves as a result of the devaluation of the dollar for the development of oil and other needed natural resources.[26] A substantial part of this money apparently will be earmarked for financing Japanese oil exploration abroad or for acquiring established petroleum resources. The monies involved far exceed the modest sums previously allocated for achieving the 1985 goal of supplying 30% of oil needs (actually 9% in 1971) through Japanese-owned resources.

In late 1972, Japan wrapped up an astonishing $780-million agreement with British Petroleum Co., Ltd. for 22.5% of its share of Abu Dhabi's offshore oil output.[27] This initiates the new policy of paying for established production. The Japanese were also looking into the buying of Abu Dhabi's "participation crude." On a smaller scale, Mitsubishi Oil Development Co. announced plans to purchase 40% of the French-owned Erap offshore concessions in Iran at yearend 1972. As of late 1972, all of the six largest Japanese industrial groups had already made plans to establish their own operating oil development companies.

As of December 31, 1972, Japan had 46 refineries owned by 31 companies, with a total atmospheric distillation capacity of 4,897,360 barrels per day (bpd). Corresponding downstream capacities were as follows: vacuum distillation, 1,414,700 bpd; catalytic cracking, 290,100 bpd; catalytic reforming, 458,800 bpd; middle distillates hydrodesulfurization, 953,600 bpd; fuel oil desulfurization, 720,260 bpd; hydrocracking, 12,500 bpd; lube oil solvent extraction,

[25] Breakdown in percentage, as follows: fuel oil, 55; naphtha, 12; gasoline, 11; kerosine, 8; and gas oil, 7.
[26] Petroleum Intelligence Weekly. May 20, 1972, p. 1.
[27] Petroleum Intelligence Weekly. Jan. 1, 1973, p. 1.

68,460 bpd; lube oil solvent deasphalting, 49,100 bpd; lube oil solvent dewaxing, 57,440 bpd; sulfur recovery, 4,042 tons a day; and liquefied petroleum gas (LPG) recovery, 19,800 tons a day.[28] Each refinery had an atmospheric distillation unit. There were also 32 vacuum distillation units, 35 catalytic reforming units and 17 catalytic cracking units.

In late 1972 MITI had already approved expansion of indvidual companies which would add 1,363,000 bpd of capacity to the October 1972 national total by October 1975. Details of Japan's atmospheric crude distillation capacity, present and future, by company and refinery, are shown in the following tabulation:

[28] Japan Petroleum Weekly (Tokyo). Japan Petroleum Consultants, Ltd., v. 8, No. 4, 1973, pp. 1–6.

Company and refinery	Capacity, barrels per day		Completion date
	October 1972	Planned	
Asia Sekiyu:			
Hakodate	25,000	--	--
Yokohama	100,000	--	--
Asia-Kyoseki: Sakaide	60,000	90,000	October 1975
Daikyo Sekiyu: Yokkaichi	195,000	20,000	October 1975
Fuji Kosan:			
Kainan	77,600	--	--
Onahama	--	30,000	October 1975
Fuji Sekiyu: Sodegaura	140,000	70,000	October 1975
General Sekiyu:			
Kawasaki	55,000	--	--
Sakai	120,000	--	--
Idemitsu Kosan:			
Aichi	--	130,000	April 1975
Chiba	310,000	--	--
Hyogo	110,000	--	--
Tokuyama	140,000	--	--
Tomakomai	--	70,000	October 1973
Kansai Sekiyu: Sakai	110,000	100,000	October 1973
Kashima Sekiyu: Kashima	180,000	--	--
Koa Sekiyu:			
Marifu	149,000	--	--
Osaka	80,000	120,000	April 1974
Kyokuto Sekiyu: Chiba	100,000	50,000	October 1975
Kyushu Sekiyu: Oita	170,000	--	--
Maruzen Sekiyu:			
Chiba	195,000	--	--
Matsuyama	50,000	--	--
Shimotsu	37,500	--	--
Mitsubishi Sekiyu:			
Kawasaki	105,000	--	--
Mitsushima	170,000	50,000	April 1973
	--	50,000	April 1975
Nichimo Sekiyu: Kawasaki	57,000	43,000	April 1973
Nihonkai Sekiyu: Toyama	30,000	30,000	April 1973
Nihon Kogyo:			
Funakawa	14,150	--	--
Mizushima	195,200	40,000	April 1973
Nihon Sekiyu: Niigata	26,000	--	--
Nihon Sekiyu Seisei:			
Kudamatsu	42,000	--	--
Muroran	10,000	100,000	October 1973
Negishi	330,000	--	--
Yokohama	70,000	--	--
Seibu Sekiyu: Yamaguchi	110,000	80,000	October 1975
Showa Sekiyu:			
Kawasaki	149,000	--	--
Niigata	43,000	--	--
Showa Yokkaichi: Yokkaichi	260,000	30,000	April 1973
	--	20,000	October 1974
Taiyo Sekiyu: Kikuma	59,000	10,000	October 1975
Teiseki Topping: Kubiki	4,410	--	--
Toa Sekiyu:			
Kawasaki	100,000	--	--
Nagoya	--	100,000	October 1973
Toa Nenryo Kokyo:			
Kawasaki	200,000	--	--
Shimizu	43,500	--	--
Wakayama	187,000	70,000	October 1973
Toho Sekiyu: Owase	40,000	--	--
Tohoku Sekiyu: Sendai	40,000	60,000	October 1974
Total	4,689,360	1,363,000	

As of late 1972, Japan had two refineries of 300,000 bpd or larger, headed by Nihon Sekiyu Seisei's (Nippon Petroleum Refining) Negishi Refinery which ranked about 15th in the world and cost $330 million to build. Idemitsu Kosan's Chiba Refinery followed Negishi in size. By October 1973, Japan will have eight refineries of between 195,000 and 290,000 bpd and 16 others of between 100,000 and 180,000 bpd.

The 68th ordinary national diet, which closed its 172-day session on June 16, 1972, passed the following six laws concerned with oil industry operations:[29] Japan Petroleum Development Corporation Law (partial revision to include natural gas); Air Pollution Control Law and Water Pollution Control Law (partial revision); promulgation of Law Concerning Promotion of Relocation of Industrial Plants; promulgation of Maritime Traffic Safety Law; promulgation of Heat Supply Enterprise Law; and promulgation of Oil Pipeline Enterprise Law. The pollution control laws will introduce a "no-fault compensation responsibility" to the polluter. The relocation law aims at making adjustments between the overdeveloped and underdeveloped regions through special taxation and financial measures. About eight refineries are presently in overcrowded areas. The implications of the other three laws are somewhat self-evident.

Japan's meager oil and natural gas output showed further slight declines. Some drilling offshore Niigata, however, showed a little promise. Idemitsu Exploration Co. (Japan Sea) Ltd. and Japan Offshore Ltd. have been jointly involved in this effort. As of the fall of 1972, three test wells have been drilled and an additional two or three wells were planned. No. 2 well proved a failure. However, No. 1 well has a potential capacity of perhaps 200 kiloliters (1 kiloliter equals 6.29 barrels) of oil and 130,000 cubic meters of gas and No. 3 well, 100 kiloliters of oil and 400,000 cubic meters of gas. After further delineating reserves, commercial production is envisaged for 1974.

Whether produced by foreign or Japanese companies, crude oil from abroad will continue to be the key supply. "Japan's new Oil Policy", announced in December 1971 by the Overall Energy Council, was formulated to cope with the problem of future oil supply. This was described in the 1971 Minerals Yearbook V. III, The Mineral Industry of Japan, and appears to contain the basic policy concepts that would hold true for perhaps the next decade. Details on Japan's efforts to find her own oil around the world have been described in various sources.[30]

During 1971–72, Japan obtained about 85% of its crude oil imports from the Middle East, including roughly 45% from Iran, 16% from Saudi Arabia, 10% from Kuwait, 5% from the Saudi Arabia—Kuwait Neutral Zone, and 7% from Abu Dhabi and Qatar. Elsewhere, Indonesia was the only important source with 12%, although several areas were of potential importance, particularly Nigeria.

One big project in Iran in which the Japanese are involved, is a three-party joint venture to develop the Lureston oil concession, reported to be one of the world's promising untapped oilfields. The National Iranian Oil Co. (NIOC) owns half the shares, the Japanese combine of five companies one-third of the shares, and Mobil Oil Co. one-sixth of the shares. Approximately $50 million were set aside for exploration and possibly $40 million for a bonus upon signature. Seismic surveys and preliminary exploration have been started in earnest with no conclusive results as yet. In mid-1972, the proposed deal with NIOC to jointly develop the natural gasfield on Qeshm Island fell through because estimated costs ran much higher than elsewhere. The Kharg Island natural gas project on the Erap concessions was moving ahead; as noted, the Japanese were buying heavily into this project. Although much smaller than the NIOC-Mitsui petrochemical deal, the Mitsubishi Gas and Chemical Co. signed a joint venture agreement near yearend to build a petrochemical plant at Bander Shahpour.

Crude oil from Saudi Arabia came mainly through the international oil companies with oilfields there. Japan signed a contract to build a new refinery at Riyadh and expand the existing refinery at Jidda in exchange for about 10 million tons of "royalty" crude oil. In the Neutral Zone where the Japanese firm Arabian Oil Co.

[29] Japan Petroleum Weekly (Tokyo). Japan Petroleum Consultants, Ltd. June 26, 1972, pp. 3–6 and July 3, 1972, pp. 2–4.

[30] Japan Petroleum Weekly (Tokyo). Japan Petroleum Consultants, Ltd. July 10, 1972 and July 17, 1972, pp. 1–12.

Ltd. operates, efforts were being made to expand production at the smaller Hout field at the expense of the Khafji field because oils are lighter and contain less sulfur. Arabian Oil also started to exchange some Khafji crude with British Petroleum for better quality Abu Dhabi and Iranian crudes.

Japan takes about 70% of Indonesia's oil exports or roughly half the production. It is involved in various joint ventures in Indonesia, buys from Indonesia's state company Pertamina directly, and imports oil from the many international oil companies. Prospects for much expanded production in Indonesia are excellent, and Japan expects to share in this prosperity. In the spring when President Suharto visited Japan, a $200 million untied soft loan (3% interest for 25 years) was granted for oil development in Indonesia. In return, Pertamina is to supply Japan with approximately 50 million tons of low-sulfur crude annually over a 10-year period. Along with this government loan, private Japanese circles also pledged $100 million at about 6.25% interest. Another deal was shaping up in the fall, involving the construction of a 100,000-bpd refinery in Java at a cost of $130 million.

Japanese efforts in Nigeria were already bearing fruit in 1972 after only a year of exploration. The terms were that the Japanese would take 49% of the output and the Nigerian Government 51%, once commercial operations commenced. The Japanese were hopeful that about 6 million kiloliters could be imported from Nigeria annually starting in 1975. Late in 1972 a well of 600 kiloliters daily capacity was discovered offshore, about 15 kilometers from the shores of western Nigeria. This find seems to be part of a potentially rich oilfield and the oil contains less than 0.2% sulfur. This is the third time that a Japanese oil development effort has been very successful, the others being Arabian Oil in the Neutral Zone and Abu Dhabi Oil in Abu Dhabi.

As of yearend 1972, Japanese discussions with the Soviets to jointly develop the Tyumen oilfield, natural gas on the Continental Shelf off Sakhalin and natural gas and coking coal in southern Yakutsk, were still far from being finalized. Specifically, the Soviets would like a $1 billion loan for Tyumen for building a 4,178-kilometer pipeline to Nakhodka among other things and $200 million to finance the Sakhalin project. In return, the Japanese hope to import 25 to 50 million tons of crude oil annually for 20 years or so. The twist is that the Soviet Union hopes to have some American participation also.

In early January 1973, PRC entered the picture as a future crude oil supplier to Japan. Although the initial Chinese offer was only 200,000 tons in 1973 (less than 0.1% of Japan's recent annual needs), the Japanese eagerly accepted the deal for negotiation and even formed a special importing combine to handle the PRC petroleum trade, in the hope that this might lead to much bigger things. The Japanese were interested in the possibility of working together with the Chinese in developing the shallow Pohai seas for oil. In September, the Japan Drilling Co. of Tokyo sold a second-hand offshore drilling rig and barge to the Chinese for use in offshore Pohai.

A survey team dispatched by the Japan Natural Gas Association around the world in mid-1972 highlights the importance of gas as a source of energy for Japan. Because of transport and other difficulties, Japan only imported perhaps 1 million tons of liquefied natural gas (LNG) in 1972, predominantly from Alaska. Brunei was expected to become an important source shortly, since the first of five 1-million-ton-a-year LNG plants was completed with the help of the Japanese in the fall of 1972. The other four plants are expected to be completed in the spring of 1973.[31] Abu Dhabi's Das Island is expected to supply annually 1 million tons of LNG and 2 million tons of liquefied petroleum gas (LPG) beginning in 1976. In Iran, the Qeshm project fell through but the Kharg Island project scheduled to supply 4 million tons of LNG annually to Japan by 1976 or 1977 was very much alive. Projects in the Soviet Union and Australia were being studied. Shell Oil was arranging to ship about half a million tons of LPG annually to Japan beginning in 1974, from its onshore Dukhan field in Qatar.

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[31] Japan Chemical Weekly (Tokyo). The Chemical Daily Co., Ltd. Oct. 12, 1972, p. 2.

The Mineral Industry of Kenya, Tanzania, and Uganda

By Avery H. Reed [1] and Robert G. Clarke [1]

KENYA [2]

The mineral industry of Kenya leveled off and suffered its first decline in many years. Output decreased 8% below the record levels of 1971. However, new annual records were set for the production of carbon dioxide, fluorspar, gem stones, lime, magnetite, and sand.

Petroleum refinery output declined 24% below the 1971 record. A new annual record was set for the output of distillate fuel oil.

The principal exports from Kenya were cement, sodium compounds, scrap iron, and residual fuel oil. Leading imports were crude petroleum, iron and steel products, fertilizers, and coal.

Installed electric capacity increased 21% to 186,100 kilowatts in 1971. Since 1962, capacity has expanded 86%. The Nairobi area has 53%; the coast area 41%; and the Eldoret area, 6%. Of the total, 149,900 kilowatts or 62% was thermal and 38% was hydro. The total consumption of electricity in 1971 was 851 million kilowatt hours, of which 293 million kilowatt hours, or 34%, was imported from Uganda. In 1962, 46% of electricity requirements was imported.

Kenya, a large country on the east coast of equatorial Africa, has an area of 225,000 square miles, about the size of California plus Washington. The economy is mainly agricultural and pastoral and there are few developed mineral resources. The Government of Kenya published an authoritative report on the country.[3]

COMMODITY REVIEW

Metals.—*Copper.*—Production of copper was 72 tons. Total copper production, 1951 to 1972, was 26,286 tons valued at $16,176,000.

Gold.—Gold recovered was 34 ounces.

Iron Ore.—Output of magnetite was 9,240 tons valued at $164,300.

Lead.—Development work continued at the new Kinagoni lead-silver mine. Output of lead was 2 tons valued at $1,400. Reserves are estimated at 2 million tons.

Nonmetals.—*Barite.*—Barite output declined 15% below the 1971 record high to 628 tons.

Carbon dioxide.—Production of carbon dioxide was 1,124 tons, 7% above the 1971 record high.

Cement.—Output of cement declined 9% below the 1971 record high to 734,400 tons. Total cement production, 1955 to 1972, was 7,606,000 tons valued at $170,430,000.

Clays.—Kaolin production was 718 tons valued at $2,880.

Diatomite.—Output of diatomite was 1,812 tons valued at $106,500.

Feldspar.—Feldspar production declined 26% below the 1971 record high to 1,962 tons.

Fluorspar.—Output of fluorspar from the new mine in the Rift Valley again set a new annual record high, 59% above the 1971 record. Production was 10,457 tons valued at $363,100. Proved reserves are 9 million tons of 50% ore. The fluorspar was exported, by truck to Kaptagat, rail to Mombasa, and ship to Japan.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.
[2] Prepared by Avery H. Reed.
[3] Government of the Republic of Kenya. Kenya—An Official Handbook, 1973, 208 pp.

Table 1.—Kenya: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Beryllium, beryl concentrate, gross weight	4	NA	(1)
Copper, mine output, metal content	79	73	72
Gold, mine output, metal content—troy ounces	NA	NA	34
Iron and steel, iron ore, gross weight	--	1,205	9,240
Lead, mine output, metal content	--	--	2
Silver, mine output, metal content—troy ounces	NA	NA	--
NONMETALS			
Abrasives, natural, corundum	60	NA	NA
Barite	447	743	628
Carbon dioxide, natural	763	1,051	1,124
Cement, hydraulic	801,615	803,823	734,354
Clays:			
Bentonite	56	--	--
Kaolin	1,770	NA	718
Diatomite	1,601	1,400	1,812
Feldspar	895	2,650	1,962
Fertilizer materials, crude phosphatic, guano	638	350	747
Fluorspar	3,904	6,561	10,457
Gaylussite [2]	204	--	--
Gem stones, precious and semiprecious:			
Amethyst—carats	290	NA	NA
Aquamarine—do	56,700	NA	89,500
Garnet [3]—kilograms	7,460	12	25
Ruby—carats	12,385	16,700	30,500
Sapphire—do	4,515	NA	235,000
Tourmaline—do	70,450	NA	3,710,000
Zircon—do	3,035	--	--
Gypsum and anhydrite:			
For cement production	59,020	[4] 91,872	NA
Other	r 1,057	NA	NA
Total	r 60,077	91,872	e 100,000
Magnesite, crude	4	221	628
Meerschaum	70	NA	NA
Salt:			
Marine	35,420	43,406	22,756
Rock	3,851	4,430	5,010
Total	39,271	47,836	27,766
Soda, raw crushed (trona)	2,879	1,923	3,665
Soda ash	167,477	161,260	148,617
Stone, sand and gravel:			
Calcareous:			
Calcite, not further described	51	--	--
Coral (for cement manufacture)—thousand tons	--	918	NA
Kunkur for cement manufacture	57,118	51,499	61,757
Limestone for cement manufacture—thousand tons	1,048	1,015	NA
Limestone products, not further described	24,149	28,127	22,854
Quartz	r 22	--	--
Sand	12,348	8,728	12,900
Shale	144,000	187,050	NA
Volcanic ash for cement manufacture	863	1,866	2,633
Vermiculite	1,668	1,359	932
Wollastonite	100	--	--
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor—thousand 42-gallon barrels	2,663	2,776	2,756
Jet fuel—do	2,365	e 2,010	e 2,056
Kerosine—do	574	e 861	e 761
Distillate fuel oil—do	3,306	3,585	3,690
Residual fuel oil—do	7,439	8,136	7,967
Other—do	797	495	435
Refinery fuel and losses—do	341	496	720
Total—do	17,485	18,359	18,385

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Less than ½ unit.

[2] Hydrous sodium-calcium carbonate mineral.

[3] Quality (gem or industrial) not specified.

[4] Figure probably includes gypsum for other than cement production.

Table 2.—Kenya: Exports of major mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity		1970 [2]	1971
METALS			
Iron and steel:			
Scrap		6,804	1,791
Semimanufactures		831	1,082
Other nonferrous metals, scrap		2,580	2,460
NONMETALS			
Abrasives		614	743
Cement		343,069	331,688
Fertilizer materials, manufactured		1,712	1,829
Lime		29	--
Salt and brine		679	681
Sodium compounds, soda ash, sodium carbonate		157,155	149,907
Stone, sand and gravel		131	19
MINERAL FUELS AND RELATED MATERIALS			
Gas, hydrocarbon		364	306
Petroleum:			
Gasoline	thousand 42-gallon barrels	172	158
Kerosine and jet fuel	do.	1,393	1,388
Distillate fuel oil	do.	779	778
Residual fuel oil	do.	4,187	4,876
Lubricants	do.	--	176
Other	do.	82	25

[1] Excludes reexports.
[2] Most figures revised.

Gem Stones.—Output of gem stones was valued at a record high of $72,300. Minerals collected included tourmaline, beryl, sapphire, garnet, aquamarine, and ruby.

Gypsum.—Production of gypsum increased. Total gypsum production, 1943 to 1972, was 597,700 tons valued at $3,839,000.

Lime.—Output of lime was 22,854 tons. Total production of lime, 1941 to 1972, was 539,000 tons valued at $9,002,000.

Magnesite.—Production of magnesite was 628 tons valued at $18,530, 78% below the 1959 record high.

Salt.—Output of salt decreased 36% to 27,766 tons and was 54% below the 1968 record high. Total salt production, 1939 to 1972, was 859,400 tons valued at $19,582,000.

Sand.—Sand production was a record 12,900 tons valued at $49,130.

Soda.—Output of soda decreased 7% to 152,280 tons and was 9% below the 1970 record high. Total production of soda, 1936 to 1972, was 3,618,000 tons valued at $99,880,000. Soda has long been Kenya's most valuable mineral resource.

Stone.—Crushed limestone production decreased 10% below the 1971 record high to 1,790,000 tons. Total limestone production, 1948 to 1972, was 12,366,000 tons valued at $11,601,000. Most of the limestone was used in cement.

Vermiculite.—Output of vermiculite declined 31% to 932 tons valued at $18,150, 44% below the 1970 record high.

Mineral Fuels.—*Petroleum.*—Petroleum has not been discovered in Kenya. In 1972, Chevron Oil Co. obtained an exploration concession which covers an area bounded by Somalia on the east, Wajir on the north, Mado Gashi on the west, and Garissa on the south. The company plans to spend about $2 million on exploration over the next 2 years.

The Government of Kenya obtained a 50% interest in the oil refinery at Mombasa.

Asphalt.—Production of asphalt was 8% less than that of 1971, and 53% below the 1970 record high. Output was 46,420 tons valued at $1,798,000. Total production of asphalt, 1964 to 1972, was 320,000 tons valued at $13,057,000.

Distillate Fuel Oil.—Record production of distillate was valued at $42,810,000. Total distillate production, 1963 to 1972, was 3,465,000 tons valued at $252,400,000.

Gasoline.—Gasoline production decreased 1% below the 1971 record high. Total production of gasoline, 1963 to 1972, was 2,624,000 tons valued at $251,000,000.

Kerosine.—Output of kerosine was 2% below the 1971 record high. Total kerosine production, 1963 to 1972, was 2,334,000 tons valued at $240,700,000.

Liquefied Petroleum Gas (LPG).—LPG production decreased 18% below the 1971 record high. Total LPG output, 1964 to 1972, was 80,180 tons valued at $6,430,000.

Residual Fuel Oil.—Output of residual fuel oil decreased 28% and was 38% below the 1970 record high. Total production of residual fuel oil, 1963 to 1972, was 8,572,000 tons valued at $334,000,000.

Table 3.—Kenya: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971
METALS		
Aluminum metal, including alloys, all forms	1,657	1,100
Copper metal, including alloys, all forms	2,444	1,233
Gold metal, troy ounces	6,091	14,631
Iron and steel:		
Ore and concentrate	9,398	100
Metal:		
Scrap	252	73
Pig iron, ferroalloys, and similar materials	783	1,270
Steel, primary forms, ingots and other	6,947	18,461
Semimanufactures:		
Bars, rods, angles, shapes, sections	31,603	51,477
Universals, plates, and sheets	116,990	150,985
Hoop and strip	1,688	1,763
Rails and accessories	284	4,927
Wire	12,329	9,464
Tubes, pipes and fittings	15,423	14,426
Castings and forgings, rough	2	3
Lead metal, including alloys, all forms	545	649
Nickel metal, including alloys, all forms	2	8
Tin metal, including alloys, all forms	115	178
Zinc metal, including alloys, all forms	2,937	2,635
Other nonferrous metals, scrap	16	45
NONMETALS		
Abrasives, natural, n.e.s	143	191
Cement	970	42,064
Clay and clay products (including all refractory brick):		
Crude clays, n.e.s	1,118	842
Products	2,037	2,435
Feldspar, fluorspar, cryolite and chiolite	--	--
Fertilizer materials:		
Crude:		
Phosphatic	188	--
Potassic	108	919
Manufactured:		
Nitrogenous	20,670	9,541
Phosphatic	19,530	22,687
Potassic	4,766	3,080
Other, including mixed	43,935	44,530
Ammonia	42	81
Graphite, natural	10	--
Lime	44	91
Mica, all forms	25	74
Salt and brine	2,418	6,785
Stone, sand and gravel:		
Dimension stone	152	62
Dolomite	--	74
Gravel and crushed rock	588	974
Limestone [2]	152	9,356
Quartz and quartzite	8	1
Sand	38	44
Sulfur, elemental, all forms	1,122	1,154
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	277	734
Coal, all grades, including briquets	81,605	81,271
Coke and semicoke	1,431	1,440
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	16,205	18,686
Refinery products:		
Gasoline, do	435	351
Kerosine and jet fuel, do	484	248
Distillate fuel oil, do	368	319
Residual fuel oil, do	119	1
Lubricants, do	162	335
Mineral jelly and wax, do	10	17
Other, do	29	22

[1] Most figures revised.
[2] Includes gypsum, plasters and similar stone used for the manufacture of lime or cement.

TANZANIA [4]

The production of diamond dominated the mineral industry of Tanzania as in the past. Depletion at one diamond mine and cut backs in diamond production at other mines by the National Development Corporation (NDC) caused a decrease in overall diamond production.

The offshore and shoreline petroleum exploration program has been active for 3 years. No domestic production of either oil or gas has resulted although more interest by large international oil companies indicates some success.

Construction of the Tanzania-Zambia (Tan-Zam) Railway from Dar Es Salaam, Tanzania, to Kapiri Mposhi, Zambia, consumed large quantities of construction materials. The Tan-Zam Railroad, 1.067 meter gage, of which 480 miles was completed in 1972, will be 1,154 miles in length when completed in 1975.

[4] Prepared by Robert G. Clarke.

Table 4.—Tanzania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 [p]
METALS			
Gold, refined—troy ounces	[1] 7,859	167	213
Silver, refined—do	1,102	36	52
Tin, mine output, metal content—long tons	104	136	31
Tungsten, mine output, metal content	5	7	8
NONMETALS			
Clays, kaolin	[r] 468	830	[e] 900
Cement, hydraulic	167,296	179,300	236,956
Diamond:			
Gem [2]—carats	359,030	418,595	365,000
Industrial [2]—do	349,115	418,595	365,000
Total—do	708,145	837,190	[1] 730,000
Gem stones, precious and semiprecious, except diamond:			
Amethyst—kilograms	153	69	80
Aquamarine—do	--	2	3
Beryl (gem only)—do	17	35	100
Chrysoprase and opal—do	2	5	31
Corundum (gem only)—do	142	33	(3)
Garnet—do	146	33	104
Ruby and sapphire—do	61	11	20
Tourmaline—do	46	2	9
Zircon—do	4	(3)	3
Zoisite (tanzanite)—do	66	16	60
Gypsum and anhydrite, crude	20,718	17,691	[1] 2,535
Lime (quicklime and hydrated lime)	[r] 6,463	5,203	[e] 4,000
Magnesite, crude	690	982	811
Meerschaum—kilograms	9,760	7,980	NA
Mica:			
Sheet	45	37	23
Scrap	13	[e] 13	[e] 13
Salt, all types	41,944	37,278	[e] 40,000
Stone, sand and gravel:			
Ornamental stones:			
Art stone	57	20	9
Amethystine quartz	(3)	--	--
Glass sand	3,938	53	NA
Vermiculite	150	29	--
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	2,664	2,798	[e] 3,000
Petroleum refinery products:			
Gasoline, motor—thousand 42-gallon barrels	1,039	1,041	1,128
Jet fuel—do	350	444	459
Kerosine—do	234	121	148
Distillate fuel oil—do	1,144	875	1,299
Residual fuel oil—do	2,341	2,379	2,501
Other—do	48	54	58
Refinery fuel and losses—do	373	609	369
Total—do	5,529	5,523	5,962

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

[1] Exports.

[2] Estimates based on reported total diamond output and best available information on ratio of gem to industrial stones in total output.

[3] Less than ½ unit.

Table 5.—Tanzania: Exports of major commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity		1970 [2]	1971
METALS			
Aluminum metal, including alloys, semimanufactures		217	239
Gold metal, unworked or partly worked	troy ounces	7,927	155
Iron and steel:			
Metal:			
Scrap		3,005	97
Semimanufactures		187	666
Silver metal, including alloys	troy ounces	917	35
Tin, ore and concentrate	long tons	237	139
Tungsten, ore and concentrate		19	5
Other nonferrous metal, scrap		1,090	1,368
NONMETALS			
Cement		2,266	5,084
Diamond, all grades	carats	719,660	807,810
Lime		--	5
Magnesite		893	476
Mica, all forms		59	40
Salt and brine		8,545	16,280
MINERAL FUELS AND RELATED MATERIALS			
Gas, hydrocarbon		722	1,159
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	1,158	1,222
Kerosine and jet fuel	do.	371	405
Distillate fuel oil	do.	1,711	3,790
Residual fuel oil	do.	1,209	1,327

[1] Excludes reexports.
[2] Most figures revised.

COMMODITY REVIEW

Metals.—*Gold and Silver.*—Production of gold and byproduct silver increased slightly over that of 1971 but was still far below that of 1970. Gold production was mainly from old workings in the Geita, Lupa Mpanda, and Mara areas.

Tin.—The production of tin concentrate continued to decline. The quantity of tin concentrate was 73% less than that of 1971, and the value was 78% less.

Tungsten.—The gross weight of tungsten concentrate produced increased 87% in quantity and 57% in value.

Nonmetals.—*Cement.*—Production of cement increased 33% in value. The cement factory of the Tanzania Portland Cement Co. was expanded in 1971 to meet the demand. Cement demand was high because of two major projects underway: the Tan-Zam Railway and the trans-Tanzania Highway. For the railway, railroad ties, signal poles, and communication poles were made of concrete. For both projects, concrete was used extensively in bridge construction to avoid the use of steel. New housing near the roads emphasized concrete slabs for the main floors and concrete blocks for walls.

Diamond.—Williamson Diamonds, a member company of the NDC of Tanzania, accounted for the entire diamond production. The total quantity of gem and industrial diamond decreased. However, exports of diamond accounted for more than 90% of the total value of minerals exported from Tanzania in 1972. Williamson Diamonds continued prospecting at its Mwadui mine, but the results were discouraging. Depletion at Mwadui was one of the factors causing a decrease in diamond output.

Other Gem Stones.—In addition to diamond, Tanzania contributed a variety of precious and semiprecious stones to world trade. Exports of the gem zoisite (tanzanite) amounted to 45% of the total value of colored gem stone exports excluding diamond. Other gem stone varieties exported included amethyst, aquamarine, chrysoprase, garnet, ruby, sapphire, tourmaline, and zircon.

Magnesite.—The NDC was reported planning to establish a new magnesite processing installation at Same (between Tanga and Moshi). The existing plant at the site has been operated by Tanganyika Magnesite Mines Ltd.[5] Exports in 1971

[5] Tanzania. Magnesite resources to be redeveloped. Industrial Minerals, London. No. 62, November 1972, pp. 30–31.

were only 476 tons. The NDC plans for a 2,000-ton-per-month plant, creating employment for 880 persons and earnings up to $2 million per year in foreign exchange.

Mineral Fuels.—*Petroleum.*—The 1,058-mile pipeline from Dar es Salaam, Tanzania, to N'Dola, Zambia, will be raised from a capacity of 15,200 barrels per day to a capacity of 22,000 barrels per day.[6]

[6] Oil and Gas Journal. ENI firms to Loop Tanzania–Zambia line. V. 70, No. 16, Apr. 17, 1972, p. 62.

Table 6.—Tanzania: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971
METALS		
Aluminum, metal, including alloys:		
Unwrought	2,519	4,015
Semimanufactures	310	362
Copper metal, including alloys, all forms	246	814
Gold metal, worked and partly worked—troy ounces	52	15,707
Iron and steel:		
Ore and concentrate	1,420	644
Metal:		
Pig iron, ferroalloys and similar materials	1,501	1,242
Steel, primary forms, ingots and other	1	7,551
Semimanufactures:		
Bars, rods, angles, shapes, sections	24,887	29,782
Universals, plates and sheets	65,360	96,065
Hoop and strip	3,088	3,266
Rails and accessories	15,831	58,692
Wire	6,630	8,760
Tubes, pipes and fittings	12,233	16,276
Castings and forgings, rough	1	--
Lead metal, including alloys, all forms	130	374
Tin metal, including alloys, all forms—long tons	44	73
Zinc metal, including alloys, all forms	2,143	2,355
Other nonferrous metals, scrap	94	64
NONMETALS		
Abrasives, natural	34	43
Asbestos	17	2
Cement	17,206	115,260
Clay and clay products (including all refractory brick):		
Crude clays, n.e.s	780	769
Products	736	1,907
Feldspar, fluorspar, cryolite and chiolite	25	45
Fertilizer materials:		
Manufactured:		
Nitrogenous	3,034	5,737
Phosphatic	3,171	6,550
Potassic	2,162	3,166
Other, including mixed	15,103	19,907
Ammonia	26	30
Graphite, natural	1	(2)
Lime	37	39
Mica, all forms	18	2
Salt and brine	10,423	4,412
Sodium and potassium compounds, n.e.s., caustic soda	3,678	2,927
Stone, sand and gravel:		
Dimension stone	47	179
Dolomite	--	--
Gravel and crushed rock	585	284
Limestone [3]	406	220
Sand	36	354
Sulfur, elemental, all forms	456	1,231
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	160	86
Coke and semicoke	1,033	2,072
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	5,349	6,916
Refinery products:		
Gasoline—do	659	788
Kerosine and jet fuel—do	212	127
Distillate fuel oil—do	1,658	1,873
Residual fuel oil—do	--	12
Lubricants—do	152	84
Mineral jelly and wax—do	3	55
Other—do	154	73

[1] Most figures revised.
[2] Less than ½ unit.
[3] Includes gypsum, plasters and similar stone used for the manufacture of lime or cement.

SNAM Progetti and Saipem, subsidiaries of Italy's state-owned Ente Nationale Idrocarburi (ENI), were awarded the contract to install about 477 miles of 12-inch pipe for a loop to increase the capacity of the line. When a refinery installation at N'Dola is completed, the product line will be converted to crude service to feed the refinery.

Increased exports of petroleum products from Tanzania in 1972 were largely refined products shipped to Zambia. These will be cut when the Zambian refinery comes into production. Tanzania expects to make up the revenue loss in exports of refined products by increased revenue from the increase of the flow of crude through the pipeline.

The search for oil continued during the year along the coastal sedimentary belt and offshore areas. Azienda Generale Italiani Petroli (AGIP) S.p.A., and an affiliate of ENI of Italy contracted originally for the seismic survey in 1969. AGIP S.p.A. subcontracted the work requiring specialists in aerial and marine search techniques to firms from the United States and France. The northern coastline of Tanzania indicated possibilities for finding oil by these methods in 1972.

UGANDA [7]

The production of copper, although less, was the dominant commodity once again of the mineral industry in Uganda. Mine output of copper decreased 8% in quantity and primary blister copper decreased 11% in quantity. Concentrates of beryllium, tin, and tungsten were produced in lesser quantities than that produced in 1971.

Management changes were decreed by the Government in a domestic policy directive that replaced nonindigenous personnel with indigenous personnel for all industries. The change-over of personnel affected output in the mineral industries.

COMMODITY REVIEW

Metals.—*Copper-Cobalt.*—Kilembe Mines Ltd., a subsidiary of Falconbridge Nickel Mines Ltd. of Canada, Uganda's only copper producer, reported decreases of 8% in metal content of mine output and 11% in primary blister copper. Ore production from the mine was 909,642 tons of which the metal content assayed 1.73% copper.

Iron and Steel.—The Steel Corp. of East Africa awarded a contract to the West German firm Rheinstahl A.G. to reconstruct and modernize the steel mill in Uganda.[8] The mill now uses only scrap iron and has a capacity of 20,000 tons per year. On completion of the modernization project in 1975, the mill will be producing steel from domestic iron ore as well as from scrap, and the capacity will be 60,000 tons per year.

[7] Prepared by Robert G. Clarke.
[8] Engineering and Mining Journal. Uganda. V. 173, No. 7, July 1972, p. 140.

Table 7.—Uganda: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Beryllium, beryl concentrate, gross weight	367	221	73
Bismuth, mine output, metal content—kilograms	780	884	396
Columbium and tantalum, ore and concentrate, gross weight—do	3,000	7,900	1,800
Copper:			
Mine output, metal content	19,159	17,070	15,747
Metal, blister, primary	16,958	15,731	14,071
Iron and steel, steel ingots	19,521	16,435	e 16,000
Tin, mine output, metal content—long tons	r 123	129	79
Tungsten, mine output, metal content	r 121	110	109
NONMETALS			
Cement, hydraulic	r 189,000	202,000	166,000
Fertilizer materials, phosphatic:			
Crude, apatite	r 16,000	16,000	e 16,000
Super phosphate	24,761	23,888	e 24,000
Lime (quicklime and hydrated lime)	21,279	e 18,000	e 18,000
Salt, evaporated	2,277	2,409	e 2,500

e Estimate. p Preliminary. r Revised.

Table 8.—Uganda: Exports of major mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity	1970 [2]	1971
METALS		
Beryllium, beryl ore and concentrate	254	230
Copper metal, blister and other unrefined unalloyed	16,446	16,808
Iron and steel metal, semimanufactures	1,131	776
Tin ore and concentrate—long tons	182	172
Tungsten ore and concentrate	224	206
Other nonferrous metals, n.e.s.:		
Ores and concentrates	113	13
Scrap	1,088	647
NONMETALS		
Cement	2,320	1,809
Clay products (including nonrefractory bricks)	606	--
Fertilizer materials	5	1
Salt and brine	2,129	1,783

[1] Excludes reexports.
[2] Most figures revised.

Other Metals.—Production of mineral concentrates of other metals decreased drastically. Beryllium concentrates, tin, and tungsten decreased 67%, 45%, and 79%, respectively.

Nonmetals.—The East African Development Bank approved a loan of about $3 million to the Uganda Cement Industry, a subsidiary of the Uganda Development Corp.[9] The Hima Cement Factory, near Kasese in Toro District, Uganda, will be expanded to produce 300,000 tons of cement per year from the present 100,000 tons per year.

[9] The Staff Newspaper of East African Railways. Cement: Shillings 20 million loan approved. Sikio. No. 311. Jan. 1, 1973. p. 2.

Table 9.—Uganda: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971
METALS		
Aluminum metal, including alloys, semimanufactures	1,068	1,151
Copper metal, including alloys, all forms	316	478
Gold metal, troy ounces	198	152
Iron and steel:		
Scrap	--	1
Pig iron, ferroalloys, and similar materials	576	1,197
Steel primary forms, ingots and other	46	12
Semimanufactures:		
Bars, rods, angles, shapes, sections	11,154	17,288
Universals, plates	120,426	86,325
Hoop and strip	2,709	1,462
Rails and accessories	2,150	542
Wire	3,738	4,210
Tubes, pipes and fittings	9,354	7,396
Lead metal, including alloys, all forms	52	78
Nickel metal, including alloys, all forms	2	1
Silver metal, including alloys, troy ounces	30	285
Tin metal, including alloys, all forms, long tons	21	55
Zinc metal, including alloys, all forms	1,327	1,799
Other nonferrous metals, scrap	32	80
NONMETALS		
Abrasives, natural	43	37
Asbestos	2,468	277
Cement	927	674
Clay and clay products (including all refractory brick):		
Crude clays, n.e.s	376	512
Products	2,303	2,071
Feldspar, fluorspar, cryolite and chiolite	1,812	919
Fertilizer materials:		
Crude:		
Nitrogenous	--	250
Potassic	--	92
Manufactured:		
Nitrogenous	3,163	4,434
Phosphatic	1,654	958
Potassic	5,492	1,596
Other including mixed	12,474	16,092
Ammonia	20	16
Graphite, natural	2	22
Lime	--	1
Mica, all forms	7	16
Salt and brine	23,935	11,734
Sodium and potassium compounds, n.e.s., caustic soda	3,367	5,823
Stone, sand and gravel:		
Dimension stone	40	157
Dolomite	527	740
Gravel and crushed rock	579	314
Limestone [2]	70	219
Quartz and quartzite	11	5
Sand	13	6
Sulfur, elemental, all forms	4,620	5,850
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	10	--
Coal, all grades, including briquets	24	--
Coke and semicoke	479	558
Petroleum:		
Refinery products:		
Gasoline, thousand 42-gallon barrels	18	21
Kerosine and jet fuel, do	7	9
Residual fuel oil, do	--	5
Lubricants, do	56	24
Mineral jelly and wax, do	2	4
Other, do	8	5

[1] Most figures revised.
[2] Includes gypsum, plasters, and similar stone for the manufacture of lime or cement.

The Mineral Industry of North Korea

By Frank B. Fulkerson [1]

North Korea continued to give priority to its mineral and power industries in the belief that development of these industries would form the basis for progress in all realms of the national economy. Geological prospecting was given top priority. Bringing new coal and ore mines into production; increasing the level of mechanization in mining; and further developing the 2.5-million-ton iron and steel industry were also urgent tasks.

North Korea is well known for its variety of mineral resources. Iron, coal, lead, zinc, gold, tungsten, magnesite, and graphite are produced in large quantities and are of international significance. In addition, manganese, nickel, cooper, barite, kaolin, asbestos, and other minerals and metals are produced. Some ores are low grade; oil and gas have not been discovered.

Facilities completed in 1972 included a sintering shop at the Hwanghae steelworks and a coke oven battery at the Kimchaek steelworks. New steel furnaces and rolling shops at the Kimchaek plant were scheduled for completion in 1973. Efforts continued on developing the iron industry by using home-produced fuel and thus hold down coking coal imports. Also, to meet the requirements of the steel industry, which used anthracite, and the chemical fertilizer industry, which relied on the gasification of anthracite, the coal industry was directed to produce high-calorific coal and improve coal quality. Metal and chemical industries were directed to introduce modern technology, such as remote control systems employing electronic computers and industrial television.

An increase in mineral commodity exports was viewed as a favorable development. Discovery of new iron ore deposits in the western area and the northern inland area widened the prospect for exports.

The first stage of the Sŏdu-su hydroelectric power project was completed. The project involves changing the course of the Sŏdu-su, which flows into the Tumen River along the North Korean-Chinese border. Power generated by the project will supply mines, metallurgical plants, and chemical factories in North Hamgyŏng Province, which has important industrial centers.

There were important developments on the international side. In July North Korea and the Republic of Korea started talks aimed at improving relations, beginning exchanges, and eventually reunifying the divided country. At the end of the year there was no sign of progress toward specific agreements, such as those that would lead to trade between the two nations. During the year, North Korea took steps to increase its trade with Japan, and it signed an agreement with the People's Republic of China (PRC) on economic and technical cooperation in geological exploration.

PRODUCTION

North Korea boasted that many of its industrial goals for 1972 were surpassed. Industrial output in the first 11 months increased 34% over the same period of 1971. Allegedly, various manufacturing plants overfulfilled their first 3-year targets of the 6-year plan (1971–76), including the Kangson steelworks, which even achieved the production level slated for the end of the 6-year plan. A special bonus was paid in December to all workers and technicians in recognition of the national increase in production in 1972.

[1] Industry economist, Division of Nonmetallic Minerals—Mineral Supply.

The 6-year plan called for an annual average increase of 14% in industrial output. For the mineral industry, ambitious objectives were set as follows, in million tons:

Commodity	1970 output [e]	1976 target
Coal	27.5	50–53
Pig iron	2.4	3.5–3.8
Steel ingots and castings	2.2	3.8–4.0
Rolled steel	1.9	2.8–3.0
Chemical fertilizers	1.5	2.8–3.0
Cement	4.0	7.5–8.0
Magnesite clinker	.7	1.6

[e] Estimate.

The 1976 targets for other mineral commodities were for percentage gains over 1970, as follows: iron ore and concentrate, 80%; primary copper, 70%; primary lead and zinc, 180%; and tungsten, 90%. Estimated tonnages in 1976 that would match these percentage increases were iron ore, 14.4 million tons; copper, 22,000 tons; lead and zinc, 420,000 tons; and tungsten content of ores and concentrates, 4,100 tons.

Table 1.—North Korea: Estimated production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Cadmium, smelter output—metric tons	110	110	110
Copper:			
Mine output, metal content	13	13	13
Metal, refined, primary	13	13	13
Gold, mine output, metal content—thousand troy ounces	160	160	160
Iron and steel:			
Iron ore and concentrate	8,000	8,500	8,700
Pig iron and ferroalloys [2]	2,400	2,500	2,600
Steel, crude	2,200	2,400	2,500
Steel semimanufactures	1,900	2,200	2,300
Lead:			
Mine output, metal content	70	80	90
Metal, primary	55	65	75
Nickel, primary	1	1	1
Silver, mine output, metal content—thousand troy ounces	700	700	700
Tungsten, mine output, metal content—metric tons	2,150	2,150	2,500
Zinc:			
Mine output, metal content	130	135	140
Metal, primary	90	100	120
NONMETALS			
Barite	120	120	120
Cement, hydraulic	4,000	4,800	5,300
Fertilizer materials, crude, natural, phosphates (apatite)	300	300	300
Fluorspar	30	30	30
Graphite	75	75	75
Magnesite:			
Crude	1,600	1,700	1,800
Clinker	700	800	900
Pyrite and pyrrhotite (including cupreous):			
Gross weight	500	500	500
Sulfur content	200	200	200
Salt, all types	550	550	500
Talc, soapstone, steatite, pyrophyllite	80	90	100
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite	21,800	24,300	27,300
Bituminous [3]	5,500	6,000	6,500
Other	200	200	200
Total	27,500	30,500	34,000
Coke	2,200	2,200	2,200

[p] Preliminary.

[1] In addition to the items listed, a number of other mineral commodities apparently are produced, but information is inadequate to make reliable estimates of output levels. These include (but are not limited to): antimony, arsenic (in arsenopyrite), asbestos, beryl, bismuth, boracite, china clay (kaolin), chromium, cobalt, columbite, germanium, indium, lithium minerals (lepidolite), manganese ore, mica (phlogopite), molybdenite, monazite, selenium, tellurium, titanium minerals (ilmenite and rutile), zircon and a variety of crude construction materials including miscellaneous clays, glass sand, building sand, stone, and gravel.

[2] Includes Krupp-Renn granulated iron.

[3] Includes low-calorie coal, much of which might be classified as low rank coal.

TRADE

North Korea's exports of mineral commodities included iron ore and concentrate, pig iron, lead and zinc ingots, and silver among the metals, and anthracite coal, barite, cement, magnesite, and talc among the mineral fuels and nonmetals. Imports included aluminum and steel semimanufactured products, ferroalloys, coking coal, and petroleum products.

Japan probably was the leading trading partner, followed by the U.S.S.R. and the PRC, which was a distant third. North Korea's trade with European countries such as Czechoslovakia, Poland, Romania, and West Germany was of some significance; magnesite was an important export to these countries. As North Korea publishes no export-import figures, foreign trade statistics in tables 2 and 3 are derived from reports of other countries.

North Korean-Japanese trade increased approximately 20% over that of 1971 and reached about $105 million in 1972. Minerals and metals were important components of the trade. The North Koreans were exporting iron ore to Japan under a 2-year contract. There appeared to be similar interest in concluding long-term contracts on exporting anthracite coal and importing steel materials and textiles. The North Koreans apparently were also anxious to import Japanese technology and capital goods for producing steel, chemicals, electric power, etc. Acquisition of complete industrial plants posed problems because of difficulties in arranging long-term payment through the Japan Export-Import Bank and securing approval for the entry of North Korean technicians into Japan. Negotiations underway with Japan involved the purchase of an integrated steelworks, a refractories plant, an aluminum foil plant, two fertilizer plants (urea and ammonia), coal, and steel goods. Many of these transactions were still pending at yearend, and the outcome was uncertain.

Mineral commodity exports to Japan in 1972 included iron ore and concentrate, pig iron, refined zinc, silver, anthracite coal, magnesite, fluorspar, soapstone, talc, and amorphous natural graphite. Mineral commodity imports from Japan to North Korea were principally steel plates, sheets, pipes, and angles, and ferrovanadium.

A protocol on the exchange of commodities between North Korea and the U.S.S.R. was signed in March. North Korea was to supply ferrous and nonferrous metals, magnesia clinker, nonmetallic minerals, and building materials, and the U.S.S.R. was to ship in return such products as solid fuel, petroleum, ferrous and nonferrous metals, and chemicals. The U.S.S.R. has been providing the bulk of the petroleum products required by North Korea. It also has been shipping important quantities of bituminous coal of coking grade, ferroalloys, and manganese ore. The North Koreans have been shipping zinc metal, barite, cement, magnesia clinker, and talc to the U.S.S.R.

North Korea signed trade pacts with three Eastern European countries in 1972. North Korea was to supply Poland with magnesite clinker, steel, and other commodities in exchange for machinery, sulfur, and chemicals. A sizable increase in trade also was envisaged under a North Korean-Romanian agreement. North Korea was to supply machine tools, magnesite, steel alloys, and other goods; Romania was to supply locomotives, trucks, harvesters, carbon black, and other items. Under a trade agreement with Czechoslovakia, North Korea was to export magnesite, machine tools, and other goods and was to import engineering products, tires, and chemicals.

North Korean-Indian trade was rather small, totaling about $7 million in 1971. The two countries formulated plans to increase their mutual trade threefold in 1972. North Korea was to provide magnesia clinker, refractories, graphite, fluorspar, and special steels, and India was to provide pig iron, maganese ore, light machinery, and textiles.

A sizable volume of trade with Chile was to be promoted under a commercial agreement that would run through the end of 1973. The agreement called for Chile to send $21 million of copper concentrate, refined copper, ferroalloys, and other articles to North Korea in exchange for nonferrous metals, steel products, steel alloys, coal, and chemicals.

In view of talks in 1972 with the Republic of Korea about eventual peaceful reunification, analysts speculated that trade might result. Shipment of mineral raw

materials from North Korea to the Republic of Korea was a long-range possibility, perhaps in exchange for textiles, machinery, or wood products. Generally speaking, the potential for trade did not seem to be great, as the two nations have moved along similar growth paths after the Korean war.

Table 2.—North Korea: Apparent exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971 [2]
METALS			
Bismuth	NA	10	All to France.
Cadmium	94	156	Belgium-Luxembourg 69; West Germany 43; U.S.S.R. 29.
Copper and alloys, all forms	1,582	431	West Germany 407; Belgium-Luxembourg 24.
Iron and steel:			
Iron ore and concentrate	534,617	449,838	All to Japan.
Pig iron and cast iron	122,272	122,245	U.S.S.R. 71,600; Japan 50,645.
Sponge iron, powder and shot	13,992	2,977	All to Japan.
Ferroalloys	--	1,632	All to U.S.S.R.
Steel:			
Primary forms	6,076	9	All to Japan.
Semimanufactures	4,000	--	
Lead metal and alloys, all forms	20,943	17,551	Italy 7,788; West Germany 4,556; U.S.S.R. 3,627; Japan 1,580.
Silver, unworked and partly worked thousand troy ounces	[2] 1,408	1,649	All to Japan.
Tungsten ore and concentrate	7	--	
Zinc:			
Ore and concentrate	80,280	8,384	U.S.S.R. 5,465; Japan 2,919.
Metal and alloys, all forms	31,291	44,053	U.S.S.R. 10,644; Japan 8,700; Netherlands 7,693.
Other metals and alloys, all forms	76	--	
NONMETALS			
Barite	67,100	82,800	All to U.S.S.R.
Cement	457,000	358,000	Do.
Feldspar and fluorspar	6,162	12,264	All to Japan.
Graphite	13,721	20,502	Japan 18,126; Austria 2,376.
Magnesite	421,702	540,224	U.S.S.R. 375,500; Poland 71,107; West Germany 66,646; Japan 24,496.
Quartz and quartzite	5,042	5,726	All to Japan.
Sand, gravel, crushed stone	740	582	Do.
Talc, soapstone, steatite	85,282	76,046	U.S.S.R. 34,800; Japan 30,776; Poland 10,470.
Other nonmetals, slag and similar materials from steel manufactures	10,142	283	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coal briquets	85,727	68,087	Do.

NA Not available.

[1] Compiled from import data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, the U.S.S.R., the United Kingdom, and Yugoslavia.

[2] Compiled from import data of Austria, Belgium-Luxembourg, France, West Germany, Italy, Japan, the Netherlands, Poland, and the U.S.S.R.

Sources: For 1970—Official import statistics of Poland and the U.S.S.R. and for all other countries 1970 edition of: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 5, Walker and Company, New York, 1972. For 1971—Official import statistics of Austria, Japan, Poland, and the U.S.S.R., and for all other countries 1971 edition of: Statistical Office of the European Communities. Foreign Trade Analytical Tables. V's. B, C, G, H, and I, Luxembourg, 1972.

Table 3.—North Korea: Apparent imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971 [2]
METALS			
Aluminum metal and alloys, unwrought and semimanufactures	2,244	15,019	Japan 13,735; U.S.S.R. 1,284.
Chromium, chromite ore and concentrates	21,000	21,000	All from U.S.S.R.
Cobalt, oxide and hydroxide	12	5	Mainly from West Germany.
Iron and steel:			
Ferroalloys	7,600	7,639	U.S.S.R. 7,600; Japan 39.
Semimanufactures	9,152	11,290	U.S.S.R. 7,981; Japan 2,809.
Manganese ore	21,000	20,000	All from U.S.S.R.
Other, nonferrous metal and alloy semimanufactures	75	80	Do.
NONMETALS			
Asbestos	4,036	4,286	Do.
Sulfur, elemental	7,236	7,051	Do.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades ---thousand tons	587	500	Do.
Coke ---do	156	159	Do.
Petroleum, crude and refinery products ---do	2,388	667	Do.
Petroleum-, coal-, and gas derived crude chemicals ---do	18	18	Do.

[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, the U.S.S.R., the United Kingdom, and Yugoslavia.
[2] Compiled from export data of Austria, Belgium-Luxembourg, France, West Germany, Italy, Japan, the Netherlands, Poland, and the U.S.S.R.

Sources: For 1970—Official export statistics of Poland and the U.S.S.R. and for all other countries 1970 edition of: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 5, Walker and Company, New York, 1972. For 1971—Official export statistics of Austria, Japan, Poland, and the U.S.S.R., and for all other countries 1971 edition of: Statistical Office of the European Communities. Foreign Trade Analytical Tables. V's. B, C, G, H, and I, Luxembourg, 1972.

COMMODITY REVIEW

METALS

Iron Ore and Steel.—Results claimed for the Musan mine, the largest iron ore source in North Korea, evidenced a continued increase in North Korea's iron ore output in 1972. Compared with 1968, Musan ore concentrate production was said to be up 50%; ore mining, up 60%; hauled ore quality, up 30%; and industrial production volume, up 80%. The mine was credited with massive blasting of 700,000 tons of ore and overburden in 1 month, and with preparation of a 3,000-foot waste ore conveyor, which solved the waste disposal problem. At the ore dressing site, efficiency of existing facilities was maximized with the result that concentrate grade was raised from 58% iron to 59% iron. The Mandok mine was commended for achieving its 1972 plan by the middle of November and for improvements in ore excavation preparation, good maintenance of equipment, and improved rail transportation.

According to a published extract from a Soviet report discussing the economy of North Korea and the Republic of Korea,[2] reserves of magnetite ore at Musan might be as much as 1 to 1.3 billion tons as compared with total North Korean iron ore reserves of 2 billion tons. The ore contains 25% to 60% iron, 0.08% to 0.3% manganese, up to 0.03% titanium, and 0.2% to 0.4% phosphorus. Other important iron ore deposits occur throughout North Korea and include the hematite-limonites at Iwan, Unyul (Ullyul), Sinchon, Chwiya-ri, Kechlon, and Kangso and the siderites at Kechlon and Sonam. In the Republic of Korea, iron ore reserves are much less and total only about 40 million tons, according to the report.

Under the North Korean 6-year plan, iron ore and concentrate production was supposed to be increased 80% by 1976, and annual production capacity of the Musan

[2] World Minerals and Metals (London). The Minerals Industry of Korea. No. 6, March–April 1972, pp. 20–21.

mine was supposed to be expanded to 6.5 million tons of concentrate. Musan, in the far north, continued to supply ore to the Kimchaek, Songjin, and Ch'ŏngjin steel plants in the northeast in addition to Japanese markets. Mines in the western region supplied ore to the Hwanghae and Kangson steelworks near P'yongyang. Exports of iron ore to Japan averaged 520,000 tons annually during 1969-72.

According to the North Korean Ministry of Metal Industry, iron and steel production rose substantially in 1972. In the first 10 months of 1972 compared with the corresponding period of 1971, output was said to have risen as follows: 8.1% in pig iron, 9.9% in steel, 8.7% in rolled steel, 12.5% in steel rope, 95.8% in welded pipe, and 17.6% in seamless tubes.

One of the major construction projects underway in the country was to expand capacity and make the Kimchaek steelworks the largest in North Korea. The new facilities were said to include a steel shop with capacity of 1 million tons of ingot per year and a mill capable of producing the full range of rolled products. The goal was to complete the expansion at Kimchaek by the end of 1973, in order to implement the 6-year plan, which called for boosting steel output to 3.8 to 4.0 million tons by 1976 compared with an estimated 2.5 million tons in 1972. Also under the 6-year plan, a rod-rolling shop at Hwanghae was to be reconstructed and enlarged, and a new rolling mill was to be built at Kangson.

Projects completed in 1972 included a modern coking battery at the Kimchaek works and a sintering and globular ore plant at the Hwanghae works.

As far as individual plant production and accomplishment is concerned, the Kangson steelworks was credited with already surpassing the production level set for the end of the 6-year plan by introducing innovations in the production of crude steel and rolled steel. The plant surpassed, by up to 10%, the level of output envisaged for the end of the 6-year plan for steel slab, heavy and light rolled steel, iron rod, seamless steel pipe, welded steel pipe, iron wire, and wire rope. The Hwanghae steel plant, which is equipped with blast furnaces, open-hearth furnaces, and electric furnaces and is the country's largest steel plant, was credited with cutting coke consumption per ton of pig iron and electric power consumption per ton of steel. The crude oil injection method was added so as to use less coke. Tapping time for molten pig iron was reduced one-half. The Songjin works increased its September production 1.2 times in crude steel and 1.3 times in rolled steel compared with that of September 1971. Production of ferroalloys was increased 1.5 times. The Kimchaek plant was commended for raising its level of output, as was the small Ch'ŏngjin plant, which produces mainly granulated iron.

A six-man Japanese mission representing steelmakers and traders visited North Korea to inquire about the sale of 100,000 tons of steel goods, such as sheets, plates, and pipes. This was the first time that Japanese had visited North Korea on actual transactions in steel. North Korea reportedly asked for deferred payments of 3 years.

In another development, North Korea negotiated with Nippon Steel Corp. relative to Nippon providing all the capital equipment and technical expertise required for the construction of a proposed integrated steelworks near Nampo on the western coast. The plant, which would initially have an annual capacity of 1 million tons of ingot steel and would eventually be expanded to 3 million tons, reportedly would cost $400 to $500 million to construct.

Nonferrous Metals.—A new nonferrous smelter was planned at the port city of Haeju on the western coast, but details were lacking. Under the 6-year plan, a copper smelter, a lead-zinc smelter, and an aluminum reduction plant are supposed to be built. At existing works, production at the Munpyong lead smelter and electrolytic zinc plant increased 20% over 1971, whereas output of the Hungnam copper smelter and refinery and the Nampo copper-zinc smelter was about the same as in 1971. At nonferrous mines, efforts were made to increase mechanization of mining, ore transport, and ore dressing. Early in 1972 it was claimed that the Komdok mine, South Hamgyŏng Province, probably the largest lead-zinc mine in the country, had already overfulfilled its first 2-years' goals of the 6-year plan.

North Korea, after exporting 62,000 tons of zinc concentrate to Japan in 1970 and 3,000 tons in 1971, shipped none to Japan in 1972. Exports of refined zinc to Japan comprised 7,400 tons in 1972, virtually unchanged from 1971. To supplement its small

production of copper, North Korea arranged to import the red metal in refined and concentrate form from Chile in 1972 and 1973. North Korea imported aluminum metal from the U.S.S.R. Negotiations were undertaken to purchase an aluminum foil plant from the Japanese. This equipment, consisting of a set of rolling mills, would reduce ingot to foil. Planned facilities to utilize local nephelite for the production of aluminum were yet to materialize.

NONMETALS

Cement.—No claims were made of cement production increases during the year. The stress was an improving quarrying, crushing, and manufacturing methods. The Madong, Sŭngho-ri, and Haeju operations were probably the largest three cement plants in North Korea. Several small plants were completed and put in operation during 1972.

The 6-year plan required an increase in cement production from 4 million tons in 1970 to 7.5 to 8 million tons in 1976. North Korea produced cement for its own needs and exported a quantity to the U.S.S.R.

Fertilizer Materials.—Increased output of chemical fertilizers (urea, ammonium sulfate, nitrolime, and superphosphate) was claimed for the factories in Hungnam, Aoji, Sunch'on, and other parts of the country. In addition, a new automated phosphate fertilizer plant was completed at Haeju that utilized modern machinery for raw materials charging, production, and packing of products.

Lacking natural gas, North Korea relied on gasification of coal for nitrogen-fixation in producing nitrogen fertilizers. Sulfur and phosphate requirements for fertilizers were supplied by indigenous pyrite, nonferrous ores, and apatite, supplemented by imports of elemental sulfur. Production by the Sinpyong, Pungnyon, and other apatite mines in North Korea was to be increased.

Magnesite.—Improvements were noted at the Yongyang mine, South Hamgyŏng Province, the largest magnesite mine in North Korea. A third pulverizing shop was completed early in 1972. In midyear, the mine was commended for mechanization at the working face, improvements in transporting excavated ore, and installation of a remote control system in the coarse crushing shop. In August the mine was said to have increased quarry output 1.3 times over that of August 1971. Other magnesite mines probably increased production also. In addition to domestic use, sizable tonnages of crude and calcined magnesite were exported to the U.S.S.R., the PRC, West Germany, Japan, and Eastern European countries.

Other Nonmetals.—The Wonri colliery (location not given) was commended for completing its annual plan for graphite production by the end of September through advanced work techniques and technical innovations. The year's goal was said to be much higher than that in 1971. Graphite was mined in several areas but chiefly in North P'yongan Province and north of Songjin. About 120,000 tons of barite was produced from large ore reserves near Changdo, Chaeryong, and Haeju. Over half the output was shipped to the U.S.S.R., under a long-term barter agreement, for use as a weighting agent in oil well drilling muds and for other applications. Sizable quantities of pyrite, fluorite, soapstone, and talc were also produced. North Korea ordered five automatic refractory brick manufacturing plants valued at $1.5 million from the Japanese firm Iwaya Industry Co. The North Koreans were trying to improve their refractory quality, which has been a weak link in their mineral industry.

MINERAL FUELS

Coal.—Directives called for greater efforts to mechanize coal mining by introduction of new coal-cutting machines, automatic loading machines, and conveyors. Also, requirements were laid down to develop new reserves at existing mines and bring new mines into production in the Tokchon, Kangson, and Anju areas. It was claimed that many collieries already surpassed the production level envisaged for 1976, the last year of the 6-year plan, and that over 100 small and medium coal mines finished the 1972 plan 4 months ahead of schedule. Five of the largest coal mines in the country were commended for introducing "technical innovations." These were the Aoji and Kogonwon mines, in the coal basin of North Hamgyŏng Province, which produces the best of the country's bituminous coal; the Sudang mine, South Hamgyŏng Province; and the Anju and Sinchang mines, South P'yongan Province, which is the source of most of North Korea's coal.

Exports of anthracite to Japan declined

from 68,000 tons in 1971 to 57,000 tons in 1972; however, the North Koreans viewed optimistically prospects of increasing coal exports. A Japanese industrial group visited North Korea to negotiate for the purchase of anthracite coal and were taken to visit the large Sinchang mine, about 40 miles from P'yongyang. This was the first time the Japanese had been allowed to visit a coal mine.

Petroleum.—North Korea continued to import all its petroleum products, mostly from the U.S.S.R. References stated a 1-million-ton-per-year oil refinery was nearing completion. The location was not specified. The new facility would process crude oil provided by the U.S.S.R. Nebuluous reports on oil refinery construction have been issued since 1967.

The Mineral Industry of the Republic of Korea

By Harold J. Drake [1]

In 1972, the mineral industry of the Republic of South Korea recorded reduced output at most of its operations. Of the principal mining products, only silver, zinc, and talc showed production gains; the rest, anthracite, amorphous graphite, kaolin, fluorspar, and limestone, recorded declines. Output of almost every other mineral commodity was off. The mineral processing sector of the industry, which relies on imported raw materials, in contrast, reported increased production in fertilizers, petroleum refining, crude steel, and nonferrous smelting, with a decline in output reported for cement only.

Production indexes (1965=100) of some major components of the mining and mineral processing sectors for the last 2 years were as follows:

	1971	1972
Petroleum and coal processing	408	421
Glass, clays, stone products	299	307
Chemical products	539	584
Cement manufacture	426	402
Metal smelting	364	446
Metal processing	263	261
Coal mining (anthracite)	125	121
Metal mining	121	128
Stone, clays, sand pits	r 262	210
Tungsten mining	r 105	93

r Revised.

The third 5-year economic development plan, 1972–76, began on an inauspicious note as the gross national product (GNP) rose at a smaller rate than planned. In terms of 1970 prices, the GNP totaled 3,027 billion won ($9.8 billion) [2] in 1972. The rise amounted to 7.1% compared with a planned rate of 9%. Industrial manufacturing rose 16.1% whereas the value of mining operations was virtually unchanged from that of the preceding year. In constant 1970 prices, mining output was valued at Kw 31.3 billion equivalent to 1% of the GNP.

Inflation continued in 1972. The wholesale price index (1970=100) for all commodities stood at 123.8, a 14% increase over the 1971 level. The index for minerals as a whole stood at 117.6 in 1972, compared with 105.4 in 1971; for metallic ores, at 122.6, compared with 104 in 1971; and for nonmetallic ores, at 108.6, compared with 108 in 1971.

The Korean Mining Promotion Corp. (KMPC), established in 1967 to help develop the private mining industry, was promoting a $4.8 million loan from the Asian Development Bank to finance the purchase of mining equipment for domestic operators. The capital is part of a planned $21.3 million investment for the general mechanization and development of private mines during the third 5-year plan. KMPC, in addition to leasing and supplying mining equipment, conducts geological and geophysical surveys, provides technical assistance, conducts training programs, and sells, or arranges for the sale, of mining products. The Government of the Republic of Korea, in addition to the activities of KMPC, plans to invest during the third 5-year plan the equivalent of $138 million in the coal mining industry, $10 million in iron mining, and $25 million in the development of copper, lead, zinc, tungsten, and talc deposits.

Expansion of the petrochemical complex at Ulsan continued at a rapid pace in 1972. The petrochemical industry in the Republic of Korea, although in existence for only a short time, has begun to operate

[1] Physical scientist, Division of Nonmetallic Minerals, Assistant Directorate–Mineral Supply.

[2] Where necessary, values have been converted from Korea won (Kw) to U.S. dollars at the rate of Kw 392.9=US$1.00.

at capacity and various expansion plans are underway. First-stage construction was completed in 1972 when Korean Oil Corp.'s naphtha working unit went on-stream thereby allowing downstream petrochemical facilities to begin operations. Second-stage construction and expansion of current facilities are underway. Current plans call for expanding the naphtha working facility from 102,000 metric tons per year to 162,000 metric tons in 1973. Annual output will be increased to 300,000 metric tons by the addition of another plant. The increased production from these plants will be handled by designed expansion capabilities of current facilities and by the addition of nine completely new plants. Completion of these new facilities is anticipated during 1974.

Foreign equity investments in the mineral industry of the Republic of Korea was higher in 1972. Approximately $1 million was to be expended on five mining projects; about $69 million was allocated for petroleum products, fertilizers, and nonmetallic mineral manufactures.

PRODUCTION

Little gain was reported in the value of mineral production in 1972. In current prices output was valued at Kw 36.6 billion ($93.2 million) compared with Kw 34.2 billion ($87 million) in 1971. Nearly the entire increase was attributable to higher prices.

Increased output was recorded for refined silver, up 15% to 1.8 million troy ounces valued at Kw 1.1 billion ($2.9 million); zinc ore, up 24% to 74,726 metric tons valued at Kw 1.7 billion ($4.3 million) and pyrophyllite, up 15% to 163,396 metric tons valued at Kw 392 million ($1 million).

Production of anthracite coal at 12.4 million tons valued at Kw 41.8 billion ($106 million), was off about 3% in quantity. Output in tungsten, large by world standards, declined 1% to 2,031 metric tons valued at Kw 3.8 billion ($9.8 million); production of amorphous graphite declined 42% to 40,768 metric tons valued at Kw 2.1 billion ($5.4 million). Korea ranks among the world leaders in production of these commodities.

Production of metals and metallic ores was well below 1971 levels—iron ore declined 2%; manganese ore, 12%; gold, 41%; lead ore, 11%; and molybdenum ore, 52%. Among the large volume, nonmetallic minerals produced in the Republic of Korea, kaolin output was off about 3%, talc, up 3%, fluorspar, was halved, while limestone production declined 4%.

The mineral-processing segment of the mining industry fared somewhat better. Output of fertilizer was up 3%, and a gain of 5% in production were recorded for petroleum refinery operations. Operations at nonferrous smelters were at a high level in 1972. Significant gains in production were recorded for lead and zinc. Output of portland cement, however, was off about 4%.

Table 1.—Republic of Korea: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum metal, primary	15,450	17,593	15,162
Antimony, mine output, metal content	--	--	9
Bismuth metal	106	97	90
Copper:			
Mine output, metal content	1,639	1,774	2,082
Metal, refined, including secondary	5,117	6,848	9,061
Gold metal [1] troy ounces	51,345	28,807	17,072
Iron and steel:			
Iron ore and concentrate, gross weight thousand tons	571	504	492
Pig iron do	48	2	1
Ferroalloys do	13	15	17
Crude steel (excluding castings) do	481	472	584
Lead:			
Mine output, metal content	16,016	16,543	14,718
Metal	r 3,338	3,111	3,807
Manganese, ore and concentrate, gross weight	3,401	2,263	1,999
Molybdenum, mine output, metal content	115	105	50
Nickel, mine output, metal content	9	--	--
Rare-earth metals:			
Monazite concentrate, gross weight	NA	NA	8
Cerium metal kilograms	NA	NA	1,500
Silver metal thousand troy ounces	1,494	1,543	1,770
Tin, mine output, metal content long tons	--	5	(2)
Tungsten, mine output, metal content	r 2,070	2,059	2,031
Zinc:			
Mine output, metal content	23,980	28,161	35,925
Metal, primary	r 2,760	8,941	10,718
Zircon concentrates, gross weight	NA	NA	13
NONMETALS			
Asbestos	1,373	2,172	5,279
Barite	--	21	30
Cement, hydraulic thousand tons	r 5,821	6,872	6,579
Clays, kaolin	194,625	191,181	184,494
Diatomite	2,584	3,162	1,955
Feldspar	28,121	16,887	14,689
Fluorspar, all grades	47,780	57,886	28,975
Graphite:			
Crystalline	218	1,776	202
Amorphous	59,312	70,739	40,768
Kyanite and related minerals, andalusite	38	74	32
Lime, slaked	85,180	86,593	e 87,000
Pyrite:			
Gross weight	NA	NA	1,171
Sulfur content	NA	NA	410
Salt, marine thousand tons	405	360	452
Stone, sand and gravel:			
Crushed and broken limestone do	9,104	10,617	10,145
Quartzite do	259	161	153
Sand (including glass sand) do	105	164	148
Talc and related materials:			
Pyrophyllite	120,124	142,335	163,396
Talc	83,949	70,114	72,352
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	3,345	7,500	8,720
Coal, anthracite thousand tons	12,394	12,785	12,403
Fuel briquets, anthracite briquets do	10,000	8,479	10,505
Peat do	8	4	e 4
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	5,623	6,504	5,873
Jet fuel do	4,623	3,749	4,211
Kerosine do	3,252	3,579	2,673
Distillate fuel oil do	11,240	13,737	14,667
Residual fuel oil do	37,117	45,980	48,353
Other do	6,446	7,988	10,092
Refinery fuel and losses do	5,745	4,076	e 4,300
Total do	74,046	85,613	90,169

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Officially reported production only.

[2] Less than ½ unit.

TRADE

Total exports of minerals and related products in 1972 showed little gain over the levels of 1971. Crude fertilizers and crude minerals exports declined from $9.6 million to $8.8 million, and exports of metalliferous ores and scrap fell about 1% to $23.6 million. Overseas shipments of coal, coke, and briquets was more than halved to $2 million. Two industries, petroleum processing and fertilizer manufacturing, have sharply expanded in recent years, and this was reflected in sharply increased exports in 1972. Exports of petroleum and petroleum products more than doubled to $15.6 million and exports of manufactured fertilizers rose 54% to $11.6 million.

Exports of nonmetallic minerals dominated foreign trade in mineral commodities and related products in 1971, the latest year for which detailed statistics are available. Exports of cement continued to soar in registering a 123% gain to 1,008,000 metric tons valued at $7.9 million. Exports of cement clinker totaled 350,436 metric tons valued at $2.7 million.

Kaolin exports fell 13% to 77,522 metric tons valued at $1.1 million, and those of talc, 45% to 9,614 metric tons valued at $1.7 million, whereas exports of fluorspar rose 36% to 45,878 metric tons valued at $1.6 million. Anthracite and bituminous coal exports were up slightly to 339,465 metric tons valued at $4.3 million.

Exports of metals and metalliferous ores in 1971 were dominated by tungsten ore and concentrate, off sharply to 3,004 metric tons valued at $11 million; iron ore and concentrate, off 18% to 421,000 metric tons valued at $4.5 million; and lead ore and concentrate, up 24% to 21,284 metric tons valued at $3.2 million. Another large export commodity, zinc ore and concentrate totaled 37,498 metric tons valued at $2.3 million, a level slightly below that of 1970.

Imports of most minerals and related commodities continued at a high level. As more mineral processing facilities become established, notably petroleum production units, imports of feed stocks are expected to rise. In 1972, imports of petroleum and petroleum products were valued at $218 million, an 18% increase over 1971 levels. Crude fertilizers and crude mineral imports were valued at $25.9 million up slightly from those of 1971, whereas imports of metalliferous ores and metal scrap declined 28% in value to $45.6 million. Imports of manufactured fertilizers rose 57% to $11.1 million, and those of coal, coke, and briquets at $1.2 million were cut in half.

In 1971, the latest year for which detailed statistics are available, imports of crude and partly refined petroleum rose 88% to 104 million barrels. Another major import commodity, scrap iron and steel, recorded a sharp decline to 755,325 tons valued at $27.7 million. Imports of copper ore increased and iron ore declined slightly in 1971.

Nonmetallic minerals accounted for the

Table 2.—Republic of Korea: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Bauxite ore	672	--
Metal, including alloys, all forms	8,687	4,089
Arsenic, natural sulfides	130	--
Chromium, ore and concentrates	185	119
Copper:		
Matte	18	4
Metal, including alloys, all forms	294	12
Iron and steel:		
Ore and concentrates thousand tons	515	421
Pig iron and ferroalloys	r 8,966	3,186
Steel, primary forms	19,000	180
Semimanufactures	69,641	185,698
Lead, ore and concentrates	r 17,208	21,284
Magnesium ore	900	--
Molybdenum:		
Ore and concentrate	238	141
Trioxide	5	5

See footnotes at end of table.

Table 2.—Republic of Korea: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Nickel metal, waste scrap	13	4
Silver:		
Silver, platinum, and similar metal ores and concentrates	2,870	2,833
Metal, including alloys thousand troy ounces	33,234	248
Tin, ore and concentrate long tons	21	--
Titanium slag	300	350
Tungsten, ore and concentrate	8,290	3,004
Zinc:		
Ore and concentrate	39,466	37,498
Oxide	r 54	85
Metal, waste, scrap, dust	358	(1)
Other:		
Ash and residue containing nonferrous metals	632	963
Oxides, hydroxides and peroxides of metals, n.e.s	9	--
Metals, base metals, including alloys, all forms	69	121
NONMETALS		
Abrasives, natural, n.e.s.:		
Emery and natural corundum	300	--
Dust and powder of precious and semiprecious stones kilograms	600	2
Cement thousand tons	451	1,008
Clays and clay products:		
Crude clays, n.e.s.:		
Kaolin	89,027	77,522
Other	17,825	9,762
Products:		
Refractory	1,068	93
Nonrefractory	5,250	4,654
Cryolite	250	--
Feldspar and related materials:		
Feldspar	5,825	4,596
Leucite, nepheline, and nepheline syenite	72,282	98,067
Fertilizer materials:		
Crude, phosphatic	377	(1)
Manufactured:		
Nitrogenous	108,976	96,600
Mixed	10,712	68,972
Fluorspar	33,628	45,878
Graphite, natural	45,648	32,118
Gypsum and plasters	97,486	30,107
Mica, all forms	1,550	1,561
Stone, sand and gravel:		
Dimension stone	5,853	13,621
Dolomite, chiefly refractory grade	26,880	23,200
Gravel and crushed stone	490	3,335
Quartz and quartzite	156,313	117,984
Sand, excluding metal bearing	20,952	10,404
Sulfur:		
Elemental	110	--
Sulfuric acid	13,762	(1)
Talc and related materials:		
Talc, crude and ground	r 17,392	9,614
Steatite, natural	100	756
Other nonmetals, n.e.s.:		
Crude:		
Meerschaum, amber, jet	798	1,950
Other	4,136	2,219
Slag, dross and similar waste, not metal bearing	45,925	49,822
MINERAL FUELS AND RELATED MATERIALS		
Coal, anthracite and bituminous	337,919	339,465
Petroleum and refinery products:		
Petroleum, crude and partly refined 42-gallon barrels	72,269	--
Refinery products:		
Gasoline thousand 42-gallon barrels	1,192	2,255
White spirit and jet fuel 42-gallon barrels	r (1)	135,019
Distillate fuel oil do	--	60
Residual fuel oil do	r 467,138	222,409
Lubricants do	--	2,333
LP gases do	42	73,639
Other do	--	9,103
Mineral tar and other coal-petroleum-or gas-derived crude chemicals	(1)	2,743

r Revised.
1 Less than ½ unit.

Table 3.—Republic of Korea: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Bauxite ore	10,054	58
Oxide and hydroxide	30,804	43,476
Fused alumina (artificial corundum)	1,179	1,217
Metal, including alloys, all forms	6,555	5,999
Chromium:		
Ore and concentrate	1,726	--
Oxide and hydroxide	454	485
Cobalt:		
Ore and concentrate, kilograms	r 1,100	2,200
Oxides, do	21	4,000
Copper:		
Ore	14,792	11,982
Metal, including alloys, all forms	5,690	6,849
Iron and steel:		
Ore	75,347	31,245
Metal:		
Scrap	r 839,938	755,325
Pig iron, ferroalloys, similar materials	7,930	53,961
Steel, primary forms	325,114	820,247
Semimanufactures	181,177	260,836
Lead:		
Oxides	r 28	2
Metal, including alloys, all forms	2,107	3,969
Magnesium metal, including alloys, all forms	31	25
Manganese:		
Ore and concentrates	10,402	14,153
Oxides	530	1,095
Mercury, 76-pound flasks	r 432	42,651
Molybdenum metal, including alloys, all forms	161	1,464
Platinum-group metals and alloys, thousand troy ounces	29	139,646
Rare-earth metals:		
Oxides, kilograms	r 5	73
Metal, including alloys, all forms, do	42,100	2,185
Silver and alloys, thousand troy ounces	r 71	41,360
Tin:		
Oxides, long tons	--	1
Metal, including alloys, all forms, do	864	628
Titanium:		
Ore and concentrates	3,331	6,819
Oxides	4,217	5,655
Tungsten metal, including alloys, all forms	9	6
Zinc:		
Oxide	32	154
Metal, including alloys, all forms	9,731	5,297
Zirconium, ore and concentrate	150	150
Other:		
Ore and concentrate of base metals, n.e.s	49	3,092
Ash and residue containing nonferrous metal	1,912	3,282
Oxides, hydroxides and peroxides of metals, n.e.s	32	77
Metals, including alloys, all forms:		
Metalloids	157	89
Pyrophorric alloys	r 2	32
Base metals, including alloys, all forms, n.e.s	r 35	109
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	214	176
Grinding and polishing wheels and stones	212	159
Asbestos	35,292	38,028
Barite	12	--
Boric oxide and acid	228	414
Bromine	r 5	1
Cement	r 10	712
Clays and clay products (including refractory brick):		
Crude clays, n.e.s	6,844	406,855
Products:		
Refractory (including nonclay brick)	10,666	9,899
Nonrefractory	384	88
Diatomite and other infusorial earths	36	14
Fertilizer materials:		
Crude:		
Phosphatic	533,205	466,754
Other	552	46
Manufactured:		
Nitrogenous	7,564	10,646
Potassic	r 83,740	95,147
Mixed	9,136	26,553

See footnotes at end of table.

Table 3.—Republic of Korea: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Fluorspar		1,492	1,746
Graphite, natural	kilograms	r 3,500	102
Gypsum and plasters		36,326	61,312
Iodine		2	2
Magnesite, crude, calcined and magnesia clinker		r 361	400
Mica, all forms		30	28
Pigments, mineral including processed iron oxides		79	1,056
Precious and semiprecious stones, except diamond	value, thousands	$48	$153
Salt		247,489	413,543
Sodium and potassium compounds, n.e.s		8,748	11,756
Stone, sand and gravel:			
Dimension stone, crude and partly worked		638	30,863
Dolomite, chiefly refractory grade		690	640
Gravel and crushed rock		182	--
Quartz and quartzite		29	50
Sand, excluding metal bearing		2,436	9,186
Sulfur:			
Elemental		149,975	157,274
Sulfuric acid		211	361
Talc, steatite, soapstone, pyrophillite		20	29
Other nonmetals, n.e.s.:			
Crude		57	11
Slag, dross and similar waste, not metal bearing		r 84	--
Oxides, hydroxides and peroxides of magnesium, strontium, barium		135	40
Building materials of asphalt, asbestos and fiber cement, unfired nonmetals, n.e.s		584	995
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		44	50
Carbon black		4,794	2,265
Coal and briquets:			
Anthracite and bituminous coal		16,754	15,389
Lignite and lignite briquets		100	--
Briquets of coal		--	289
Coke and semicoke		63,245	40,784
Hydrogen, helium, rare gases		13	69
Peat, including peat briquets and litter		79	5
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	1 55,225	1 103,915
Refinery products:			
Gasoline	do	1	844
Kerosine	do	44	204
Distillate fuel oil	42-gallon barrels	r 9	--
Residual fuel oil	do	r 1	3,486
Lubricants, including grease	thousand 42-gallon barrels	r 198	51,968
Mineral jelly and wax	do	44	62
Other	do	12,342	120,571
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		6,492	17,876

r Revised.

1 Officially reported imports; apparently incomplete as this quantity is not sufficient to provide refinery throughput.

Source: Statistical Yearbook of Foreign Trade; Office of Customs Administration; Republic of Korea. 1970 and 1971 editions.

bulk of tonnage of imports in 1971. Asbestos imports increased, again, by 8%; salt, by 67%; manufactured fertilizers, by 32%; and elemental sulfur, by 5%. Declines in imports were recorded for crude fertilizers, 13%; coal 9%; and coke 36%.

COMMODITY REVIEW

METALS

Aluminum.—The Korean Development Bank was reported to be planning the liquidation of Hankuk Aluminum Co. Late in 1972, however, it was announced that Hankuk and Aluminium Péchiney of France had signed a contract to establish a joint venture in the Republic of Korea to produce 33,000 tons of aluminum per year. Target date for completion of the facility was 1975.

Copper, Lead, and Silver.—The Kunbuk, Kooryong, Dalsung, and Daeduk mines contributed to a significant increase in output of copper in 1972. These mines accounted for the great bulk of the output

of 2,082 tons of copper. Sharply increased demand for copper and increased processing facilities are expected to increase output from indigenous copper mines.

Silver output continued to soar led by an expansion at the Bupyong silver-lead mine. The Yeong Hwa mine again accounted for much of the lead output, although there was a decline in production.

Iron Ore.—The opening of the integrated steel mill at Pohang in 1973 is expected to treble iron ore output by 1976. The Yangyang mine is expected to contribute materially to the increased demand. Most of the iron ore output is currently shipped to Japan.

Iron and Steel.—Work was progressing rapidly on the steel manufacturing complex at Pohang. An iron mill, a hot strip mill, and a strip-plate rolling mill were expected to be completed by yearend 1972. The first stage of the complex, with a capacity of 1 million tons, is due to be completed by the middle of 1973. The second stage, which will expand capacity to 2.6 million tons, is expected to be completed in 1979.

Tungsten.—The Sangdong mine of Korean Tungsten Mining Co., Ltd., accounted for nearly 90% of the 1972 production of tungsten. Other companies such as Bando Mining Co., Ltd., and the Okbang Mining Co., Ltd., contributed small quantities. Nearly all of the mine output was exported to Japan for processing.

NONMETALS

Cement.—Ko Ryo Cement Manufacturing Co., Ltd., completed a 660,000-ton-capacity plant, and Ssang Yong Cement Industrial Co., Ltd., made plans to expand capacity of one of its plants from 0.7 to 1.7 million tons. The sharply increased capacity of the cement industry was being felt in the foreign trade sector. Imports have dwindled to minor amounts whereas exports have soared from 17,500 tons in 1968 to 1,008,000 tons in 1971.

MINERAL FUELS

Anthracite.—Coal production is concentrated in the eastern Province of Kangwando and the southern Province of Cholla Nando. Eighty-six private mines accounted for about two-thirds of total output, the remainder was accounted for by eight government-owned mines. The Government hopes to expand coal production by 48% by 1976 and to this end plans to expend the equivalent of $138 million in the coal mining industry. Since the industry has a significant amount of excess capacity at present, the planned expansion is to be achieved through rehabilitation and expansion of existing mines. Studies are also underway to determine the feasibility of producing coke from anthracite.

Petroleum.—After 2 years of preliminary surveys, exploratory drilling began in November 1972 in the Yellow Sea, the Sea of Japan, and the East China Sea. The potential petroleum deposits lying in the Continental Shelf of the Republic of Korea, if proven, will help supply its growing petroleum refining industry, which is currently dependent on imports from the Middle East.

The rapid expansion of petroleum refining capacity since 1965 has made the Republic of Korea the fifth largest producer in Asia. Capacity at its four refineries in 1972 was at 400,000 barrels (42 gallons) per stream day with actual production totaling about 82 billion barrels for the year. Not only is the industry the nation's major source of energy, it is on the verge of becoming the sole supplier of feed stocks for the rapidly growing petrochemical industry. Demand for refined petroleum products is expected to increase at an annual rate of 14% through 1976. Refineries are located at Ulsan, Yosu, Pusan, and Inchon. The Republic of Korea was reportedly planning to establish a 5.6-million-metric-ton-capacity crude terminal on Cheju Island, which will cost $88 million.

The Mineral Industry of Kuwait and Saudi Arabia

By John L. Albright [1]

CONTENTS

The former Kuwait-Saudi Arabia Neutral Zone has been partitioned into two equal administrative areas since December 1969; the northern half is administered by Kuwait and the southern half by Saudia Arabia. Petroleum is the only marketable mineral obtained both onshore and offshore in the partitioned zone, and the two countries share the revenue from the production of crude oil. Three oil companies are working concessions in the former Neutral Zone: Arabian Oil Co., Ltd. (AOC), American Independent Oil Co. (Aminoil), and Getty Oil Co. (Getty). AOC is the concessionaire for both Kuwait and Saudi Arabia offshore operations, Aminoil is the onshore concessionaire for Kuwait, and Getty is the onshore concessionaire for Saudi Arabia. AOC and Aminoil activities will be discussed under Kuwait, and Getty activities will be discussed under Saudi Arabia, although many Getty facilities are located in Kuwait-administered area.

KUWAIT

Kuwait's petroleum industry dominated an expanding economy. During the 1972–73 fiscal year, April 1, 1972, to March 31, 1973, the estimated gross national product (GNP) was $3.5 billion, and oil and natural gas accounted for more than 80% of the GNP. The country had the second largest refining capacity in the Middle East, ranked sixth among the world's crude oil producers and third in the Middle East, and was the world's third largest crude oil exporter. During the year, production and exports of crude oil and refining and sales of petroleum products increased, processing and marketing facilities were enlarged, most operating companies realized larger profits, and the Government collected greater amounts of income taxes and royalty payments. Government oil income for the 1972–73 fiscal year was estimated at $1,540 million, an increase of 52.2% from the previous fiscal year and 72.9% from the 1970–71 fiscal year. This tremendous rise in Government oil revenues was attributed to increased oil company sales, higher prices, and larger royalties and tax receipt payments. The oil income accounted for 94.5% of the Government's total revenue. Nonpetroleum mineral activities were insignificant.

Active construction projects were carried out in various sectors of the economy, and plans under review for expanding the industrial base called for a steel mill, petrochemical plant, liquefied petroleum gas (LPG) installation, and a methanol production and shipping facility. The Government was also considering the possibility of offering attractive inducements to draw small- and medium-sized firms to the country.

During the year support was given to the growing economy with the inauguration of a 330,000-ton-per-year cement plant, enlarged telecommunications facilities, and expansion of the country's air and water transportation installations. Demands on the electric power industry continued, and

[1] Mineral specialist (petroleum), Division of Fossil Fuels—Mineral Supply.

several substantial tenders were issued for the construction of new electric power generating facilities and transmission networks. Preliminary government approval was given for the construction by yearend 1976 of six generating units at Shuaiba with a combined capacity of 600,000 kilowatt-hours.

PRODUCTION

Crude oil production by the Kuwait Oil Co., Ltd. (KOC) during the first quarter of 1972 was more than 3.1 million barrels per day. Fear of rapidly depleting reserves prompted the Government to request KOC to keep its production rate under 3 million barrels per day, and by yearend the country's resultant daily average was only 2.5% higher than in 1971. At the close of 1972 Kuwait's recoverable crude oil reserves were estimated at 65 billion barrels, equal to Iran's, and in the Middle East exceeded only by those of Saudia Arabia. Company production in barrels per day follow:

Kuwait Oil Co. Ltd. (KOC)	2,999,232
Arabian Oil Co. (AOC)	204,925
American Independent Oil Co. (Aminoil)	[1] 78,200
Total	3,282,357

[1] One-half of the joint Aminoil-Getty Oil Co. operation.

More than 91% of the oil produced came from KOC wells in Kuwait proper, and the remainder was the country's one-half share of production from oilfields in the partitioned, former Neutral Zone.

Natural gas output remained virtually unchanged from 1971, but sales increased nearly 31% and amounts of flared gas decreased by almost 6%.

Production of refined petroleum products increased by 11% during the year at the Kuwait National Petroleum Co. (KNPC) oil refinery at Shuaiba, but Aminoil's Mina Abdullah refinery operated at only 55% capacity, reflecting reduced demands for high-sulfur fuel oil. Throughput at the AOC refinery at Khafji, in the former Neutral Zone, increased by 9% over 1971 operations.

Table 1.—Kuwait: Production of mineral commodities

Commodity		1970	1971	1972 [p]
NONMETALS				
Fertilizer materials, manufactured, nitrogenous:				
Ammonium sulfate	metric tons	87,511	NA	NA
Urea	do.	145,981	NA	NA
Lime, hydrated and quicklime	do.	742	[r e] 800	[e] 700
Salt	do.	4,653	[e] 4,700	4,977
Sulfur	do.	48,091	36,904	40,668
MINERAL FUELS AND RELATED MATERIALS				
Natural gas: [1]				
Gross production	million cubic feet	569,679	643,053	632,032
Marketed production	do.	[r] 141,945	157,765	180,400
Natural gas liquids:				
Natural gasoline	thousand 42-gallon barrels	4,903	5,403	5,580
Liquefied petroleum gas (propane and butane)	do.	12,670	13,664	15,005
Petroleum:				
Crude [1]	do.	1,090,040	1,167,329	1,201,346
Refinery products: [2]				
Motor gasoline	do.	[r] 3,194	4,302	[3] 25,876
Jet fuel	do.	[r] 783	793	874
Kerosine	do.	4,762	5,446	8,756
Distillate fuel oil	do.	[r] 54,089	51,592	25,079
Residual fuel oil	do.	72,280	76,959	75,322
Naphtha	do.	[r] 12,134	11,066	([3])
Asphalt	do.	187	169	233
Other	do.	3,562	3,611	2,454
Refinery fuel and losses	do.	2,080	2,832	3,202
Total [4]	do.	153,071	156,770	141,796

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

[1] Includes Kuwait's one-half share of production in the former Kuwait-Saudi Arabia Neutral Zone.

[2] Includes Kuwait's share of refinery output by its concessionaires in the former Kuwait-Saudi Arabia's Neutral Zone.

[3] Naphtha has apparently been included with gasoline in sources.

[4] Total revised to include refinery fuel and losses.

TRADE

Large quantities of manufactured goods and building materials were imported, mainly from the United States and Japan, and oil comprised over 95% of the country's exports. By the end of 1972 Kuwait ranked third on the list of the world's largest crude oil exporters, passing Libya and exceeded only by Saudi Arabia and Iran. Western Europe was KOC's largest customer, purchasing 61% of the company's crude oil exports during the year; Japan and Southeast Asia received 32% of the shipments; and the remaining 7% was distributed to several other countries, mainly in North and South America. KOC's daily exports during 1972 were 2,718,000 barrels of crude oil and nearly 209,400 barrels of refined petroleum products, including LPG.

Table 2.—Kuwait: Exports of mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1970	1971	1972
METALS			
Aluminum and alloys, unwrought and semimanufactures	7	84	
Copper and alloys, unwrought and semimanufactures	9	4	
Iron and steel:			
Scrap and unwrought	53,864	27,870	
Semimanufactures	9,117	12,231	NA
Lead and alloys, unwrought and semimanufactures	44	8	
Tin and alloys, unwrought and semimanufactures ——long tons	10	1	
Other:			
Nonferrous metals, scrap, not subdivided	9,007	4,939	
Unwrought and semimanufactures	(2)	--	
NONMETALS			
Asbestos, crude	141	300	
Cement, hydraulic	7,997	16,420	
Clays, products:			
Refractory	244	1,001	
Nonrefractory	274	129	
Fertilizer materials:			
Natural, crude, all types	--	25	
Manufactured:			
Nitrogenous	223,450	182,210	
Other, including mixed	2,896	76,427	
Gypsum and plasters	240	14	
Lime	130	--	NA
Salt	3	1,101	
Sand and gravel:			
Sand	7,413	7,880	
Gravel (including crushed stone)	272	--	
Stone, dimension:			
Unworked:			
Marble	40	35	
Mosaic stones, pebbles and powder	159	334	
Other	1	12	
Worked	4	45	
Other: Unspecified crude minerals, chalks, colored soil, and clay	2	1	NA
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke and briquets	--	1	
Petroleum:			NA
Crude ——thousand 42-gallon barrels	943,833	1,011,933	
Refinery products:			
Shipments other than bunkers:			
Gasoline ——do	7,354	6,994	[3] 24,967
Kerosine and jet fuel ——do	4,562	5,038	8,201
Distillate fuel oil ——do	41,409	37,419	22,936
Residual fuel oil ——do	43,833	47,270	42,640
Liquefied petroleum gas ——do	12,816	13,174	15,724
Other ——do	[r] 47,163	[4] 9,305	
Total ——do	[r] 117,137	119,200	114,468
Bunkers:			
Aviation gasoline ——do	7	6	
Jet fuel ——do	351	389	1,268
Distillate fuel oil ——do	8,493	13,838	
Residual fuel oil ——do	26,444	28,262	33,588
Total ——do	35,295	42,495	34,856

[r] Revised. NA Not available.
[1] Includes Kuwait's share of former Neutral Zone exports of petroleum.
[2] Less than ½ unit.
[3] Apparently includes natural gasoline, and may also include naphtha for petrochemical feedstocks.
[4] Includes natural gasoline as follows in thousand barrels: 1970—3,448; 1971—2,198.

Table 3.—Kuwait: Imports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, unwrought and semimanufactures	1,746	1,619
Copper metal, including alloys, unwrought and semimanufactures	311	321
Iron and steel:		
Pig iron and scrap	13,515	6,332
Semimanufacturers:		
Bars, rods, angles, shapes, sections	85,435	132,252
Universals, plates, sheets	24,210	28,652
Wire	867	1,814
Tubes, pipes, fittings	40,579	63,234
Lead metal, including alloys, unwrought and semimanufactures	277	141
Silver and platinum troy ounces	386	--
Tin metal, including alloys, unwrought and semimanufactuers long tons	7	4
Uranium, radium, thorium and alloys grams	964	7,683
Other:		
Nonferrous metal scrap, not subdivided	630	1,075
Metal, including alloys, unwrought and semimanufactures	26	126
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	49	54
Asbestos	2,453	1,969
Cement	625,551	687,392
Clays, products:		
Refractory (including nonclay bricks)	769	620
Nonrefractory	7,440	7,470
Diamond, gem, not set or strung carats	1,100	1,020
Fertilizer materials:		
Crude, natural, all types	214	126
Manufactured, other, including mixed	66	256
Gypsum and plasters	4,885	8,572
Lime	75	216
Precious and semiprecious stones, except diamond kilograms	5	34
Salt	3,924	4,792
Stone, sand and gravel:		
Dimension stone:		
Unworked:		
Marble	6,174	5,058
Mosaic stones, pebbles, powder	30,502	58,890
Other	1,179	1,808
Worked	1,801	3,502
Gravel and crushed stone	15,562	40,740
Sand	200	94
Other:		
Agricultural soil and clay	38	33
Unspecified crude minerals, chalks, colored soil, and clay	136	233
Coal, coke and briquets	82	172
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	8	18
Kerosine and jet fuel do	1	(1)
Lubricants do	112	155
Asphalt do	78	41
Total do	199	214

[1] Less than ½ unit.

COMMODITY REVIEW

Nonmetals.—*Fertilizer Materials.*—Exports of fertilizer increased during the year, and KNPC signed an agreement to double previous sales of chemical fertilizers to the People's Republic of China (PRC). The new order is for products valued at $915,000. Negotiations were concluded near yearend between Kuwait and India for 500,000 tons of urea to be shipped to India over a 3-year period beginning in 1973. The delegations also discussed the possibility of Indian technical assistance in constructing a fertilizer plant in Kuwait. In a related matter, the Council of Ministers planned a study which will compare the efficiency of producing fertilizers from crude oil and natural gas.

Major expansions were completed at the Kuwait Chemical Fertilizer Co. (KCFC) facility at Shuaiba. Two 800-ton-per-day ammonia units using natural gas feedstocks were brought onstream, raising KCFC's daily ammonia production capacity to 2,000 tons, and the daily urea production capacity was increased to 1,130 tons.

Sulfur.—KNPC's plant at the Shuaiba petroleum refinery produced 36,698 tons of sulfur by yearend, or 90% of the country's total, and Aminoil's Mina Abdullah petroleum refinery produced the remaining 3,970

tons. All sulfur was recovered from crude oil. An agreement was concluded in midyear for the shipment of 10,000 tons of sulfur to the PRC.

Mineral Fuels and Related Materials.—*Natural Gas.*—In January 1972 an agreement was signed between the Government and KOC declaring the state's right to obtain any quantity of natural gas produced either for use within Kuwait or for export. Concession holders may continue to obtain gas required for local operations and for the existing LPG plant, but they may not expand or construct new liquefaction plants without government approval.[2] During the year, AOC utilized more than 3 billion cubic feet of natural gas at its water distillation plant, powerplant, and petroleum refinery.

The Government inaugurated an investigation of long-range proposals for the utilization of natural gas to establish an optimum development plan. Priority will be given for the domestic use of this important natural resource.

AOC reported an important nonassociated gasfield discovery in the Persian Gulf offshore of the former Neutral Zone, and company officials believed that the new gasfield may be among the world's largest. Kuwait's yearend natural gas reserves were estimated at 33 trillion cubic feet.

Petroleum.—Tentative agreement was reached concerning the state's participation, initially by 25% ownership, in KOC. By yearend the partricipation agreement was not consumated with KOC's owners, British Petroleum Exploration Co. (Associated Holdings) Ltd. and Gulf Kuwait Co. The Government did not make any move to change the status of Aminoil or AOC.

American Independent Oil Co. (Aminoil)—Company activities were meager during the year, attributable mainly to the continued deterioration of worldwide demand for high-sulfur fuel oils. No new exploratory operations were reported, crude oil production and exports fell, and refinery output declined.

Improvements were carried out in crude oil gathering and processing operations with the installation of four high-volume pumps, three in the Wafra and one in the South Umm Gudair oilfields, and the completion of crude oil dehydration facilities in the South Umm Gudair field.[3] Crude oil throughput at the Mina Abdullah petroleum refinery was 28.9 million barrels during the year, and fuel oil accounted for more than three-fourths of the 27.9 million barrels of refined products obtained. Aminoil employees totaled 772 at yearend, of whom Kuwaiti nationals numbered 175, or 23% of the total.

Arabian Oil Co., Ltd. (AOC).—Activities offshore of the former Neutral Zone continued as a seismic survey, covering 1,196 kilometers of survey lines, was carried out. The survey was to clarify geological structures in three parts of the concession area, west to Khafji oilfield, west to Dorra and Hout oilfields, and between Khafji and Dorra oilfields. Three rigs completed 10 wells and reworked 18 others, drilling a total of more than 19,150 meters during the year.

Marine petroleum terminal facilities at Khafji were enlarged with the completion of an additional sea berth capable of serving 250,000-deadweight-ton tankers. Two 322,000-barrel, crude oil storage tanks were placed in service at Khafji, and two additional tanks with a combined capacity of 1 million barrels were under construction at yearend. Expansions to production and transportation installations permitted higher production rates. Wells in the Khafji and Hout oilfields produced a total 150 million barrels of crude oil, at the rate of 409,850 barrels per day. For royalty and tax payment purposes, the oil production was split equally between Kuwait and Saudi Arabia. Output increased 14.9% over the 1971 total of 130.6 million barrels, and 83% of AOC's crude oil came from the Khafji oilfield. Nearly 142 million barrels of crude oil were exported during the year, of which 116.6 million barrels were Khafji crude and 25.4 million Hout crude. Cargoes were handled by 259 ocean tankers.[4]

The Khafji petroleum refinery processed crude oil at the rate of 27,000 barrels per day, an increase of 9% over 1971 operations. Throughput totaled 9.2 million barrels, 90% of the plant's maximum capacity, and fuel oil accounted for nearly three-fourths of the refinery's production of 9.0 million barrels of finished products.

Company employees totaled 1,345 at yearend, of whom Arabs numbered 1,217, or more than 90% of the total.

Kuwait National Petroleum Co. (KNPC).—Refinery operations and sales of refined petroleum products improved during the year, and the company planned expansions

[2] Middle East Economic Survey (Beirut, Lebanon). V. 15, No. 19, Mar. 3, 1972, pp. 11–14.
[3] American Independent Oil Co. 1972 Annual Report of Operations, p. 7.
[4] Arabian Oil Co., Ltd. 1972 Annual Review of Operations, p. 4.

to the oil processing plant, bulk storage facilities, and marketing outlets. KNPC's throughput at the Shuaiba refinery averaged 115,070 barrels per day, of which 72,409 barrels or 62.9% were Burgan crude oil and 42,661 barrels were Umm Gudair crude oil. Average daily throughput increased 11% from 104,000 barrels in 1971, and the year's record, 149,785 barrels, was processed on April 7, 1972. By yearend 42.6 million barrels of crude oil had been processed and 40.7 million barrels of finished products were made available for sale. Sales of most products increased during the year, prompting the company to consider expanding refinery capacity to 180,000 barrels per day. Additional refined product storage tanks were under construction at Shuaiba, and further expansions were proposed.

KNPC was the sole outlet for petroleum products in Kuwait. Expansion and improvement of the company's retail filling stations during the year included three new facilities opened to the public, two others under construction, and services broadened at other company outlets.[5]

Employees numbered 1,713 at yearend, with 15% of the staff Kuwaitis, 71% other Arabs, and 14% others.

Kuwait Aviation Fuelling Co. (KAFCO).—A new fuel depot was constructed at Kuwait International Airport, and company sales amounted to 857,800 barrels, an increase of 6.5% from 1971. Negotiations carried out during the year resulted in KAFCO becoming a wholly owned subsidiary of KNPC.

Kuwait Oil Co. Ltd. (KOC).—Early in the year, Kuwait's largest crude oil producer finalized expansion plans for the Mina al Ahmadi marine petroleum terminal. Three 1-million-barrel storage tanks, 27 kilometers of large-diameter pipelines, and a second offshore loading platform were scheduled for construction to serve supertankers. However, the company abandoned the project in April 1972, when the Government placed a 3-million-barrel-per-day ceiling on KOC's crude oil production.

Kuwait Spanish Petroleum Co. (KSPC).—Exploration activities continued, and 1972 drilling totaled more than 8,500 meters. Geological and geophysical studies were carried out, and KSPC initiated a sedimentary study to determine the existence of other possible areas for exploration.

SAUDI ARABIA

The Saudi Arabian economy enjoyed a year of growth and expansion, as it realized a gross national product (GNP) of $4,497 million at 1972 prices. Urban service buildings, industrial plants, housing, and transportation projects completed during the year placed increased demands on the country's construction firms and necessitated the expansion of cement production at Jidda and the inauguration of a new plant at Riyadh. Plans were finalized by yearend for several industrial plants to be built in Jidda, Mecca, and Riyadh and for the construction of more than 130 kilometers of roads. The steady increase in the consumption of electricity continued, and electric power generated during Hejira calendar year 1391 (February 15, 1971, to February 15, 1972) totaled 762.9 million kilowatt-hours. Consumption of petroleum products, mostly fuel oils also increased during the year and reached the estimated daily rate of 223,000 barrels by yearend, up 42% from 1971.

The petroleum industry continued to dominate the economy. Saudi Arabia was the world's leading oil exporter. The country had the largest reserves and produced the most oil in the Middle East, and its refinery capacity was third largest in the area. Major petroleum developments during the year included expansions to oil production and processing capabilities and to storage and transportation facilities.

Petroleum producers paid $2,779.3 million to the Government during the year in royalties, taxes, and fees, compared with $1,944.9 million during 1971. The significant rise in crude oil production and higher prices brought about this large increase in revenues. In millions of U.S. dollars, payments by source were Arabian American Oil Co. (Aramco) 2,677.9,[6] Getty Oil Co. (Getty) 28.0, Arabian Oil Co. Ltd. (AOC) 68.7, and other concessionaires 4.7.[7] Estimated petroleum income during the fiscal year ending August 11, 1972, amounted to $2.4 billion, or 91% of the Government income, and the projected petroleum income

[5] Kuwait National Petroleum Co. 1972 Annual Report, pp. 10–19.

[6] Including $45.2 million value of royalty oil delivered to Petromin.

[7] Saudi Arabian Monetary Agency. Statistical Summary. Jidda, December 1972, p. 55.

for the fiscal year ending August 1, 1973, is $2.9 billion.

Government Policies and Programs.—In December 1972 after 10 years of negotiations, Saudi Arabia signed a participation agreement with Aramco, the largest oil producer in the Kingdom. According to this agreement, Saudi Arabia will have an initial participation of 25% in the company starting from January 1973 and the right to reach a final 51% participation in 1982. The Government will have a right to a percentage of each grade of crude oil available and a right to take an active part in the operating management of the company; it did not negotiate similar agreements with AOC or Getty.

During the year, the Saudi Arabian Oil Minister proposed Saudi investment in downstream operations in the United States in return for future guarantees of crude oil shipments to the United States. No agreements were signed concerning this offer.

Saudi Arabia issued a new mining code in August 1972, replacing the former code of 1963. This new law is directed toward easing the previously rigid requirements for exploration and exploitation of nonpetroleum minerals. It encourages Saudi Arabian and foreign mining companies to employ their capital in Saudi Arabia. The state reserved the right to participate as partner in any exploration or mining company or to purchase for itself from any leasee a maximum of 10% of the annual production. Salient features of the code are—

1. Abolition of the annual royalty payment to the state of 3% of the value of the minerals extracted.
2. Abolition of annual surface rentals for exploration licenses during the term of the license.
3. Abolition of the two-renewal limit for exploration licenses, and the establishment of a 5-year license capable of renewal periods as long as 4 years.
4. An increase in the size of the exploration license area to 10,000 square kilometers, and permission for one person to hold more than one exploration license at the same time.
5. The state's share of a concession holder's annual net profits is set at a maximum of 50%.
6. Mining concession holders are exempted from income tax for an initial period of 5 years from the first sale of products or from the beginning of the fourth year of the concession, whichever comes first. This exemption also applies to small mining permits granted to Saudi citizens.

PRODUCTION

Crude oil production during the year exceeded 2.2 billion barrels at the rate of 6 million barrels per day, an increase of 26.4% over that of 1971. Saudi Arabia broadened its lead as the largest producer in the Middle East and remained the world's third largest, behind the United States and the Soviet Union, accounting for 11.6% of the world oil production during the year. Increases in production were brought about by significant expansions to oil producing, handling, storage, and transportation facilities. Stabilizers, gas-oil separators, pumping equipment, and pipelines were placed in service, and storage installations and marine petroleum terminals were expanded. Construction works at the offshore Berri oilfield were completed, which doubled the production capacity of that field. The Ghawar and Abqaiq oilfields were the largest.

Aramco remained the most important producer in the country, averaging 5.7 million barrels per day and accounting for 95.3% of total production. Its production reached 2,098 million barrels during the year, an increase of 27.8% over that of 1971. AOC increased its production offshore of the former Neutral Zone to 150 million barrels in 1972, of which 75 million barrels went to Saudi Arabia at the rate of nearly 205,000 barrels per day. Getty's joint crude oil production with Aminoil in the former Neutral Zone declined during the year, and Getty received 28.6 million barrels at the rate of 78,200 barrels per day.

Nearly all of the natural gas produced was in association with crude oil production. During the year 1,127 billion cubic feet of natural gas were produced, of which most was flared.

Cement production totaled 927,503 tons during 1972, accounting for an estimated 56% of the country's demand.

TRADE

Saudi Arabia enjoyed a favorable balance of trade in 1972, with exports valued at an estimated $5.5 billion and imports valued at an estimated $1.4 billion. The

United States and Japan were the country's chief trading partners.

Crude oil and refined petroleum products were the Kingdom's major exports, and the country continued to be the largest oil exporter in the world. Most of these oils were shipped to Western Europe, and more than one-third was sent to Africa, Asia, and Australia. Western Hemisphere and Western European demands for Saudi oil more than doubled since 1969. Export-import traffic of other mineral commodities was comparatively insignificant.

Iron and steel imports during 1972 were estimated at 403,000 tons. Tonnages reported were: bars and rods 109,000, sheets and plates 31,000, pipes, tubes, and fittings 257,000, and others 6,000. Nearly 70% of

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

Commodity	1970	1971	1972[p]
METALS			
Steel semimanufactures, hot rolled ---metric tons---	8,498	10,300	10,076
NONMETALS			
Cement, hydraulic [2] ---do---	651,455	712,206	927,503
Gypsum [2] ---do---	17,231	35,926	[e] 45,000
Lime [2] ---do---	21,620	[e] 22,000	12,698
Stone, marble [2] ---do---	2,000	NA	NA
Sulfur [e] ---do---	5,000	5,000	5,000
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural:			
Gross production ---million cubic feet---	710,940	938,347	1,126,974
Marketed production ---do---	[r] 79,636	96,050	98,578
Petroleum:			
Crude ---thousand 42-gallon barrels---	1,387,266	1,741,149	2,202,049
Refinery products:			
Gasoline, aviation and other ---do---	[r 3] 36,213	31,200	30,873
Jet fuel ---do---	13,668	13,277	16,323
Kerosine ---do---	6,876	5,300	5,042
Distillate fuel oil ---do---	[r] 21,533	23,053	23,410
Residual fuel oil ---do---	123,759	136,954	119,413
Naphtha ---do---	[3]	5,246	6,171
Liquefied petroleum gas ---do---	18,218	17,897	15,854
Asphalt ---do---	948	1,081	939
Other ---do---	4	35	70
Refinery fuel and losses ---do---	3,947	4,568	7,044
Total [4] ---do---	[r] 225,166	238,611	225,139

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

[1] Includes Saudi Arabia's one-half share of crude oil and natural gas production in the Kuwait-Saudi Arabia Neutral Zone and Saudi Arabia's share of refinery output by its concessionaires in that area.

[2] Data presented are for Hejira calendar years as follows: 1970—Hejira year 1390 (March 9, 1970—February 26, 1971); 1971—Hejira year 1391 (February 27, 1971–February 15, 1972); and 1972—Hejira year 1392 (February 16, 1972–January 27, 1973).

[3] Naphtha included with gasoline.

[4] Total revised to include refinery fuel and losses.

Table 5.—Saudi Arabia: Exports of crude petroleum and petroleum refinery products [1]

(Thousand 42-gallon barrels)

Commodity	1970	1971	1972
Crude petroleum	1,174,179	1,528,220	1,992,514
Petroleum refinery products: [2]			
Shipments other than bunkers:			
Gasoline	27,011	17,271	28,320
Jet fuel	13,436	641	13,675
Kerosine	4,476	3,060	3,500
Distillate fuel oil	23,160	20,758	27,409
Residual fuel oil	68,450	68,734	47,200
Other	15,844	19,162	17,448
Total	152,377	129,626	137,552
Bunkers:			
Distillate fuel oil	603	786	842
Residual fuel oil	49,074	59,596	60,598
Total	49,677	60,382	61,440

[1] Includes Saudi Arabia's share of exports from the former Kuwait-Saudi Arabia Neutral Zone.

[2] Excludes exports (if any) by General Petroleum and Mineral Organization (Petromin).

the iron and steel imports came from Japan, 25% from European countries, and 5% from others.

Exports of crude petroleum and refined petroleum products are shown in table 5. See tables 6 and 7 of the 1971 Bureau of Mines Minerals Yearbook for the latest available export-import statistics on other mineral commodities.

COMMODITY REVIEW

Prospecting and geological studies continued during the year. An important discovery of copper ores was made at Jabal Sa'id; small scale investigations were intensified, and ground surveys have shown good promise of copper prospects in the Wadi Bidah and Wadi Shwas areas, located 240 to 320 kilometers southeast of Jidda. Preliminary results of the resurvey work conducted in the Mahd Adh Dhahab former gold mine area were also encouraging. The Government's General Petroleum and Mineral Organization (Petromin) was investigating the possibility of mining phosphate and potash, and it was looking into the commercial value of the Kingdom's copper, gold, iron, lead, pyrite, silver, and zinc deposits.

Reconnaissance geological mapping of the Precambrian Shield at a scale of 1:100,000 continued. The first maps were issued during the year, and a further 90 were being worked on. The Arabian Geophysical and Surveying Co. (Argas) and the Lockwood Survey Corp. (Lockwood) obtained a contract late in the year for the flying of 40,000 line-kilometers of four-channel radiometric survey over the basal sedimentary beds overlying the eastern margin of the Precambrian Shield.

Metals.—*Copper.*—A major new ore zone averaging 1.5% copper was discovered during the year at the Jabal Sa'id copper deposit, 320 kilometers northeast of Jidda. The Government exploration program revealed a large ore-bearing structure adjacent to the known ore body, and copper reserves on Jabal Sa'id Mountain were estimated to be more than 15 million tons.[8] A license for further work will probably be granted in 1973.

Uranium.—The Minister of Petroleum and Mineral Resources awarded a contract during 1972 to the Lockwood and Argas companies for exploration of uranium in the Western and Central provinces. The current fiscal year budget allocated $724,000 for this project.

Nonmetals.—*Cement.*—In an effort to broaden the local industrial base and reduce imports, the Yamama Saudi Cement Co. plant at Riyadh was placed in service during 1972. The Arabian Cement Co. began doubling the annual capacity of its Jidda facility to 660,000 tons, scheduled for completion in mid-1974.

Fertilizer Materials.—Saudi Arabian Fertilizer Co. (Safco) production during 1972 was 75,000 tons of urea, down 16.6% from its first-year 1971 report of 90,000 tons and 75% below the plant's designed capacity. Production losses resulted from technical problems at the Ad Dammam complex. Repairs and design changes have been made, and Safco is considering a substantial expansion of the plant's capacity. Nearly 97% of the urea production was exported, and domestic consumption of the product was 2,400 tons in 1972, an increase of 900 tons from the previous year. Sulfur, a byproduct of Safco's operations, was utilized by a nearby sulfuric acid plant.

Phosphate.—Deposits occurring in a 10-kilometer outcrop at West Thaniyat along the Sirhan-Turaif Basin contain an estimated 25 million tons of ore grading between 14% and 33% P_2O_5. Petromin was investigating the feasibility of mining these deposits and the possibility of setting up a domestic phosphate fertilizer industry based on a projected new phosphoric acid plant.[9]

Potash Salts.—Early in the year Petromin conducted feasibility studies concerning the possibility of producing up to 100,000 tons per year of potash salts from evaporating seawater at Tarut Bay. The Government's petroleum and mineral organization believed this source could produce byproducts of 20,000 tons per year magnesium, 56,000 tons per year magnesium chloride, and 1 million tons per year salt. Results of Petromin's studies have not been announced.

Mineral Fuels and Related Materials.—*Natural Gas.*—Saudi Arabia injected more than 300 million cubic feet of natural gas daily into producing oil-fields, and nearly all of the remaining gas produced was flared. Natural gas is an important potential source of wealth to the kingdom, and extensive studies were initiated during the year con-

[8] Al-Madinah, Jidda. (JPRS), Aug. 1, 1972, p. 12.

[9] Phosphorus and Potassium. No. 57, January–February 1972, p. 16.

cerning its domestic utilization as a source of energy for industry and as a feedstock for the manufacture of petrochemicals. Saudi petroleum officials wish to use the natural gas domestically, rather than market it abroad, but no known agreements were signed during 1972 to harness this valuable source of energy.

Petroleum.—The year was one of continued improvements and expansions to the petroleum industry. The dramatic growth of crude oil production continued, as the Kingdom maintained its position of the world's largest crude oil exporter. The country's crude oil production was exceeded only by that of the United States and the Soviet Union. Daily average production during the year was 6 million barrels, and the total crude oil produced—including the country's share in the former Neutral Zone—exceeded 2.2 billion barrels, an increase of 26.5% from the 1971 level. Saudi Arabia accounted for 11.6% of world oil production, and Aramco remained its largest operator. Aramco's daily production of crude oil averaged 5.7 million barrels, an increase of 27.5% over its previous year's accomplishment. Production by company during the year, in million barrels, follow:

Arabian American Oil Co. (Aramco)	2,098.5
Arabian Oil Co. (AOC)	75.0
Getty Oil Co. (Getty)	28.6
Total	2,202.1

The AOC crude oil shown above is one-half of the company's production in the former Neutral Zone. Getty has a joint operating agreement with Aminoil in the former Neutral Zone; the above figure is one-half of the two companies' joint production.

Arabian American Oil Co. (Aramco).—In 1972 Aramco became the first oil company in history to produce 2 billion barrels of crude oil in 1 year. More than three-fourths of the company's crude oil was piped to the Ras Tanura marine terminal for export by ocean tankers, and less than 11% left the country by pipeline. The remaining oil was consumed locally or processed at the company's refinery. The 1972 production was disposed of as follows:

Destination	*Thousand barrels*
Ras Tanura, for export	1,681,171
Al Qaysumah Tapline terminal	164,296
Bahrain, via pipeline	60,695
Ras Tanura refinery	187,108
Local use	5,153
Total	2,098,423

More than 3,700 ships were loaded with a combined total of 1,877 million barrels of crude oil and petroleum products during 1972, an increase of 31% over the 1971 tonnage. Of the total, crude oil shipments accounted for 1,684 million barrels, averaging 4.6 million barrels daily. The export pattern of crude oil and petroleum products during the year was essentially unchanged from that of the previous year:

Area	Percentage 1971	1972
Europe	53.2	56.5
Asia	30.6	29.1
South America	6.3	6.0
North America	4.0	4.5
Africa	4.9	3.2
Australia	1.0	.7

Major projects completed during the year included the installation of a fourth tanker-loading sea island at the Ras Tanura marine petroleum terminal, Aramco's major crude oil and only petroleum products ocean exporting terminal. One of the new tanker berths went into operation at the end of the year, and the other is scheduled for service during 1973.[10] When this latest sea island is completed, Ras Tanura will have eight berths available for supertankers and a loading capacity of 439,000 barrels an hour.[11] Two crude oil storage tanks with a combined capacity of 2 million barrels were placed in service at Ras Tanura, serving the tanker terminal. The company's second deepwater terminal, located 65 kilometers offshore to serve the Zuluf oilfield, was near completion at yearend. Design engineering has been finalized for a third tanker-loading terminal. Construction is scheduled to begin during 1973 on this facility at Ju'aymah, 25 kilometers northwest of Ras Tanura.[12]

The Ras Tanura refinery processed 205 million barrels of crude oil, natural gasoline, and LPG during the year, averaging 560,923 barrels per day. Daily LPG production capacity at Ras Tanura was increased during the year from 51,000 to 89,000 barrels with the addition of a fractionating plant and butane refrigeration plant. A deethanizer column and associated equipment was installed at Abqaiq. In December 1972 a serious fire at the Ras Tanura refinery resulted in reduced plant operations for several weeks. Fuel oil and diesel oil ac-

[10] Petroleum Intelligence Weekly. V. 11, No. 52, Dec. 25, 1972, p. 8.
[11] Aramco World Magazine. V. 24, No. 72, March–April 1973, p. 6.
[12] Middle East Economic Survey (Beirut, Lebanon). V. 16, No. 26, Apr. 20, 1973, p. 8.

counted for 64% of the refined products manufactured during the year, as shown in the following tabulation:

Product	Thousand barrels	Percent of total
Fuel oil	105,057	52.68
Diesel oil	22,528	11.30
Gasoline and naphtha	33,721	16.91
Jet fuel	16,323	8.18
LPG	15,784	7.91
Kerosine	5,042	2.53
Asphalt and others	987	.49
Total	199,442	100.00

Significant projects carried out during the year in the Ghawar oilfield included completion of the gas-oil separator plants at Shedgum and 'Ayn Dar, and the capacity of another 'Ayn Dar gas-oil separator was increased by 550,000 barrels daily. A 150,000-barrel-per-day gas-oil separator plant at Harad and a major water injection facility at Shedgum were under construction. Construction of the gas-oil separation facilities at Abu 'Ali doubled the production capacity of the offshore Berri oilfield, and construction was nearly complete at yearend of a water injection facility at Abu 'Ali.

Seismic crews worked at Rub' al Khali, in the near-coastal fields, and in the western part of the concession. Five large vibrating earthshakers were introduced during the year. These new seismic tools were truck-mounted, hydraulically operated vibrating pads. Impulses were sent into the ground, and the signals were recorded on magnetic tapes and interpreted by specialists.[13] Offshore seismic work was conducted at Abu Sa'fah, Berri Manifa, and Safaniyah. Nineteen drilling rigs were in operation at the end of the year, and drilling tallies counted 176 development and pressure maintenance wells, an average of one every 2.1 days. Yearend proved reserves were 92,992 million barrels, a gross increase of 4,934 million barrels from the previous year brought about mainly by the addition to the reserve of the recently discovered Mazalij and Harmaliyah oilfields.

Stabilization capacity increased by 310,000 barrels per day in late 1972 with the completion of Abqaiq Stabilizer No. 11. Four stabilizers capable of treating 1.8 million barrels of crude oil daily were under construction, and a two-stage gas-oil separator plant, a 15,500 horsepower addition to pump station No. 5, and an additional steam boiler were completed during the year at Abqaiq. Crude oil from Zuluf offshore wells will be serviced by a newly constructed 480,000-barrel-per-day gas-oil separator plant.

More pipelines were constructed during 1972 than in any previous year, when nearly 400 kilometers of trunk lines, flowlines, and water lines brought the company's total system to more than 8,000 kilometers. Approximately 34 kilometers of pipelines were installed monthly. Contracts were awarded for an additional 450 kilometers of 20- to 122-centimeter-diameter pipelines to be placed in service by the end of 1973.

Aramco's workforce grew by 11% during the year and totaled 11,282 by yearend. Of the total, 9,211 were Saudi Arab employees, 1,031 were Americans, and 1,404 were other nationalities.[14]

Getty Oil Co. (Getty).—Although joint Getty-Aminoil oil production in the former Neutral Zone was down about 16% from the previous year, Getty's Mina Saud petroleum refinery operated at record rates. Product output was up nearly 12% to over 32,500 barrels per day, and fuel oil sales set a record, despite increasing difficulty in marketing high-sulfur fuels.

General Petroleum and Mineral Organization (Petromin).—Contracts were signed early in 1972 by Petromin and Chiyoda Chemical Engineering and Construction Co., a subsidiary of the Japanese firm Mitsubishi Corp., for the expansion of the Jidda oil refinery and construction of a new refinery at Riyadh. Construction work will be completed in 3 years, raising the Jidda refinery's daily capacity from 12,000 to 45,000 barrels and placing a new 15,000-barrel-per-day plant onstream at Riyadh. These projects call for the supply of $127 million worth of Japanese refining equipment and construction services. Mitsubishi contracted to buy 70 million barrels of Petromin's share of Aramco royalty oil, with the value and duration of the agreement matching the refinery undertakings.

Foreign lubricants continued to dominate the market, but Petromin began to sell Petromin Lubricating Oils Co. (Petrolube) products in 1972, and total sales by that company amounted to nearly 7.8 million barrels.

A number of contracts were issued during the year by Petromin for drilling in

[13] Aramco World Magazine. V. 23, No. 6, November–December 1972, pp. 8–11.
[14] Arabian American Oil Co. 1972 Review of Operations.

the central part of the Kingdom. The Agip Saudi Arabia, S.p.A (Agip)-Phillips Petroleum Co. (Phillips) permits in the Rub' al Khali were extended for 3 years. An aerial magnetic survey was conducted onshore and offshore along the Red Sea coast by Tenneco Oil Co. and the Société Auxiliare de l'Enterprise de Recherches et d'Activités Pétrolières (Auxerap). Argas carried out geophysical surveys throughout the Kingdom and conducted seismic surveys for Agip and Auxerap. Arabian Drilling Co., a joint French-Petromin company, completed drilling contracts for AOC in the Neutral Zone and for Aramco in Abqaiq, and commenced a 2-year drilling contract for Aramco.[15]

[15] World Petroleum Report, 1973. V. 19, p. 56.

The Mineral Industry of Liberia

By Henry E. Stipp [1]

Liberia's mineral industry in 1972 was centered mainly around the mining and shipment of iron ore and concentrates. Iron ore pellets also were manufactured and exported. The value of iron ore production (including pellets) in 1972 was estimated at about $194 million,[2] 42% of the estimated gross domestic product, of around $459 million. Diamond valued at more than $6.3 million and petroleum refinery products valued at about $13.2 million were two other significant mineral commodities produced in Liberia.

The Government of Liberia concluded negotiations with a consortium of Dutch companies to explore and develop deposits of heavy minerals along the coast between the Cestos and Cavalla Rivers, eastern Liberia. Negotiations also were being conducted between the Government of Liberia and Liberia Mining Co. (LMC) on concession rights to the Bie Mountain iron ore deposit located in northwestern Liberia. Two Japanese firms reportedly were interested in obtaining concession rights to the Bie Mountain deposit, and the Government was holding discussions with the companies at yearend. Apparently LMC would be given at least one-half of the deposit to develop. The company has conducted some mineral exploration work on the deposit in previous years. The Government of Liberia, together with the Governments of Guinea, Algeria, Nigeria, and Zaire, formed a company called Guinean Iron Mining Co. (MIFERGUI) to exploit iron ore deposits in the Nimba and Simandou Mountains of Guinea. At yearend the Government and the Liberian American-Swedish Minerals Co. (LAMCO) concluded negotiations on a revised concession agreement. Reportedly the new agreement will increase Government revenues from LAMCO by about $2 million per year. Liberia's Geological Survey continued to prepare geological maps and analyze geological data in cooperation with the U.S. Geological Survey and United Nations Mineral Exploration Teams. During the last half of calendar year 1972, the Liberian Geological Survey carried out detailed investigations of areas in central northwestern Liberia and areas near the Bomi Hills. The United Nations also was conducting an assessment of mineral resources in a 15,440-square-mile area of western and central Liberia. Mineral commodities specifically sought included diamond, tin and ilmenite, rutile, zircon, and monazite (heavy minerals).

Two Romanian officials were in Liberia at yearend studying the feasibility of establishing a steel plant and also investigating the Wologisi iron ore deposit. Reportedly the Romanian Government had signed an agreement with Liberia to participate in the Wologisi project. The Liberian mining industry was a major purchaser of mining and support equipment from U.S. manufacturers in 1972 and will constitute a market for this type of equipment and replacement parts in future years.

PRODUCTION AND TRADE

Iron ore production decreased slightly in 1972 to 24.59 million tons compared with 24.63 million tons in 1971. Although output decreased, value increased owing to a rise in the per ton price of iron ore in world

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.
[2] Liberia uses U.S. dollar currency.

markets. LAMCO continued to account for nearly half (44%) of total production. Pellet production increased 19% to 4.0 million tons in 1972, compared with 3.4 million tons in 1971. Bong Mining Co.'s (DELIMCO) new pellet plant, which became operational early in 1971, accounted for the increased pellet output. Only DELIMCO increased total production (concentrates and pellets) as shown in the following tabulation, in thousand metric tons.

Production of gold declined substantially in 1972, and total diamond output declined 45,000 carats. Petroleum refinery product output increased slightly.

	1971	1972
Liberia Mining Co.:		
Lump ore	962	919
Fines	846	934
Concentrates	906	793
Bong Mining Co.:		
Concentrates	5,407	5,587
Pellets	1,297	2,103
Liberian American-Swedish Minerals Co.:		
Lump ore	4,018	3,488
Fines	5,309	5,513
Pellets	2,104	1,930
National Iron Ore Co. Ltd.:		
Lump ore	r 1,492	1,091
Fines	r 2,293	2,237

r Revised.

Export and import trade in mineral commodities is shown in tables 2 and 3.

Table 1.—Liberia: Production of mineral commodities

Commodity [1]		1970	1971	1972 p
METALS				
Gold [2]	troy ounces	669	2,547	1,324
Iron ore	thousand metric tons	23,661	24,634	24,594
NONMETALS				
Cement, hydraulic	do	r 91	91	e 90
Diamond: [3]				
Gem	thousand carats	577	532	414
Industrial	do	235	277	350
Total	do	812	809	764
MINERAL FUELS AND RELATED MATERIALS				
Petroleum refinery products:				
Gasoline, motor	thousand 42-gallon barrels	464	470	574
Jet fuel	do	170	89	142
Kerosine	do		87	83
Distillate fuel oil	do	917	1,166	1,125
Residual fuel oil	do	1,201	1,585	1,553
Other	do	116	133	137
Refinery fuel and losses	do	281	216	226
Total	do	3,149	3,746	3,840

e Estimate. p Preliminary. r Revised.

[1] In addition to the commodities listed, a variety of crude construction materials such as clays, stone, and sand and gravel were undoubtedly produced, but available information is inadequate to make reliable estimates of output levels.

[2] Purchases by the Bank of Monrovia.

[3] Exports for fiscal year ending August 31 of that stated.

Table 2.—Liberia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal unwrought including alloys	2	--	
Iron and steel:			
Ore and concentrate--thousand tons	23,561	21,235	West Germany 4,491; Netherlands 3,801; Italy 3,226.
Primary forms and semimanufactures	28	37	Senegal 19; Mali 9; Guinea 9.
Nonferrous metal scrap n.e.s	2,307	9,903	United Arab Republic 4,623; Spain 3,065; Italy 1,425.
Platinum and platinum-group metals troy ounces	--	102	All to Sweden.
NONMETALS			
Cement	147	155	All to Guinea.
Clay products	14	--	
Diamond, industrial--carats	825,959	738,928	Belgium-Luxembourg 436,022; United Kingdom 154,058; Netherlands 85,900.
Salt	1,524	11,431	All to Guinea.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gas oil--42-gallon barrels	33	--	
Lubricants--do	31	18	Mainly to Ghana.
Other--do	--	18	Mainly to Sierra Leone.

Table 3.—Liberia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	1	1
Metal semimanufactures, including alloys	119	101
Arsenic trioxide, pentoxide and acids	r 12	107
Copper semimanufactures, including alloys	33	18
Gold--troy ounces	3,274	4,817
Iron and steel:		
Pig iron and ferroalloys	68	138
Ingots and other primary forms	324	523
Semimanufactures	18,347	15,947
Lead, including alloys, all forms	73	60
Mercury--76-pound flasks	13	2
Platinum-group metals, including alloys, all forms--troy ounces	--	10
Silver:		
Silver and platinum ore--value	--	$463
Metal, including alloys, all forms--troy ounces	513	1,321
Tin metal, including alloys, all forms--long tons	2	(1)
Zinc metal, including alloys, all forms	--	4
Other:		
Oxides, hydroxides and peroxides of metals, n.e.s	99	28
Metals, including alloys, all forms:		
Alkali, alkaline earth and rare-earth metals	76	79
Base metals, including alloys, all forms, n.e.s	2	3
NONMETALS		
Abrasive materials, natural:		
Infusorial earth	2	--
Grinding and polishing wheels and stones	45	33
Asbestos, crude	37	620,503
Cement	19,789	56,459
Clay products, refractory and nonrefractory, including nonclay brick--value	$301,634	$624,301
Fertilizer materials:		
Natural:		
Nitrogenous	232	87
Phosphatic	13	80
Potassic salts	34	6
Manufactured:		
Nitrogenous	5,068	2,012
Phosphatic, basic slag	339	176
Potassic	--	711
Mixed	687	618
Ammonia	1,564	3,225
Gypsum and plaster	4,276	565
Lime	528	1,384
Salt	3,049	3,329
Sodium and potassium compounds:		
Caustic soda	2,375	3,729
Caustic potash	54	--

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked, mainly calcareous		895	33,887
Worked		60	37
Gravel and crushed rock		6,926	1,212
Limestone, except dimension		17,684	443
Sand		255	2
Sulfur:			
Elemental		1	1
Sulfur dioxide		9	31
Sulfuric acid		56	106
Other:			
Refractory minerals, clays, graphite, dolomite, and magnesite		22,425	19,174
Slag, dross and similar waste, not metal bearing		269	467
Building materials of asphalt, asbestos and fiber cement and unfired materials	value	r $309,594	$349,233
Other crude materials		r 40,829	19
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		27	9,786
Carbon black and gas carbon		1	(1)
Coal, coke and briquets		5,524	22,235
Gas, hydrocarbon, manufactured	value	$57,144	$934
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	1,381	2,906
Refinery products:			
Gasoline	do	12	7
Kerosine and jet fuel	do	(1)	--
Distillate fuel oil	do	r 32	(1)
Gas oil	do	r 101	7
Residual fuel oil	do	306	--
Lubricants	do	r 126	78
Mineral jelly and wax	do	(1)	1
Other	do	7	9
Mineral tar and other crude chemicals derived from the distillation of coal, petroleum, or gas		22	26

r Revised.
1 Less than ½ unit.

Shipments of iron ore in 1972 increased 7.5% to almost 22.8 million tons compared with 21.2 million tons in 1971. Record high inventories, accumulated during 1971 as a result of deferred deliveries, were reduced somewhat. The value of iron ore shipments in 1972 was estimated at $182.6 million compared with $160.6 million in 1971. Liberia's best customer for iron ore in 1972 was West Germany, which received almost 7 million tons. The European Community (EC) received 71% of total shipments from Liberia or 16.2 million tons. Japan and the United States received about 2.5 million tons each. Shipments of iron ore in 1972 by individual company and country of destination are shown in the following tabulation, in thousand metric tons.

	LMC	NIOC	Bong	LAMCO	Total
Belgium-Luxembourg	--	111	--	1,469	1,580
France	--	431	--	820	1,251
Germany, West	853	726	3,440	1,947	6,966
Italy	--	309	1,983	2,159	4,451
Japan	--	--	--	2,558	2,558
Netherlands	483	1,466	--	--	1,949
United Kingdom	--	693	15	--	708
United States	103	271	--	2,198	2,572
Others	540	--	--	175	715
Total	1,979	4,007	5,438	11,326	22,750

COMMODITY REVIEW

METALS

Iron Ore.—LAMCO intensified its exploration activities in the western deposits of Mount Tokadeh, Gangra, Yuelliton, and Beeton. Reserves at these deposits were estimated, on the basis of tunneling and boreholes, at 348 million tons of soft ore and 550 million tons of hard ore (magnetite and hematite). Exploration also was started in the northwest extension of the Nimba Range. The Mount Tokadeh project was completed and tested at yearend. Purchases of new equipment valued at $6.5 million was approved by LAMCO directors in December. Reportedly the new equipment consisted of a crusher installation at Buchanan and magnetic separators, which will be required to bring the Mount Tokadeh deposit into production. Employment at yearend totaled 3,989 persons, of which 3,235 were laborers, 243 were Liberian staff, and 511 were foreign staff.

LMC completed construction on the Jones high-intensity magnetic separator installation. The separator will facilitate the handling of tailings and lower the cutoff grade of ore. Construction of ancillary facilities in the Bie Mountain area were completed. The company planned to initiate a diamond drilling program at Bie Mountain, but the project was postponed. LMC was nearing the end of reserves in its Bomi Hills deposit at yearend. Although LMC may be permitted to exploit the deposit at Bie Mountain, it is doubtful that production will begin there before the Bomi Hills operation is terminated. In September LMC employed 2,554 persons, of which 2,267 were laborers, 156 were Liberian staff, and 131 were foreign staff.

National Iron Ore Co. (NIOC) was completing installation of a Humphrey spiral plant, a jigging plant, a secondary crusher, a water reclaiming system, and a new tailings disposal system. The expansion project, which was in its final stages, was designed to increase production and extend the life of NIOC's Mano River mine. The following equipment was obtained for the expansion project: 2 new diesel locomotives, 55 new ore cars, 4 used D-8 tractors, 8 Haulpak trucks (50-ton), 2 flatbed trucks, and 1 forklift. NIOC dredged the harbor on both sides of its pier to reduce excessive shoaling. Employment as of December totaled 2,112 persons, of which 1,858 were laborers, 142 were Liberian staff, and 112 were foreign staff.

At the DELIMCO operation, two new concentrator lines became fully operational, and output of the pelletizing plant was approaching the planned capacity of 2 million tons per year. In December a new dispensary was completed. The company applied to the Government for eight exploration lots totaling 44,888 acres in the Putu Range. Employment at DELIMCO totaled 2,502 persons, of which 2,015 were laborers, 132 were Liberian staff, and 355 were foreign staff.

The Liberian Iron and Steel Corp. (LISCO) continued exploration of the Wologisi iron ore deposit. Thirty-two drill holes totaling 26,680 feet were completed, bringing the total drilled so far to 84,996 feet. Pilot plant tests on 425 long tons of Wologisi ore indicated that a concentrate of more than 65% iron could be produced economically with 3 tons of Wologisi ore to 1 ton of final concentrate.[3] Pelletizing tests indicated that the concentrate is well suited to pelletizing and produces pellets of internationally accepted standards. Two laboratories at Wologisi tested 8,670 samples of ore by July 31. A survey of the Babo Basin was conducted to locate a safe area to dispose of concentration plant tailings so as not to pollute the local rivers. Two other surveys were conducted to obtain information for planning of the railroad route and for demarcation of the concession boundaries. The Japanese consortium interested in the Wologisi deposit decided not to exercise its option to purchase 5.1 million shares of Liberian International American Corp. (LIAC). However, the consortium decided to participate in the Wologisi project to the extent of the 730,000 shares it already owned.

Heavy Minerals.—A Dutch consortium comprising William H. Muller (Ertsen and Mijnbouw) N.V., Bos Kalis, Westminister Dredging Group N.V., and Hoogovens Ijmuiden, obtained a concession for exploration and exploitation of heavy minerals in a 2-mile-wide strip of coastline running from the Cestos River to the

[3] Republic of Liberia, Ministry of Lands and Mines (Monrovia). Annual Report for the Period September 1, 1971 to December 31, 1972. March 1973, p. 29.

Cavalla River, eastern Liberia. The consortium will invest $4 million in addition to spending an estimated $1 million for exploratory work and a feasibility study. The Dutch companies plan to process crude minerals in concentrating equipment aboard a dredge. The rough mineral concentrate will be shipped from the port of Greenville, and a final separation will take place at facilities in the Netherlands.

A United Nations geologist investigated heavy mineral concentrations in beach deposits from Marshall to Monrovia. In the Robertsport area 4,700 tons of heavy minerals were mapped that included 4,000 tons of ilmenite, 400 tons of zircon, 150 tons of monazite, and 150 tons of rutile. In the Marshall area 400,000 tons of heavy minerals were found that contained an estimated 90,000 tons of ilmenite, 9,000 tons of zircon, 7,000 tons of rutile, 1,000 tons of monazite, and 16,300 tons of almandite, kyanite, and staurolite.

NONMETALS

Diamond.—Two sources of diamond, metasedimentary and kimberlite rocks, have been discovered in Liberia. A kimberlite intrusive was mapped in the Mano Godua area, about 59 miles north of Monrovia.[4] Diamond indicator minerals such as corundum and picroilmenite were observed; however, the presence of diamond was not investigated. The intrusive was outlined by a weak magnetic anomaly, and detailed field work by the United Nations survey was undertaken to delineate the kimberlite body.

MINERAL FUELS

Ashland Oil Co. acquired all of the stock of Union Carbide Petroleum Corp. in late 1971. Ashland Petroleum Liberia assumed responsibility for exploration activities in Union Carbide's concession area and relinquished 3,864 square kilometers of the original concession on September 15, 1972.

Chevron Oil Co. of Liberia relinquished its concession area (Block B) on June 30, after reevaluating geophysical and log data from a wildcat well drilled in early 1971 and from data obtained by a seismic program.

Frontier Liberian Oil Co. relinquished its concession area in September after reevaluating and interpreting geophysical and well-log data and paleogeological information.

[4] Page 36 of work cited in footnote 3.

The Mineral Industry of Libya

By Richard F. Zaffarano [1]

The Libyan Government, continuing its emphasis on building an integrated national oil industry, established a college for petroleum and mineral studies to be attached to the Libyan University in March 1972. The college will be at Tripoli, and studies will commence in the 1973 academic year. The country continued preliminary planning studies for an iron and steel plant and pipe mill.

In December 1972, negotiations between Nelson Bunker Hunt and Libyan authorities were terminated. Libya demanded an immediate 50% interest in Hunt's half share of the Sarir field (Africa's largest oilfield) and 50% of the Hunt's profits from the sale of Sarir oil retroactive to the end of 1971 when the Libyan Government nationalized the British Petroleum Co., Ltd., half of the Sarir field in concession 65. This nationalization was a reprisal for Britain's failure to prevent Iran from occupying three small islands in the Persian Gulf.

At yearend, the Italian State Oil Co., Ente Nazionale Idrocarburi (ENI), settled with the Libyan Government for 1% less than the Libyan demand covering operations in concessions 82 and 100.

The Libyan Government concluded agreements with Bulgaria, Romania, and the U.S.S.R. creating some markets for nationalized oil.

Major mineral industry developments included completion of the Esso Standard Libya, Inc., $168 million liquefied natural gas (LNG) plant at Marsa el Brega. The plant has an export potential of 345 million cubic feet of gas per day in the form of LNG. Exploratory activities declined to their lowest level since 1969. Oil production followed the downward trend that commenced since the mid-1970's when oil production was restricted by allowables. Crude oil output declined to an average 2.2 million barrels per day. Growth in oil production will be restricted by the Libyan Government to only 7.5% per year compared with about a 25% annual growth rate in the late 1960's.

PRODUCTION

Oil output in Libya plummeted 18.9% to slightly above 2.2 million barrels per day, down 521,400 barrels per day from the previous year. Continued imposition of crude oil production allowables and Libya's inability to market some oil acquired from nationalization of the Sarir field at yearend 1971 were the principal factors contributing to the decline in production. Production by all operators declined, and output of all major producers fell sharply with the exception of the Oasis Oil Co. of Libya. A comparison of company production in thousand barrels per day is presented in table 1.

[1] Physical scientist, Division of Fossil Fuels.

Table 1.—Libya: Crude oil production, by operating company

(Thousand barrels per day)

Company	1971	1972
Oasis Oil Co. of Libya, Inc	824.4	796.9
Occidental of Libya, Inc	586.4	423.3
Esso Standard Libya, Inc	349.1	260.9
American Overseas Petroleum Ltd. (Amoseas)	261.5	233.8
Arabian Gulf [1]	[2] 196.3	66.5
Nelson Bunker Hunt	223.3	146.0
Mobil Oil Libya, Ltd./Gelsenberg Benzin, A.G	186.5	162.8
Esso Sirte	98.2	93.2
AGIP, s.p.f	--	17.7
Aquitaine	16.8	16.0
Libyan National Oil Co. (Linoco)	3.7	13.0
Amoco Libya Oil Co	14.6	9.4
Total	2,760.8	2,239.4

[1] Prior to Dec. 7, 1971, British Petroleum Co., Ltd.
[2] Approximately 2.2 thousand barrels per day produced by Arabian Gulf.

Table 2.—Libya: Production of mineral commodities

Commodity [1]		1970	1971	1972 [p]
NONMETALS				
Cement, hydraulic	thousand metric tons	95	72	[e] 80
Gypsum	do	4	[r e] 4	[e] 4
Salt	do	16	16	16
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural:				
Gross production	million cubic feet	[r] 685,148	556,531	496,075
Marketed production [e]	do	10,400	25,000	100,000
Petroleum:				
Crude	thousand 42-gallon barrels	1,209,314	1,007,687	819,619
Refinery products:				
Gasoline	do	733	607	606
Kerosine and jet fuel	do	319	335	374
Distillate fuel oil	do	828	1,078	717
Residual fuel oil	do	1,115	1,337	1,360
Other	do	--	96	103
Refinery fuel and losses	do	190	330	NA
Total	do	3,185	3,783	[2] 3,160

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, construction materials such as sand, gravel, crushed stone, brick, and tile are produced but information is inadequate to make reliable estimates of output levels. Natural gas liquids are also produced, but are blended with crude oil and are reported as a part of that total.
[2] Partial figure, includes no estimate for refinery fuel and losses.

TRADE

The most important factors affecting Libyan trade are government policies limiting foreign influence in nonpetroleum sectors of the economy and that are directed toward improving the well-being of Libyan people. Implementing these policies has entailed increased state control over the economy.

The goal of reducing foreign influence has led to nationalization of petroleum marketing, banking, and insurance interests; the expulsion of Italian business interests; and the promulgation of laws providing for majority or exclusive Libyan participation in most activities of the private sector.

Libya's foreign trade continued to be dominated by exports of crude oil to the European Community (EC) countries. Calendar year 1971 is the latest for which export data are available. Total crude oil exports declined 204 million barrels, 17% below the previous year. As shown in table 3, exports to Italy accounted for the largest decrease in crude oil trade. However, much of the difference is attributable to accounting procedures. For 1970 and earlier, export reports included the quantity of crude oil shipped to Italy for refining and returned to Libya, whereas 1971 data excluded such shipments from total exports.

Table 3.—Libya:—Crude oil exports, by country

(Thousand 42-gallon barrels)

Country	1969	1970 r	1971 p
Austria	--	1,479	548
Bahamas	--	12,028	35,588
Belgium-Luxembourg	43,866	47,789	25,514
Brazil	2,330	3,939	5,074
Bulgaria	--	--	3,249
Canada	3,829	--	4,928
Denmark	10,034	8,699	2,811
Egypt, Arab Republic of	--	--	4,015
France	130,320	166,223	126,838
Germany, West	252,794	220,968	185,311
Greece	2,183	2,004	--
Italy	252,689	306,311	239,915
Japan	--	2,930	2,665
Netherlands	110,936	111,203	52,341
Netherlands Antilles	795	--	--
Norway	7,657	5,968	3,468
Romania	3,925	426	767
Spain	59,241	58,841	45,516
Sweden	2,397	2,992	--
Switzerland	11,505	18,272	16,352
Trinidad and Tobago	8,739	18,873	26,171
Turkey	1,918	4,087	2,701
United Kingdom	154,541	178,792	163,046
United States	58,086	34,609	55,955
Other and/or undistributed	2,845	407	28
Total	1,120,630	1,206,840	1,002,801

p Preliminary. r Revised.

Source: 1969–70: Official Libyan export statistics; 1971: Organization of Petroleum Exporting Countries Statistics Unit. Annual Statistical Bulletin 1971. Vienna, June 1972, 144 pp.

Table 4.—Libya: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1969	1970
EXPORTS		
Metals:		
Iron and steel:		
Ore and concentrate	--	516
Scrap	4,960	7,996
Uranium and thorium ores	10	1
Nonferrous metals:		
Ores and concentrates	--	66
Scrap	787	462
Nonmetals: Crude minerals, not further described	10	4
Mineral fuels and related materials: Petroleum, crude—thousand 42-gallon barrels	1,120,630	1,206,840
REEXPORTS		
Metals: Iron and steel semimanufactures	--	245
Nonmetals:		
Cement	--	3
Stone, paving—kilograms	145	--
Mineral fuels and related materials:		
Petroleum refinery products:		
Gasoline—thousand 42-gallon barrels	1,371	1
Kerosine—do	63	(1)
Distillate fuel oil—do	930	2
Lubricants—do	--	4
Total—do	2,364	7

1 Less than ½ unit.

Table 5.—Libya: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal sources, 1970
METALS			
Aluminum including alloys, unwrought and semimanufactures	1,868	3,820	Italy 2,718; Lebanon 309; Greece 177.
Copper including alloys, unwrought and semimanufactures	835	644	France 561; Italy 61; United States 5.
Iron and steel:			
Ore and concentrate	3,020	--	
Scrap, metal	46	1	All from Italy.
Pig iron, ferroalloys, similar materials	75	1,374	Tunisia 1,330; Belgium 39.
Steel, primary forms	1,567	1,340	Italy 716; Netherlands 225; Poland 202.
Steel semimanufactures	254,449	136,336	Italy 28,247; West Germany 19,538; U.S.S.R. 16,639.
Lead including alloys, unwrought and semimanufactures	607	398	Tunisia 140; West Germany 93; France 55.
Nickel including alloys, unwrought and semimanufactures	3	1	Mainly from Italy.
Platinum and silver:			
Ores and metallurgical residues:			
Containing silver	1	--	
Containing platinum and/or silver kilograms	NA	323	West Germany 175; Italy 148.
Metal:			
Platinum and platinum-group metals, unworked or partly worked troy ounces	6,945	33,276	Italy 17,201; West Germany 16,075.
Silver, unworked or partly worked do	188,692	216,824	France 90,633; Italy 63,787; West Germany 41,732.
Tin including alloys, unwrought and semimanufactures long tons	13	27	United Kingdom 23; West Germany 3.
Zinc including alloys, unwrought and semimanufactures	380	445	Japan 316; Belgium 75; West Germany 54.
Other:			
Nonferrous ores, not further identified	1,300	1	All from Yugoslavia.
Nonferrous scrap, not further identified	1	1	NA.
Nonferrous metals, not further identified kilograms	200	382	All from United States.
NONMETALS			
Abrasives:			
Crude, natural, including industrial diamond	25,139	2,421	Italy 2,262; United States 112.
Grinding and polishing wheels and stones	102	112	Italy 90; West Germany 3; Austria 3.
Asbestos, crude	442	540	NA.
Cement, hydraulic thousand tons	598	405	Greece 191; U.S.S.R. 57; Lebanon 35.
Chalk	31	15	Tunisia 10; United States 2.
Clays and clay products:			
Crude thousand tons	15	13	Greece 9; Italy 2; United States 1.
Products:			
Refractory	1,388	163	Morocco 71; West Germany 69.
Nonrefractory	149,484	115,086	Tunisia 78,927; Italy 30,233; United Kingdom 1,169.
Fertilizer materials:			
Crude, all types	1,804	6	All from France.
Manufactured:			
Nitrogenous	24,061	18,616	Italy 10,185; West Germany 4,632; Netherlands 1,797.
Phosphatic	15	968	West Germany 570; Belgium 398.
Potassic	NA	472	Belgium 297; West Germany 175.
Mixed	2,111	7,247	West Germany 3,847; Italy 2,550.
Graphite kilograms	30,000	150	All from Italy.
Gypsum and plasters	3,866	237	Lebanon 150; Italy 66; Poland 19.
Lime	68,582	65,394	Lebanon 37,687; Italy 19,912; Cyprus 2,635.
Mica, worked	47	6	Mainly from Bulgaria.
Pigments, mineral	3,023	205	United Kingdom 71; United States 50; West Germany 28.
Salt	205	50	Mainly from France.
Stone, sand and gravel:			
Dimension stone, crude and worked	19,963	10,875	Italy 10,571; Greece 165.
Gravel and crushed stone	84,184	25,728	Italy 24,812; France 300; United Kingdom 202.
Sand	181	421	West Germany 250; United States 121.
Sulfur and unroasted iron pyrites	2,009	126	Turkey 76; France 50.
Talc and steatite	35	27	Italy 26; Lebanon 1.

See footnote at end of table.

Table 5.—Libya: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal sources, 1970
NONMETALS—Continued			
Other nonmetals, n.e.s.:			
Crude	2,118	--	
Quartz, mica, feldspar, fluorspar, cryolite	NA	597	Romania 343; Sri Lanka 128; Italy 79.
Slag, dross and similar materials, not metal bearing	10	--	
Building materials of asphalt, asbestos, fiber-cement, and unfired nonmetals, n.e.s.	NA	8,392	Lebanon 2,496; Italy 2,164; Czechoslovakia 1,158.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	24,416	6,599	United Kingdom 4,070; Italy 2,329.
Coal, coke and briquets	792	137	United States 89; Italy 31; Tunisia 11.
Petroleum refinery products:			
Gasoline---thousand 42-gallon barrels	1,306	1,175	Italy 653; Netherlands 432; United States 69.
Kerosine and jet fuel---do	95	1	Mainly from Italy.
Distillate fuel oil---do	1,860	1,446	Italy 1,135; Netherlands 311.
Residual fuel oil---do	296	60	Italy 54; Netherlands 5.
Lubricants---do	187	115	United States 57; United Kingdom 41; Italy 13.
Liquefied petroleum gas---do	101	182	Italy 180.
Other---do	770	181	Italy 96; Venezuela 67.
Total---do	4,615	3,160	
Crude chemicals from distillation of coal, oil, and gas	3,363	27	United Kingdom 25; Netherlands 2.

NA Not available.

The EC countries imported 79% of Libyan crude oil in 1971. Italy, West Germany, France imported 69% of Libyan crude oil. Italy continued to be the leading nation importing Libyan crude oil, 240 million barrels. Exports to the United States showed a progressive increase throughout 1971 to over 55 million barrels compared with 35 million barrels in the previous year. Imports by the United Kingdom amounted to about 163 million barrels, almost triple the U.S. level.

During 1972 a total of 157 million barrels (97 billion cubic feet) of LNG were exported from Libya to Italy and Spain. In addition, about 5.1 million barrels of naphtha were shipped to the United Kingdom and Brazil. Some 3 million barrels of liquefied petroleum gas (LPG) were exported to Spain, Argentina, Brazil, Egypt, Italy, the United States, the United Kingdom, and Lebanon.

COMMODITY REVIEW

METALS

As shown in table 2, Libya did not produce metals in 1972. Some iron and steel scrap was exported in 1970, as shown in table 4.

Iron and Steel.—Libya signed a contract with a French consortium for the development of the Wadi Ash Shati (Fezzan) iron ore deposits. An economic study continued during the year concerning the feasibility of constructing an iron and steel plant to utilize these ores. If the plant is constructed, Libya will retain top priority of the steel production.

NONMETALS

Only modest production of nonmetals occurred in 1972, as in the past. The Government was encouraging the development of a nonmetallic industry and contracted for construction of an ammonia plant together with a plant for the manufacture of urea and nitrogen fertilizers. Original construction site was scheduled to be Benghazi. Reportedly the planned site was changed to Brega. The ammonia plant was designed to produce 1,000 tons daily, the majority of which will be exported.

Cement.—Expansion of the Benghazi cement plant continued during the year. Plant capacity will be increased to 1,200 tons per day. The Homs cement plant was undergoing expansion during the year to 400,000 tons per year.

MINERAL FUELS

The Libyan Government is seeking to develop its own domestic petroleum operations by making the Libyan National Oil Co. (Linoco) a fully integrated organization capable of engaging in exploration, production, refining, and marketing petroleum products, domestically and abroad.

At midyear, an Italian company signed a contract with the Libyan Government to create an advanced petroleum school. Libya's future petroleum specialists, production to management personnel, will be Italian-trained.

A total of 65 wells—28 dry holes, 27 oil wells, and 10 service wells—were drilled in 1972. Total footage drilled during the year was 555,789 feet. At yearend Libya had 978 producing wells—183 injection, 386 pumping, and 409 flowing wells. Libya produced 496 billion cubic feet of natural gas; about 276 billion cubic feet were utilized, and 220 billion cubic feet flared. Occidental of Libya, Inc., was the primary natural gas producer followed by Esso Standard Libya, Inc. The Libyan Government has committed itself to utilization of the country's natural gas resources, and the cessation of flaring natural gas is an important element of the country's conservation and economic utilization program.

Libya was in the process of devising a new formula on allowable oil production that will be more flexible than the one it has been using to control output on a well-by-well basis. The intent was to remove some of the uncertainties for the producers. The net effect of the new formula may be to permit somewhat higher output or at least enable companies to sustain production at their present allowable rates. The Government revision in the allowable system was expected to be based on a "net voidage" system. Basically, this system provides that volumes of oil removed should be replaced either by water or gas injection, or by natural drive. The effect would be to stabilize output at actual allowable levels, since at present, companies often are unable to maintain production. Under one proposal, operators would be permitted overall field allowables instead of the current per-well-per-day limits. A system of bonus points to encourage operators to maximize secondary recovery programs was also under study.

Construction work on the Zawia 60,000-barrel-per-day refinery continued during the year, and completion was scheduled for mid-1973. The refinery output will exceed local consumption, and the remainder will be exported to international markets. Two floating docks will be constructed to receive crude oil and export products. One dock will be capable of receiving 100,000-dead-weight-ton tankers and will be linked to the shore by two pipelines. The second dock will provide facilities for gas, kerosine, naphtha, and diesel oil and will be capable

Table 6.—Exploration activity in Libya, 1972 (crew-months)

Company	Geology	Seismic	Gravity	Air magnetic
AGIP, s.p.f.	--	7.0	--	0.4
Amoseas	--	12.0	--	--
Amoco	--	7.0	--	--
Aguitaine/Linoco	--	4.3	--	--
Esso Libya	--	.9	--	--
Esso Sirte	--	2.1	--	--
Linoco [e]	6	12.0	--	--
Mobil/Gelsenberg	--	12.0	--	--
Oasis [e]	--	12.0	--	--
Shell/Linoco	--	4.7	2.6	--
Wintershall/Elwerath	--	2.0	--	--
Total 1972	6	76.0	2.6	.4
Total 1971	19	118.0	--	--

[e] Estimate.

Source: American Association of Petroleum Geologists.

of serving tankers up to 30,000 deadweight tons. It also will be linked to the shore by two 16-inch pipelines. The Zawia refinery will process crude oil from the Brega and Sidra ports. Also planned for completion at the time of the Zawia refinery is a lube oil plant. The plant has a design capacity of 220,000 barrels per year, which will exceed domestic consumption for several years to come. The plant will contain storage for blending oils and storage tanks for mixing oils. The lube oil output will be concentrated primarily on a high-grade diesel oil and a high-grade motor oil.

Linoco was also planning to construct a 100,000-ton-per-day methanol plant in the eastern part of the country near Brega. This plant is a joint venture between Linoco and Occidental of Libya, Inc., and will be the first methanol plant in the Arab world. The majority of the production will be exported.

Sales to East bloc countries of Libya's nationalized Sarir oil in November 1972 totaled nearly 130,000 barrels daily. Reportedly, exchange agreements with Yugoslavia, Romania, Bulgaria, and the U.S.S.R. totaled more than 100,000 barrels per day.

The Libyan Oil Minister in November 1972 disclosed plans for a 130,000-to-150,000-barrel-per-day refinery to be located near the Egyptian border at Tobruk. This refinery would process Sarir crude plus any eventual output from noncommercial existing discoveries (estimated to total as much as 40,000 barrels per day in concession 82, lying along the Sarir pipeline in which Libya recently acquired a 50% interest from ENI).

Occidental of Libya, Inc., sold 3 million tons of low-sulfur crude oil to Japanese utilities for direct burning over a 3-year period. Also, Occidental, signed a contract to supply 12 million barrels of its Libyan gas-condensate to the Sumitomo group for direct burning in Japanese powerplants. With these two contracts, Occidental will be placing more than 30,000 barrels daily of Libyan hydrocarbons in the Japanese market for 3 years.

Esso Standard Libya, shutdown its LNG complex at Marsa el Brega in the last quarter of 1972 for planned turnaround overhaul. The LNG plant had ceased production earlier in the year because of a technical breakdown not long after the dispute with the Libyan Government on prices for its LNG supplies to Spain and Italy. No significant tonnage of sulfur was recovered at the plant in 1972, although LNG shipments were achieved on a regular basis at the end of the year.

Linoco placed an order with Spanish shipyards for two 47,000-deadweight-ton tankers of which the first, the *Sarir*, was rescheduled for delivery in August 1973 and the second, the *Hariga*, in November of 1973.

At midyear a Russian tanker loaded the first shipment of Sarir crude for marketing by the Libyan Government since British Petroleum Co., Ltd., production was nationalized in December 1971. The terms of the U.S.S.R. agreement were not made public.

Linoco signed an agreement with ENI giving Libya 50% participation in ENI's Libyan oil concessions. Compensation to ENI will be based on book value. Libya's 50% share of the crude output will be bought by ENI at a price tied to market prices. Dividends are to be divided equally by ENI and Libya after tax and royalty deductions. Production is predicted by ENI at 200,000 barrels per day eventually. ENI was expected to begin exports of crude from concession 100-A at a producing rate of 100,000 barrels per day at yearend. According to the Oil Ministry, concession 100-A has reserves of approximately 1.1 billion barrels of oil and a production potential of 270,000 barrels per day. Crude from the concession will move through Occidental's Zuetina terminal under a 20-year agreement.

The oil companies operating in Libya reached an agreement January 20, 1972, concerning the compensations payable to the Libyan Government as a result of the decrease in the purchasing power of the Libyan dinar following the deevaluation of the U.S. dollar. The agreement was signed by Mobil Oil Co., Esso Standard Libya, and Gelsenberg. In accordance with the agreement, the posted price of Libyan crude oil was increased 8.49%, thus increasing the income of the Libyan Government about 10%. The total revenue increase, payable by oil companies, was expected to be about $170 million in 1972. The agreement contained a formula for increasing posted prices to reflect any future changes in the value of the dollar.

In 1972 the Oil Ministry indicated to the

oil companies operating in Libya that it wished to begin participation negotiations to determine the extent and manner in which Libya would become a partner in local petroleum operations. These talks progressed throughout 1972.

Table 7.—Libya: Crude oil production

(Thousand barrels)

Year	Daily average	Total	Cumulative	Annual % change in daily production
1970	3,318	1,211,086	5,476,409	6.7
1971	2,761	1,007,692	6,484,101	−16.8
1972	2,239	819,619	7,303,720	−18.9

Table 8.—Libya: Producing wells [1] and wells drilling at yearend

Year	Flowing	Producing oil wells artificial lift	Total	Wells drilling
1970	515	365	880	--
1971	431	363	794	18
1972	409	386	795	9

[1] Excluding wells shut in.

Table 9.—Libya: Refinery operations

(Thousand barrels per calendar day)

	1970	1971	1972
Capacity	10.0	10.0	10.0
Crude oil throughput	8.7	7.7	8.6
Production of refined products:			
Gasoline	1.9	1.5	1.7
Kerosine	1.0	1.1	1.0
Distillate fuels	2.1	1.8	2.2
Residual fuels	3.7	3.3	3.7
Total	8.7	7.7	8.6

Table 10.—Libya: Consumption of refined products

(Thousand barrels per calendar day)

	1970	1971	1972
Gasoline	4.1	5.2	5.9
Kerosine	1.9	2.9	3.6
Distillate fuels	7.1	6.7	8.9
Residual fuels	2.4	3.0	3.6
Others	.9	2.1	2.4
Total	16.4	19.9	24.4

The Mineral Industry of Malaysia

By K. L. Harris [1]

Despite a last quarter revival, depressed demand for Malaysia's basic export commodities of rubber, timber, and tin through the first half of the year meant modest growth for the year as a whole. Exports decreased 3.6% for the year, but imports increased 2.9%. The gross national product (GNP) increased 6.1%, slightly less than the Government's projected annual growth rate of 6.5% for the second Malaysia plan period of 1970–75. The country's balance of trade and payments, although lower than that of last year, remained in surplus.

The export value of tin increased by approximately 2%, but it was displaced to third place by timber in relative importance of exports. Malaysia continued as the world's leading tin mining and smelting nation. Malaysia's tin mining sector, employing 45,574 people at yearend, produced over 38% of the non-Communist countries output of tin from its extensive alluvial deposits. The two tin smelters, which process all domestic ores plus those of several neighboring countries, produced over 47% of the world's tin metal.

Petroleum production increased 35% above that of 1971, but exports and reexports decreased 48%. With nearly all of Malaysia's offshore areas leased for oil exploration, anticipated discoveries coupled with known reserves should make petroleum a more important factor in Malaysia's future exports.

Because of Malaysia's dependence on tin as the main mineral export, a major new exploration program for other minerals, principally copper, lead, zinc, and silver, was initiated.

Malaysia and the U.S.S.R. signed a 5-year agreement covering technical and economic cooperation in developing Malaysia's mineral resources. Areas of cooperation specified in the agreement are geological survey work for investigation and evaluation of ferrous and nonferrous ores, exploitation of new ore deposits and development of modern mining methods for existing ore deposits, and construction of industrial ventures, including nonferrous metallurgical plants.

The Government formed the Ministry of Primary Industries to supervise production of primary commodities and to encourage secondary processing of primary products.

Kuala Lumpur has been chosen as the headquarters of the Tin Industry Development and Research Center for Southeast Asia. The functions of the Center would include the investigation of problems relevant to exploration, evaluation, and exploitation of the area's tin deposits. A determination of the requirements of the Center will be conducted under the auspices of the United Nations Development Program, which will assist in the establishment of the Center.

PRODUCTION

Despite relatively low prices, Malaysia's tin output increased to the highest level since 1941. Production of tin-in-concentrates totaling 75,619 long tons and valued at $282 million [2] represented a 2% increase over last year's production. Production of petroleum, all from Sarawak, increased 35%. Bauxite production increased marginally even though the industry experienced a reduction in the number of producing mines. Kaolin production increased ninefold. Other commodities such as manganese and monazite recorded increases in production; gold, iron ore, and titanium recorded decreases.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Because of fluctuating exchange rates, a meaningful conversion to U.S. dollars is impractical. However, where necessary, values have been converted from Malaysian dollars (M$) to U.S. dollars at the yearend rate of M$2.82=US$1.00.

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

(Metric tons unless otherwise specified)

Commodity [2]		1970	1971	1972 [p]
METALS				
Aluminum, bauxite, gross weight	thousand tons	1,139	978	1,076
Antimony, mine output, metal content (Sarawak)		180	289	205
Columbium and tantalum concentrates, gross weight		61	24	68
Copper, mine output, metal content [e] [3]		305	214	63
Gold, mine output, metal content:				
West Malaysia	troy ounces	3,912	4,491	3,853
Sarawak	do	1,265	1,180	1,663
Total	do	5,177	5,671	5,516
Iron and steel:				
Iron ore and concentrate	thousand tons	4,491	950	528
Pig iron and blast furnace ferroalloys [e]	do	60	[r] 70	80
Crude steel [e]	do	60	70	80
Manganese ore and concentrate, gross weight		--	12,700	33,528
Rare-earth minerals:				
Monazite, gross weight [4]		1,657	1,471	1,748
Xenotime (yttrium mineral), gross weight [4]		353	101	50
Tin:				
Mine output, metal content	long tons	72,630	74,253	75,619
Smelter output	do	[r] 90,049	85,719	89,564
Titanium, ilmenite concentrate, gross weight [4]		192,455	155,682	151,571
Tungsten, mine output, metal content		[r] 70	9	125
Zirconium, zircon concentrate, gross weight [4]		860	2,543	2,010
NONMETALS				
Cement, hydraulic	thousand tons	1,030	1,096	1,060
Clays, kaolin		3,327	11,655	104,972
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural (Sarawak):				
Gross production [e]	million cubic feet	6,500	25,000	35,000
Marketed production	do	2,698	2,297	3,325
Petroleum:				
Crude (Sarawak)	thousand 42-gallon barrels	[r] 6,299	25,071	33,867
Refinery products (Sarawak and West Malaysia):				
Gasoline	thousand 42-gallon barrels	[e] 3,984	2,731	10,510
Jet fuel	do	[e] 7,290	8,138	5,774
Kerosine	do	[e] 2,423	1,032	3,217
Distillate fuel oil	do	[e] 6,746	6,198	6,469
Residual fuel oil	do	[e] 17,186	7,267	15,775
Lubricants	do	--	--	135
Other	do	[e] 2,062	15,115	2,776
Refinery fuel and losses	do	[e] 2,427	1,682	2,359
Total	do	[e] 42,118	42,163	47,015

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

[1] All production recorded is from West Malaysia unless otherwise indicated in commodity column.

[2] In addition to the commodities listed, a variety of crude construction materials (clays, sand, gravel, and stone) is also produced, but production is not reported and available general information is inadequate for the formulation of reliable estimates of output levels.

[3] Estimate based on exports of copper concentrates.

[4] Exports.

TRADE

Tin, Malaysia's leading export among mineral commodities, is third behind rubber and timber as an overall foreign exchange earner. Malaysia exports only tin metal, some of which is mined in Indonesia and Australia and imported into Malaysia for smelting. Exports of tin metal were up 3% from 85,334 long tons in 1971 to 88,006 long tons in 1972, with a corresponding value increase of 2%. Exports of tin were about 116% of the total tin mined in the country. Buyers of 80% of Malaysia's exported tin were the United States, 34%; Japan, 26%; the Netherlands, 13%; and Italy, 7%.

Although crude petroleum production increased, petroleum exports including reexports fell by 48%. Previously, crude oil from Brunei was brought to a terminal in Sarawak for reexport, but production from Sarawak's own fields now utilizes the terminal, and Brunei, with a new terminal, exports most of its crude oil directly.

Malaysia's main trading partners in 1972 were Japan, Singapore, the United States, and the United Kingdom.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum:			
Bauxite		1,083,217	983,707
Metal, including alloys:			
Scrap		677	569
Unwrought		60	23
Semimanufactures		173	535
Copper:			
Ore		1,221	1,109
Metal:			
Scrap		1,228	1,040
Unwrought and semimanufactures		565	625
Iron and steel:			
Iron ore	thousand tons	4,901	879
Metal:			
Iron and steel scrap		19,729	9,380
Pig iron, ferroalloys, and similar materials		9	4
Steel, primary forms		101	93
Semimanufactures:			
Bars, rods, angles, shapes, sections		2,281	1,128
Universals, plates, sheets		5,632	4,194
Hoop and strip		44	51
Rails and accessories		3,971	7,734
Wire		229	65
Tubes, pipes, fittings		12,433	1,173
Castings and forgings, rough		266	98
Lead:			
Ore		306	--
Oxides		(2)	7
Metal, including alloys, all forms		458	377
Magnesium metal, including alloys, all forms		1	1
Manganese ore		--	12,904
Mercury	76-pound flasks	(2)	(2)
Monazite		1,657	1,471
Thorium ore		393	99
Tin:			
Ore	long tons	696	494
Metal, including alloys:			
Unwrought	do.	90,501	85,334
Semimanufactures	do.	39	92
Residues (slag and hardhead)	do.	898	2,556
Titanium, ore and concentrate		223,495	155,992
Tungsten, ore and concentrate		172	273
Zinc:			
Metal, including alloys:			
Scrap		313	406
Blue powder		--	4
Unwrought		12	--
Semimanufactures		244	91
Other:			
Ash and residue containing nonferrous metals		645	666
Oxides, hydroxides and peroxides of metal, n.e.s.		15	2
Metals, including alloys, all forms:			
Alkali, alkaline earth and rare-earth metals		5	11
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.		77	20
Asbestos		7	19
Barite and witherite		2,246	2,188
Boron materials, crude		(2)	1
Cement		354,166	219,316
Clays and clay products (including refractory brick):			
Crude:			
China clay (kaolin)		962	7,389
Fuller's earth		31	20
Other clays		1,369	1,196
Products:			
Refractory		19	470
Nonrefractory		2,183	4,668
Diamond, gem, not set or strung	value	$516,507	$534,817
Diatomite and other infusorial earth		13	24
Fertilizer materials:			
Crude, phosphatic		1,226	2,187
Manufactured:			
Nitrogenous		19	310
Phosphatic		2	19
Potassic		16	32
Other, including mixed		7,679	24,299
Ammonia		279	301
Gypsum and plasters		68	83

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Lime		7,898	4,823
Pigments, minerals, natural crude		9	46
Precious and semiprecious stones, except diamond, natural	value	$80,356	$34,758
Salt and brine		1,748	331
Sodium and potassium compounds, n.e.s.:			
Caustic soda		206	263
Caustic potash, sodic and potassic peroxides		(2)	(2)
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked		14,262	1,795
Worked		285	269
Dolomite, chiefly refractory grade		1,157	2,387
Gravel and crushed rock		171,439	191,397
Limestone (except dimension)		11,069	15,354
Quartz and quartzite		187	165
Sand, excluding metal bearing		7,559	15,484
Talc, steatite, soapstone, pyrophyllite		72	474
Other nonmetals, n.e.s.:			
Crude		261	168
Slag, dross and similar waste, not metal bearing		25	67
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals n.e.s		18,294	12,659
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		278	5
Carbon black and gas carbon		3	12
Coke and semicoke		384	159
Petroleum:			
Crude	thousand 42-gallon barrels	28,077	50,282
Partly refined	do	8,126	10,654
Refinery products:			
Aviation gasoline	do	3	3
Motor gasoline	do	6,553	7,236
Kerosine	do	1,910	1,761
Jet fuel	do	565	82
Distillate fuel oil	do	2,155	1,661
Residual fuel oil	do	8,839	585
Lubricants	do	49	105
Other, bitumen and other residues	do	69	94
Total	do	20,143	11,527

[1] Table includes West Malaysia, Sarawak, and Sabah.
[2] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	3,281	3,240
Metal and alloys, all forms	11,797	7,854
Chrome, oxide and hydroxides	65	42
Cobalt, oxide and hydroxides	3	6
Copper:		
Ore and concentrate	264	269
Metal and alloys, all forms	4,137	4,250
Iron and steel:		
Iron and steel scrap	3,422	2,556
Pig iron, including cast iron	23	178
Sponge iron, powder and shot	254	107
Ferroalloys:		
Ferromanganese	579	152
Other	950	997
Steel, primary forms	879	25,505
Semimanufactures:		
Bars, rods, angles, shapes, sections	79,994	114,962
Universals, plates, sheets	198,004	169,553
Hoop and strip	33,349	36,917
Rails and accessories	4,274	5,453
Wire	30,064	30,270
Tubes, pipes, fittings	35,184	19,915
Castings and forgings, rough	2,957	1,860

See footnote at end of table

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Lead:		
Ore and concentrate	2	5
Oxides	756	777
Metal, including alloys, all forms	2,642	1,676
Magnesium metal, including alloys, unwrought	46	27
Manganese:		
Ore and concentrate	1,629	1,188
Oxides	307	1,029
Mercury—76-pound flasks	66	29
Molybdenum metal, including alloys, all forms	53	3
Nickel metal, including alloys, unwrought and semimanufactures	63	602
Platinum-group metals, including alloys—troy ounces	16,530	1,137
Silver—do	3,919	1,910
Tin:		
Ore—long tons	20,833	14,868
Metal, including alloys, all forms—do	522	381
Titanium oxides	1,862	1,999
Zinc:		
Ore	2,673	3,558
Oxide	794	626
Metal, including alloys, all forms	4,928	3,976
Other:		
Ash and residues containing nonferrous metals	1,541	1,059
Metals, including alloys, all forms:		
Metalloids	360	189
Alkali, alkaline earth and rare-earth metals	73	2
Pyrophoric alloys	22	26
NONMETALS		
Abrasives, natural, n.e.s.: Pumice, emery, corundum, etc	299	168
Asbestos	14,371	13,799
Barite and witherite	7,608	4,386
Boron materials:		
Crude natural borates	180	1,998
Oxide and acid	97	85
Cement	27,102	66,985
Chalk	265	217
Clays and clay products:		
Crude:		
Bentonite	251	48
China clay (kaolin)	1,577	1,042
Fuller's earth	1,507	1,217
Mullite, charmotte, dinas earths	180	279
Other clays	4,260	1,766
Products:		
Refractory	18,358	16,433
Nonrefractory	10,564	7,701
Diamond, gem, not set or strung—value, thousands	$2,035	$2,009
Diatomite and other infusorial earth	167	180
Feldspar	5,828	7,754
Fertilizer materials:		
Crude:		
Nitrogenous	117	90
Phosphatic	92,993	113,882
Potassic	578	971
Other	34,574	39,934
Manufactured:		
Nitrogenous	91,855	70,740
Phosphatic:		
Thomas (basic) slag	25	729
Other	8,690	8,330
Potassic	105,262	103,717
Other, including mixed	56,300	42,172
Ammonia	12,960	9,000
Graphite, natural	126	409
Gypsum and plasters	40,987	30,602
Lime	1,414	5,224
Magnesite	243	192
Pigments, mineral:		
Natural, crude	163	594
Iron oxides	714	694
Precious and semiprecious stones, except diamond:		
Natural—value	$224,083	$99,143
Manufactured—do	$2,342	$8,381
Pyrite	47	33
Salt and brine	95,504	137,035
Sodium and potassium compounds, n.e.s.:		
Caustic soda	5,486	7,192
Caustic potash, sodic and potassic peroxides	684	572

See footnote at end of table.

Table 3.—Malaysia: [1] Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension stone, crude and worked		2,149	1,862
Dolomite, chiefly refractory grade		233	171
Gravel and crushed rock		2,206	1,276
Limestone (except dimension)		1,711	1,661
Quartz and quartzite		501	213
Sand, excluding metal bearing		4,307	695
Sulfur:			
Elemental, all forms		10,824	10,218
Sulfur dioxide		4	2
Sulfuric acid		385	90
Talc, steatite, soapstone, pyrophyllite		598	3,346
Other nonmetals, n.e.s.:			
Crude		25,810	24,873
Slag, dross and similar waste, not metal bearing		41	194
Oxides and hydroxides of magnesium, strontium, barium		14	32
Building materials of asphalt, asbestos, fiber cement, and unfired metals, n.e.s.		14,441	7,875
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		3,577	1,893
Carbon black		4,266	5,331
Coal, coke, briquets:			
Anthracite and bituminous coal		12,414	15,591
Lignite and lignite briquets		51	19
Coke and semicoke		12,076	47,188
Petroleum:			
Crude	thousand 42-gallon barrels	70,316	63,144
Partly refined	do	355	253
Refined products:			
Aviation gasoline	do	82	111
Motor gasoline	do	1,291	1,571
Kerosine	do	575	673
Jet fuel	do	484	559
Distillate fuel oil	do	5,478	5,092
Residual fuel oil	do	375	580
Lubricants	do	1,124	456
Mineral jelly and wax	do	30	31
Other:			
Nonlubricating oils	do	103	47
Petroleum coke	do	18	40
Bitumen and other residues	do	98	146
Total	do	9,658	9,306

[1] Table includes West Malaysia, Sarawak, and Sabah.

COMMODITY REVIEW

METALS

Bauxite.—The output of bauxite increased 10% from that of 1971. The number of operating mines, all in the State of Johore, declined from 5 to 3, and the labor force dropped from 547 to 460 during the year. Most of Malaysia's bauxite production was exported to Japan.

Copper.—The first shipment of concentrate from the Mamut copper mine in Northwestern Sabah was delayed until 1975. A 15,000-ton-per-day flotation plant will be constructed to produce 120,000 tons per year of concentrate containing 25% copper. The projected cost of about $80 million required to develop the mine and infrastructure will be shared by a consortium of seven Japanese firms owning 51% and individual shareholders, including the Malaysian Government, owning 49%. Proven reserves of 80 million tons of ore containing 0.63% copper and 0.02 troy ounce of gold per ton are contained in a diorite porphyry deposit.

Iron Ore.—Malaysia experienced a 44% reduction in iron ore output in 1972. Four mines ceased production during the year. Of the eight remaining mines, four are in the State of Perak, two are in Johore, and one each in Kedah and Pahang. The mine in Pahang produced over 50% of the annual output.

Iron and Steel.—Tokyo Boeki Ltd., Kawasaki Steel Corp., and a group of Malaysian shareholders have invested over $1 million in an industrial steel plant at the Batu Tiga industrial estate at Shah Alam,

Selangor. The plant produces hollow section steel, round, square, and rectangular tubing, and plain and lip channels of different gages and sizes. Capacity of 3,500 tons per month will be realized when additional equipment is installed. The projected capacity is sufficient to satisfy domestic requirements, with some surplus available for export.

Tin.—Malaysia continued to lead the world in production and smelting of tin in 1972. A total of 75,619 long tons of tin-in-concentrate was mined, the highest output in 31 years. At yearend there were 58 tin dredges, 940 gravel pump mines, and 46 opencast, underground, and other miscellaneous mines in operation, a 6% decrease in total number of mining operations compared with 1971 figures.

Gravel pump operations, worked for the most part by the same families that own the mines, accounted for about 56% of the concentrate produced; dredging by corporations furnished another 32%. Opencast mines brought in 3% of the ore produced; underground mines accounted for 3%, and the remaining 6% came from miscellaneous sources. Metal production, at 89,564 long tons, was 4% above the 1971 level of 85,719 long tons and the largest since 1941.

The Government opened up 40,000 acres of virgin land in the State of Johore, 36,000 acres in Pahang, and 10,000 acres in Perak for tin exploration.

Berjuntai Tin Dredging Berhad, the largest tin dredging operator in the world, increased its tin concentrate output by 714 long tons to a record of 4,917 long tons in its fiscal year ending April 30, 1972. This output is the second highest recorded by any private tin mining company in the world. Berjuntai operates dredges in an area about 20 miles from Kuala Lumpur on the Selangor River.

The Pehang Consolidated Co. Ltd., Malaysia's only significant lode tin producer, reported an output of 2,632 long tons of tin concentrate averaging 71.1% tin during its fiscal year ended July 1972. Further expansion of production at the Sungei Lemb-ing mine, principally through expenditures for mining and dressing equipment and on the Gakak shaft, has been announced.

State and private interests have made plans to locate four new dredges in Selangor. Two dredges are planned by the Selangor State Development Corp. for a 1,000-acre site at Ulu Langat, one is planned by Petaling Tin Berhad at Kuala Langat, and Berjuntai Tin Dredging Berhad is considering replacing its 35-year-old No. 1 dredge with a new and more modern plant.

Pernas, the Malaysian State corporation, has been granted exploration rights for tin off the west coast of West Malaysia along the States of Selangor, Perak, and Penang. Pernas began a soil study of 2,600 acres in the Johore River estuary, using seismic profiling and core sampling to produce a geochemical map that would indicate areas for final evaluation.

Pacific Tin Consolidated Corp. the only U.S.-based company mining tin in Malaysia, operated three bucketline dredges and four gravel pump mines on its properties in 1972. The year's results from these operations follow:

	1971	1972
Cubic yards processed (dredges and gravel-pumps)	9,288,000	11,585,000
Pounds of tin recovered	2,397,194	2,867,666

Source: Pacific Tin Consolidated Corp., 1972 Annual Report.

Tin ore reserves on company land in Malaysia as of December 31, 1972, follow:

	Estimated reserves (cubic yards)	Tin (pounds)	Pounds of tin per cubic yard
Dredging ground	72,850,000	15,859,000	0.22
Gravel pump, ground	12,322,000	3,008,000	.24
Total	85,172,000	18,867,000	.22

Source: Pacific Tin Consolidated Corp., 1972 Annual Report.

NONMETALS

Cement.—All Malaysian cement production was supplied by three firms owning four plants. Associated Pan Malaysian Cement Sdn. Berhad, Malaysia's largest cement producer with a total capacity of 750,000 tons per year, has plants in Chemor, Perak, and in Rawang, Selangor. Each plant operated two wet-process rotary kilns. Two dry-process rotary kilns with a total capacity of 520,000 tons per year were in operation at the Tasek Cement Ltd.

Ipoh plant. Malaya Industrial & Mining Corp. Berhad operated a small 60,000-ton-per-year plant at Batu Caves, Selangor. An additional 400,000-ton-per-year plant was being constructed by Cement Industries of Malaysia Sdn. Berhad with initial production scheduled for October 1974.

MINERAL FUELS

Natural Gas.—Sarawak Shell Berhad located a large natural gasfield about 80 miles offshore from Bintulu, Sarawak. Shell was reportedly negotiating to sell the output to Tokyo Electric Co., Tokyo Gas Co., and Osaka Gas Co., all of Japan. The cost of the gas will reflect increased expenses incurred in bringing the gas to shore. Shell hopes to build a liquid natural gas plant in Sarawak.

Petroleum.—The State of Sarawak is Malaysia's only oil-producing area. Production has increased rapidly from about 4,000 barrels per day in 1968 to over 90,000 barrels per day at yearend 1972. Total crude oil production in 1972 increased about 35% above that of 1971. Sarawak Shell Berhad holds the producing concession. Shell closed down its oilfield at Miri, Sarawak, after 62 years of production. The field only accounted for 450 barrels per day while operating in 1972.

Shell began production from a new field, Bukau, located about 15 miles offshore of Lutong in northern Sarawak. Another field, Baronia, recently entered production to make a total of four fields that Shell now operates off the Baram River delta. The two older fields are West Lutong and Batam. Shell continued extensive exploration and drilling operations off Sarawak's coast.

Sabah Teiseki Oil Co., Ltd., a Japanese company which holds a 7,500-square-mile concession on Sabah's east coast joined forces with a French company, Aquitaine Petroleum Co., which has a 2,000-square-mile concession off the northeast coast. The companies signed a special tax agreement, under which they will be given allowances in the form of tax relief to make their operations more competitive if they discover oil in commercial quantities. Should they strike oil, the two companies will receive a 30-year lease to produce and an option to lease for an additional 10 years. Their current prospecting license will expire in 1974, but there is a provision for a 5-year renewal.

Both Esso Exploration Malaysia Inc. and Shell Oil Co. withdrew their exploration rigs from Sabah's waters to allow time for data evaluation prior to proceeding with further exploration.

Continental Oil Co. (Conoco), Broken Hill Proprietory Co., Ltd. (BHP), El Paso Natural Gas Co., and the Malaysian Government signed an offshore petroleum agreement covering the 7,400-square-mile offshore concession held by Conoco off Pahang on the east coast of West Malaysia. Conoco requested the Government to bring in two more oil companies to intensify exploration. BHP and El Paso will each have a 25% interest in the concession.

The Mineral Industry of Mexico

By Burton E. Ashley [1]

The value of mineral production (excluding petroleum) gained 7% over the 1971 level, but the industry's contribution to the gross national product (GNP) declined. Production gains, on a volume basis, were made in iron and steel, copper, and to a lesser extent in lead, zinc, cadmium, and bismuth; the nonmetals were mixed with about as many gainers as losers.

Mining labor increased by about 8%, but was a minor part of the entire industrial labor force.

In progressing toward autarky, the Mexican Government was considering, or was putting into practice, a number of regulations to control foreign business and investment. While foreign investment remained welcome, the direction of foreign investment appeared to be oriented to the greater benefit of Mexico and Mexicans. Preferred foreign investment would be directed to businesses that would not overlap established Mexican enterprises or operate to the detriment of Mexican firms. New firms would be more welcome in the lesser developed areas of Mexico and where unemployment was high. Development of commodities for export was a prime goal.

Several pieces of legislation of interest to the minerals industry were enacted or under consideration in 1972. The law that established the National Registry of Science and Technology was mostly new; the proposed law on Foreign Investment, which was awaiting legislative action at yearend, was largely a codification of existing laws, with the addition of new rules affecting entry and use of foreign capital in Mexico. Industry should be aware of these laws in order to avoid what might amount to severe penalties in case of violation. The following brief outline describes the main points of the new legislation:

On December 30, the President signed a law establishing the National Registry of Science and Technology, which was to be administered by the Secretariat of Industry and Commerce. The law was to become effective on February 1, 1973. Its purpose was to place control of the transfer of technology, patents, and trademarks in the Mexican Congress. All new technology contracts must be submitted to the Registry for approval. Contracts may be barred from registration if the technology is available in Mexico or when the technology is considered too costly. There were about 14 conditions under which approval would not be granted for registration, but some discretion was given to waive certain conditions for good reason. If the Registry fails to decide on a contract within 90 days, the contract was to be considered to have been approved and duly registered. It was presumed that the law would guide Mexican companies to obtain maximum benefits of foreign technology at minimum cost, thereby reducing the loss of foreign exchange or adversely affecting economic growth.

At yearend a law on Foreign Investment was sent to the Chamber of Deputies for approval. The object of the law was "to promote Mexican investment and to regulate foreign investment in order to stimulate a just and balanced development, and to consolidate Mexico's economic independence." The law would apply to foreign individuals or corporations, and to Mexican companies with majority foreign ownership, or which are managed by foreigners. Various industries were listed which were reserved to the Mexican Government, or which were reserved exclusively to Mexican citizens or companies which exclude foreign participation.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Of particular interest to the mining industry was the article that limited mineral and mining concessions to not more than 49% foreign equity; in special concessions granted for the exploitation of mineral resources held by the Mexican Government, foreign equity was limited to 34%.

This law was to be administered by a commission which, in addition, will decide whether particular foreign investment would be advantageous to the Mexican economy from a standpoint of whether that industry was already well established in Mexico, or how much foreign equity may be held in new lines of industry. Other questions for decision include whether the foreign investment complements domestic investment or whether it might displace established Mexican industry that is operating satisfactorily. Other considerations include the effect on the balance of payments, wages generated, technical training of Mexicans, and other problems relating to the economy. The Commission was allowed some flexibility concerning foreign participation when new investment was to be made in lesser developed areas of the country, or where unemployment was high.

Various policy statements by government officials stressed that foreign investment was welcome, but on terms under which such investment aided in realizing Mexican goals of growth. The right of the investor to a legitimate profit was recognized.

In a speech to the annual General Assembly of the Mexican Chamber of Mines, the Secretary of National Patrimony indicated that the time was approaching for a second stage of Mexicanization in the minerals industry. Mexicanization of mining production had been accomplished, and the next step should be Mexicanization of mineral and metal sales. A national commercial sales company would enable Mexican miners to sell directly in foreign markets, presumably at higher prices than were being obtained.

A Presidential Decree of March 20 established the Coordinating Commission for the development of the Tehuantepec Isthmus. The purpose of the Commission was to devise a plan for the orderly development of the area's agricultural and mineral resources for the benefit of the entire country. The Isthmus is the narrowest part of the country and topographically is suitable for an oceanic link between the Gulf of Mexico port of Coatzacoalcos and the Pacific Ocean port of Salina Cruz. The area already had substantial infrastructure such as port facilities, a railway, electric power, and gas and ammonia pipelines. The primary goal for concentrated development of natural resources and industry was to increase the export of goods and services.

The Commissioners included the Ministers of various government departments and corporations as well as the governors of the four states that comprise the area.

The Mexican Border-Industry Program was broadened by the Presidential Decree of October 1972, which would allow establishment of facilities in most parts of Mexico, and allow some products to be marketed domestically. New industries under the Program could not be established in the more highly industrialized centers of Mexico City, Guadalajara, Monterrey, or some other locations to be determined. The Program started in 1965 and allowed companies to import all equipment and raw materials duty free; in exchange, the manufactured products must be exported. Some marketing within Mexico was made possible by the payment of duty on imported components if sales did not compete with established Mexican industry.

At midyear, a Presidential Decree concerning regional development was signed. The country was divided into three industrial zones for the purpose of decentralizing industry and encouraging growth in the lesser developed areas. Provision was made for fiscal facilities, credit aid, technical assistance, preinvestment studies, and a decreased interest rate to firms established outside of congested areas.

PRODUCTION [2]

The value of mineral production (excluding petroleum) in 1972 was about $574 million,[3] a rise of 7% over the 1971 value.

Copper, with a 25% gain to 78,720 tons, was the leading gainer in output over the 1971 level; other production gains were shown in bismuth 10%, cadmium 6%, and lead and zinc, 3% each. Reflecting increased steel production, output of coke gained 16%, manganese 11%, and iron (contained in iron ore) by 8%. Production of the nonmetallic minerals was mixed with about as many gainers as losers on a quantity basis.

In terms of value, metals accounted for 73% of the total, and nonmetals the remainder. Preliminary figures indicated that in 1972 minerals supplied 1.39% of the national product, compared with the revised total of 1.47% in 1971.

There were about 120,000 persons employed in the mining industry in 1972.

Table 1 lists the states that produced the greatest percentage quantity of selected mineral commodities in 1972.

Table 1.—Mexico: Percentage of total national production, by State, 1972

(By volume)

Commodity	State	Percent of total national output
Metallic minerals:		
Gold	Durango	30
Silver	Chihuahua	29
Lead	----do	62
Copper	Sonora	52
Zinc	Chihuahua	52
Iron	----do	40
Manganese	Hidalgo	90
Nonmetallic minerals:		
Sulfur	Vera Cruz	97
Fluorite	San Luis Potosí	32
Do	Coahuila	26

[2] Consejo de Recursos Naturales No Renovables. Anuario Estadístico de la Mineria Mexicana—1972. D. F., June 1973, pp. 1–22.

[3] Where necessary, values have been converted from Pesos (Mex) to U.S. dollars at the rate of Mex$1=$0.08.

Table 2.—Mexico: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 p
METALS				
Aluminum, primary		33,955	39,931	39,483
Antimony:				
Mine output, metal content		4,468	3,361	2,976
Metal (in mixed bars)		818	1,055	758
Arsenic, white [2]		9,133	11,483	5,097
Bismuth, content of exported concentrates, bullion and refined metal		571	570	629
Cadmium:				
Mine output, metal content		1,967	1,662	1,757
Metal, refined		268	192	186
Copper:				
Mine output, metal content		61,012	63,150	78,720
Electrolytic solution [3]		92	98	67
Precipitate, metal content [3]		38	--	--
Metal:				
Blister		59,609	61,936	74,236
Refined		53,676	52,577	59,591
Gold:				
Mine output, metal content	troy ounces	198,241	150,915	146,061
Metal, refined	do	191,457	147,057	137,412
Iron and steel:				
Iron ore:				
Gross weight [4]	thousand tons	4,354	4,354	5,089
Metal content	do	2,612	2,819	3,053
Pig iron and sponge iron	do	2,261	2,357	2,674
Ferroalloys	do	75	67	77
Crude steel	do	3,881	3,281	4,431
Steel semimanufactures	do	2,879	3,024	3,473
Lead:				
Mine output, metal content		176,597	156,852	161,358
Smelter (in refined and mixed bars)		171,007	151,471	155,820
Manganese ore:				
Gross weight [5]		273,914	266,892	295,622
Metal content		98,609	96,081	106,424

See footnotes at end of table.

Table 2.—Mexico: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS—Continued			
Mercury, mine output, metal content—76-pound flasks	30,256	35,390	22,510
Molybdenum, mine output, metal content	141	79	78
Nickel, mine output, metal content	44	[e] 50	[e] 50
Selenium, metallic	126	52	44
Silver:			
Mine output, metal content—thousand troy ounces	42,836	36,657	37,483
Metallurgical products, metal content—do	41,493	35,349	36,263
Tin:			
Mine output, metal content—long tons	525	471	348
Smelter, primary—do	525	471	348
Tungsten, mine output, metal content	288	408	362
Zinc:			
Mine output, metal content	266,400	264,972	271,844
Smelter, primary	80,662	77,862	79,378
NONMETALS			
Asbestos	126	--	--
Barite	319,092	279,742	261,403
Cement, hydraulic—thousand tons	7,267	7,360	8,602
Clays:			
Bentonite	65,012	57,628	37,984
Fuller's earth	[r] 28,309	20,245	30,392
Kaolin	78,548	72,587	71,891
Refractory	106,704	189,888	111,080
Diatomite	22,795	21,802	9,077
Feldspar	85,745	99,342	98,363
Fertilizer materials:			
Crude, phosphate rock	46,726	58,286	62,674
Manufactured:			
Nitrogenous, gross weight—thousand tons	1,177	709	[e] 900
Phosphatic, gross weight—do	368	402	[e] 450
Mixed, gross weight—do	279	306	[e] 340
Fluorspar, all grades	978,485	1,180,955	1,042,392
Graphite, all grades	55,648	50,916	55,110
Gypsum and anhydrite, crude—thousand tons	1,291	1,298	1,498
Magnesite	6,926	13,018	20,858
Mica, all grades	560	708	826
Perlite	12,307	11,146	12,868
Salt, all types—thousand tons	4,153	4,360	4,558
Stone, sand and gravel:			
Calcite, common	4,678	7,707	3,984
Dolomite	474,468	453,362	485,956
Limestone [6]—thousand tons	2,361	3,001	4,068
Marble	12,187	8,632	5,826
Quartz, quartzite and glass sand	355,862	393,350	404,567
Cobblestone	5,197	4,331	5,112
Strontium minerals	25,409	35,063	24,424
Sulfur, elemental:			
Frasch process—thousand tons	1,296	1,091	861
Other native mined—do	24	23	21
Byproduct from natural gas—do	60	64	62
Total—do	1,380	1,178	944
Sulfates, natural sodium	130,574	132,615	127,890
Talc and related materials, talc	2,105	1,714	3,130
Wollastonite	7,012	3,224	599
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous—thousand tons	[r] 3,614	3,552	2,959
Coke:			
Metallurgical—do	1,300	1,497	1,735
Breeze—do	NA	111	[e] 130
Gas:			
Manufactured, all types—million cubic feet	NA	7,400	[e] 6,500
Natural:			
Gross production—do	665,026	643,416	660,232
Marketable production—do	481,106	478,552	496,019
Petroleum:			
Crude [7]—thousand 42-gallon barrels	[r] 177,599	177,274	185,011

See footnotes at end of table.

Table 2.—Mexico: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products:				
Aviation gasoline	thousnad 42-gallon barrels	493	520	503
Other gasoline	do	51,183	52,100	55,602
Jet fuel	do	3,086	3,265	3,621
Kerosine	do	11,348	11,556	11,572
Distillate fuel oil	do	30,403	30,195	34,502
Residual fuel oil	do	47,640	45,951	52,116
Lubricants	do	1,977	1,995	2,270
Other	do	25,440	26,550	27,594
Refinery fuel and losses	do	11,668	11,635	9,441
Total	do	183,238	183,767	197,221

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

[1] In addition to the commodities listed, carbon black, lime, pumice, and a variety of crude construction materials are also produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

[2] Calculated white arsenic equivalent of metallic arsenic content of products reported.

[3] For export.

[4] Calculated on the basis of ore containing 60% iron, from reported metal content of mine production.

[5] Estimate calculated from reported metal content of mine production.

[6] Excluding that for cement production.

[7] Including field condensate, not previously included.

TRADE [4]

Preliminary figures indicated that 1972 export trade in minerals was valued at $214 million, and that mineral imports were valued at $106 million, resulting in a favorable balance of mineral trade of $108 million. Mineral exports amounted to 11% of total exports, by value, and mineral imports were 4% of the total value of imports. Metallic mineral exports accounted for approximately 63% of total mineral exports; nonmetallic minerals accounted for the remainder. As for mineral imports, nonmetallics accounted for about 57%, and metallics the remainder.

In terms of value of metallic mineral exports, four commodities supplied 82%; namely, zinc 28%, copper 24%, and silver and lead, 15% each. Of total nonmetallic mineral exports, fluorite accounted for 52% by value, followed by salt 19%, and sulfur 14%; thus, 85% of nonmetallic mineral exports represented only three commodities. About 60% of metal imports, by value, were made up of iron and steel, followed in order by nickel, aluminum, tin, and others in substantially smaller values. Leading imports of nonmetallic material, by value, were coke 24%, asbestos 16%, coal and phosphates 15%, each, which amounted to 70% of nonmetallic imports.

According to preliminary figures for 1972, of the total value of mineral trade, 54.3% was directed to the United States, and the United States supplied 79% of mineral imports to Mexico.

The following tabulation shows selected commodities in mineral trade as a percentage of total mineral trade for 1971 and 1972:

	1971	1972
EXPORTS		
Metals:		
Zinc	26	28
Silver	27	15
Lead	16	15
Mercury	7	3
Copper	9	24
Other	15	15
Total	100	100
Nonmetals:		
Fluorite	53	52
Sulfur	20	14
Salt	12	19
Other	15	15
Total	100	100
IMPORTS		
Metals:		
Iron	62	60
Tin	11	8
Nickel	13	12
Other	14	20
Total	100	100
Nonmetals:		
Asbestos	18	16
Coal	12	15
Coke	14	24
Phosphates	15	15
Talc	12	3
Potassium compounds	9	8
Other	20	19
Total	100	100

[4] Pages 26-98 of work cited in footnote 2.

Table 3.—Mexico: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide (alumina)	1	1	All to Colombia.
Metal, including alloys, all forms	820	2,912	Argentina 1,350; Colombia 1,194.
Antimony:			
Ore and concentrate, metal content	15,670	8,769	United States 8,553.
Metal, including alloys, all forms	167	259	United States 195; Brazil 64.
Arsenic:			
Oxide, white	6,645	6,040	United States 6,028.
Oxide, black	327	960	All to United States.
Oxide content of speiss and similar materials	--	71	Do.
Bismuth, metal, including alloys, all forms, bismuth content	693	577	United States 325; Panamá 112.
Cadmium:			
Concentrate and speiss, metal content	2	21	All to United States.
Flue dust, metal content	739	777	Do.
Metal	252	136	United States 82; Brazil 53.
Copper:			
Ore and concentrate, metal content	536	60	All to United States.
Copper sulfate	199	282	Brazil 190; United States 92.
Metal, including alloys, all forms	6,570	13,620	United States 6,580; Japan 3,148; Netherlands 1,201.
Gold, troy ounces	2,679	879	All to United States.
Iron and steel:			
Ore and concentrate, metal content	359	8	All to West Germany.
Metal:			
Scrap	2,643	1,481	All to United States.
Steel, primary forms, ingots	115	8,518	United States 8,216.
Semimanufactures	192,790	337,110	United States 306,742.
Lead:			
Ore and concentrate, gross weight	1,579	573	All to United States.
Oxides			
Litharge	32,674	33,625	United States 13,959; Italy 4,508; Netherlands 4,185.
Red lead	8,001	7,205	United States 3,876; Netherlands 614; West Germany 441.
Metal including alloys:			
Antimonial and other bars	10,036	8,974	Netherlands 6,349; Venezuela 1,067.
Refined bars	77,636	67,315	United States 26,298; Italy 20,766.
Semimanufactures	1,173	828	United States 789.
Manganese ore and concentrate, gross weight	24,355	63,075	United States 61,029.
Mercury, 76-pound flasks	35,012	37,003	United States 14,079; Japan 7,616; Netherlands 7,223.
Molybdenum concentrate, metal content	(1)	3	All to United States.
Nickel, metal, including alloys	1	(1)	NA.
Selenium, elemental	32	20	United States 10; Panamá 3; Brazil 3.
Silver, thousand troy ounces	17,262	21,534	Switzerland 9,950; West Germany 6,000; United States 3,630.
Tin metal, semimanufactures, long tons	1	--	
Titanium ore and concentrate, metal content	NA	--	
Tungsten concentrate, metal content	459	522	United Kingdom 317; United States 101.
Zinc:			
Ore and concentrate, gross weight	326,250	270,981	United States 213,770; Japan 41,392.
Oxide, white	5,930	7,499	United States 6,979.
Sulfate	3,249	2,359	United States 2,268.
Metal, including alloys:			
Powder	986	1,143	Argentina 1,080.
Unwrought	38,142	41,914	Brazil 19,892; United States 8,261; Colombia 3,540.
Other metals and metallic residues	800	1,544	All to United States.
NONMETALS			
Abrasives, natural:			
Emery	21	46	Mainly to United States.
Pumice	95	167	United States 164.
Asbestos	11,175	3	Mainly to Canada.
Barite and witherite, thousand tons	117	93	Mainly to United States.
Cement	97,837	159,018	United States 158,936.
Clays and clay products, crude clays, n.e.s.:			
Bentonite	32	225	Guatemala 213.
Fuller's and other earths	6,059	7,320	Brazil 2,062; Peru 2,030; Colombia 857.
Kaolin (china clay)	121	30	Venezuela 21; United Kingdom 6.
Other clays, including refractory	--	154	Peru 64; United States 39; Colombia 35.
Diatomite, infusorial earth, tripoli and chalk	6,246	8,543	United States 1,462.
Feldspar	(1)	14	All to United States.

See footnotes at end of table.

Table 3.—Mexico: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Fertilizer materials:			
Crude, phosphatic	13,182	10,087	Mainly to United States.
Manufactured:			
Nitrogenous, including ammonia and urea	18,891	70,115	Peru 31,308; Nicaragua 10,956; Chile 10,609.
Phosphatic	148,741	99,527	United States 32,636; Poland 30,003; Colombia 12,032.
Potassic	139	265	Guatemala 264.
Other, including mixed	6,951	1,894	Honduras 1,527.
Fluorspar:			
Acid grade	319,347	374,716	United States 373,209.
Metallurgical grade	600,117	719,412	United States 541,834; Canada 167,411.
Graphite, natural	45,696	42,315	United States 42,311.
Gypsum:			
Crude—thousand tons	1,056	1,660	United States 1,065; Japan 388.
Calcined	10	11	United States 5; Guatemala 5.
Lime	79	664	United States 622.
Mica, all forms	4	5	All to United States.
Perlite	654	1,222	Peru 386; Colombia 373 Venezuela 370.
Precious and semiprecious stones, except diamond—kilograms	170	176	Japan 120; West Germany 33.
Salt—thousand tons	3,406	3,365	Japan 2,326; United States 731.
Stone, sand and gravel:			
Dimension stone	8,867	10,492	United States 10,491.
Calcite, industrial	255	--	
Crushed rock	58	21,120	All to United States.
Limestone and dolomite	206	488	United States 478.
Quartz	300	43	All to United States.
Sand and gravel	26,727	475	Mainly to United States.
Strontium minerals	27,537	32,138	All to United States.
Sulfur, elemental, all forms—thousand tons	662	683	United States 444; United Kingdom 143.
Talc, soapstone, and pyrophyllite	16	1	All to Ecuador.
Wollastonite	2,078	1,675	United States 1,644.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural (including gilsonite)	r NA	99	United Kingdom 92.
Carbon black	31	1,136	Costa Rica 1,019; Guatemala 96.
Coal and coke	2	1	All to United States.
Gas, natural—million cubic feet	41,336	23,353	Do.
Petroleum:			
Refinery products:			
Gasoline—thousand 42-gallon barrels	10	--	
Distillate fuel oil—do	41	28	United States 8; Italy 6; Panamá 3.
Gas oil—do	2	2	Mainly to West Germany.
Residual fuel oil—do	18,020	7,745	United States 7,343.
Lubricants—do	r 1	1	Mainly to United States.
Mineral jelly and wax—do	r 9	5	Do.
Asphalt—do	NA	4,894	Do.

r Revised. NA Not available.
1 Less than ½ unit.

Table 4.—Mexico: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	25,514	28,591	All from United States.
Oxide and hydroxide	81,363	90,057	Switzerland 51,385; United States 37,737.
Metal, including alloys, all forms	10,480	4,790	United States 3,667.
Antimony metal and alloys, all forms—kilograms	47	37	United States 23; Italy 14.
Arsenic:			
Trioxide, pentoxides and acids	4	(1)	NA.
Metal, including alloys, all forms	66	62	Mainly from United States.
Beryllium metal and alloys, all forms	47	5	Do.
Bismuth metal alloys, all forms—kilograms	175	2,605	Do.
Cadmium metal and alloys, all forms—do	24	30	All from United States.

See footnotes at end of table.

Table 4.—Mexico: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Chromium:			
Chromite	24,999	38,169	Mainly from United States.
Oxide and hydroxide	430	489	West Germany 150; United States 137; Denmark 103.
Cobalt, oxide and hydroxide	136	90	Belgium-Luxembourg 54; United States 27.
Copper, metal, including alloys:			
Scrap	19	74	Mainly from United States.
Unwrought	13	34	United States 22; United Kingdom 5.
Semimanufactures	859	889	United States 512; West Germany 243.
Gold, metal, unworked or partly worked troy ounces	36,748	48,305	United States 43,178; West Germany 4,018.
Iron and steel:			
Ore and concentrate	184,525	87,444	Mainly from United States.
Metal:			
Scrap	721,698	511,145	United States 510,657.
Pig iron, ferroalloys and similar materials	6,429	9,694	United States 9,099.
Steel, primary forms	79,091	46,739	United States 46,693.
Semimanufactures	192,676	160,299	United States 90,993; Japan 40,020.
Lead:			
Oxides	67	160	Mainly from United States.
Metal, including alloys	143	111	United States 107.
Magnesium, metal, including alloys, all forms	1,434	572	Canada 307; United States 264.
Manganese oxides	2,432	2,014	United States 1,769; Japan 219.
Mercury—76-pound flasks	33	27	United States 14; Netherlands 10.
Molybdenum:			
Ore and concentrate	34	286	Mainly from United States.
Metal, including alloys, all forms	5	44	Do.
Nickel:			
Matte, speiss and similar materials	490	1,151	United States 537; Canada 282; France 249.
Metal, including alloys, all forms	1,130	1,288	United States 844; Canada 264.
Platinum-group metals, including alloys, all forms—troy ounces	6,392	5,825	United States 3,548; Canada 604; West Germany 530.
Selenium, elemental—kilograms	7	9	Mainly from United States.
Silver, metal, including alloys troy ounces	38,604	21,852	West Germany 15,359; United States 4,505.
Tantalum metal, all forms—kilograms	80	72	France 46; United States 26.
Tellurium, elemental—do	943	231	United States 183; Ecuador 48.
Tin:			
Ore and concentrate—long tons	2,512	2,670	United States 2,017; Bolivia 604; Australia 48.
Oxide—do	96	56	United Kingdom 36; United States 14.
Metal, including alloys, all forms do	464	17	United States 12.
Titanium:			
Ore and concentrate	762	956	Australia 569; United States 319.
Oxide	603	232	Mainly from United States.
Slag and residues	25,771	28,073	Canada 28,045.
Tungsten, metal, including alloys, all forms	27	15	Mainly from United States.
Zinc, metal, including alloys, all forms	143	73	West Germany 27; United States 22; Belgium-Luxembourg 11.
Zirconium, ore and concentrate	2,426	2,475	Australia 1,457; United States 1,018.
Other:			
Ore and concentrate, n.e.s	119	3,578	Mainly from United States.
Ash, cinder and other metallurgical residues containing nonferrous metals, n.e.s	535	201	Do.
Metals and alloys, unwrought, n.e.s	307	267	United States 250; Belgium-Luxembourg 16.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	683	830	United States 757; Netherlands 47.
Dust and powder of precious and semi-precious stones except diamond kilograms	3	--	
Grinding and polishing wheels and stones	123	112	United States 83; United Kingdom 21.
Asbestos, crude	40,460	38,470	Canada 21,977; United States 8,146; Republic of South Africa 6,363.
Barite and witherite	95	111	United States 61; West Germany 50.
Boron materials, oxide and acid	1,698	1,397	United States 1,391.

See footnotes at end of table.

Table 4.—Mexico: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Bromine	68	132	United States 76; Israel 5.
Cement	3,103	3,886	United States 3,328; West Germany 440.
Chalk	55	1	All from West Germany.
Clays, crude:			
Fuller's earth	92	155	All from United States.
Kaolin (china clay)	23,317	23,228	United States 22,967.
Refractory	111,424	94,018	United States 92,823; France 1,100.
Other	806	1,444	United States 1,437.
Cryolite	27	49	Denmark 40; United States 9.
Diamond:			
Gem, not set or strung—carats	12,925	25,930	Belgium-Luxembourg 17,410; Netherlands 3,355.
Industrial stones—do	5,450,000	6,160,000	Spain 5,985,000.
Powder and dust—do	220,000	6,235,000	France 4,995,000; United States 1,135,000.
Diatomite	1	3	United States 2; Switzerland 1.
Feldspar and nepheline syenite	1,123	971	United States 898; Canada 73.
Fertilizer materials:			
Crude phosphatic rock	825,001	1,075,213	United States 842,733; Morocco 208,079; Israel 24,400.
Manufactured:			
Nitrogenous	32,751	179,421	Netherlands 45,697; Japan 43,558; United States 43,140.
Phosphatic	13,022	8,719	Mainly from United States.
Potassic	71,678	72,835	United States 68,858; West Germany 3,974.
Mixed	6,790	7,802	Chile 7,486; United States 288; Canada 28.
Fluorspar	--	1	All from United States.
Graphite, natural	215	476	United States 311; Canada 110; Switzerland 55.
Gypsum	20,301	19,161	United States 19,084.
Iodine	58	87	Chile 76.
Lime	5,996	2,996	Mainly from United States.
Magnesite	31,856	8,788	United States 8,511; Spain 223; Brazil 51.
Mica, all forms	266	342	Brazil 177; United States 98; Argentina 66.
Pigments, mineral, including processed iron oxides	333	33	United States 27.
Precious and semiprecious stones, except diamond—kilograms	1,231	925	France 727.
Pyrite, unroasted	163	77	United States 56; West Germany 21.
Salt	623	498	Mainly from United States.
Sodium and potassium compounds:			
Caustic soda	1',215	4,432	United States 4,393; West Germany 17.
Potassium hydroxide	823	922	United States 584; West Germany 179; Belgium-Luxembourg 117.
Stone, sand and gravel:			
Dimension stone, roughly worked	6,478	7,999	Italy 7,122; Guatemala 333; United States 325.
Dolomite, calcined	9	47	All from United States.
Gravel, crushed stone and paving stone	1,134	6,426	United States 6,324.
Sand	182,474	182,426	United States 181,341.
Quartz	259	413	United States 361.
Strontium minerals	80	(1)	NA.
Sulfur	966	942	United States 932.
Talc, soapstone, and pyrophyllite:			
Steatite	67,010	76,136	United States 72,261; Italy 3,441.
Talc	277	225	United States 87; Italy 80; Switzerland 55.
Pyrophyllite	222	283	All from United States.
Vermiculite	630	328	Do.
Other nonmetallic minerals	(1)	(1)	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	1,280	737	United States 736.
Coal, including lignite	153,114	263,216	United States 263,105.
Coke	340,191	68,156	United States 67,939.
Gas, hydrocarbon:			
Natural gas—million cubic feet	14,678	14,261	All from United States.
Natural gas liquids—thousand 42-gallon barrels	8,085	9,696	United States 8,635; Venezuela 817.
Petroleum:			
Crude—do	--	409	All from Venezuela.
Refinery products:			
Gasoline—do	2,378	4,692	Netherlands Antilles 3,903; United States 714.
Kerosine—do	177	588	Panama 384; United States 149.

See footnotes at end of table.

Table 4.—Mexico: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum—Continued			
Refinery Products—Continued			
Distillate fuel oil thousand 42-gallon barrels	2,184	3,778	Netherlands Antilles 1,319; Venezuela 1,016; United States 922.
Residual fuel oil do	1,718	1,998	Mainly from United States.
Lubricants do	313	123	United States 122.
Mineral jelly and wax do	263	141	United States 139.
Other do	1,219	1,795	United States 1,777.
Mineral tar and other coal–, petroleum–, or gas–derived crude chemicals	16,257	17,648	United States 16,415.

NA Not available.
[1] Less than ½ unit.

COMMODITY REVIEW

METALS

Antimony.—Metallurgical tests were completed by Cía. Minera y Refinadora Mexicana, S.A. to up-grade its antimony sulfide ores by means of a heavy-media plant. The feasibility of a 600-ton-per-day heavy-media plant to be installed at Wadley, San Luis Potosí, was being evaluated.

Copper.—Cía. Minera de Cananea, S.A. (which was Mexicanized November 15, 1971), reported record production and profits during its first year operating under Mexican control. The Anaconda Company which owns 49% of the company, furnished technical assistance upon request. Production for 1972 rose 9.4% to 40,300 tons of copper, and value of sales increased 35.7%. The cost of operation decreased 5.5%; payment of income taxes to the Mexican Government increased threefold. A 5-year expansion program was expected to increase production to 70,000 tons of copper by 1976. Reserves at Cananea were put at 1.6 billion tons of ore averaging 0.72% to 0.75% copper.

In what was called "a significant step toward the democratization of capital" the Nacional Financiera, S.A. put 720,000 shares of Cananea stock up for public sale; this represented 12% of the total stock in the company. The stock was to be on sale for 1 month at $8 per share, and no individual could buy more than 60,000 shares (1% of the total stock). In addition to this sale, Cananea workers were given the right to buy up to 3% of the total stock. Employees purchasing shares were allowed to pay for them in interest-free monthly payments over a period of 5 years.

Anaconda owned its 49% interest in shares designated as Series B which can vote only for minority representation on the Board of Directors. The Mexican Government would continue to hold the majority interest in Series A shares, which are voted to elect the majority of the Board.

Lytton Minerals Ltd. completed exploration at its La Verde copper property in Michoacán and was negotiating with the Mexican Government for further rights. Reserves were reported as follows:

	Tons (million)	Copper (percent)	Silver (ounce per ton)	Gold (ounce per ton)
Ore reserves	80	0.697	0.15	0.01
Probable reserves	10	.645	.10	--
Possible reserves	20	.50	--	--

Source: Mining Journal (London). V. 279, No. 7150, Sept. 1, 1972, p. 171.

As a result of a resampling survey, New Taku Mines Ltd. outlined 1.5 million tons of ore at La Verde, Sonora, grading 1.75% copper, and containing 2.5 ounces of silver per ton. New Taku was also negotiating to acquire the Cerro Prieto mine lying 30 miles northeast of La Verde. The Cerro Prieto prospect contained lead, silver, and copper with the ore dumps running 3% zinc. Mina Del Valle, S.A., a Mexican company, would hold the Cerro Prieto mine.

Iron and Steel.—Production of steel advanced from the 1971 total and gained 15% in tonnage over that year. Steel out-

put reached the record level of 4.4 million tons, which is probably very near the national capacity. Mexico produced 29% of Latin America's steel output in 1972. Output of rolled products, pipe, wire, and galvanized sheet also showed considerable gains. Consumption gained to the extent that there was no exportable surplus at yearend. Combined output of pig iron and sponge iron totaled 2,674,000 tons, a gain of 13% over that of 1971.

Of the total crude steel output of 4.4 million tons, Altos Hornos de Mexico (AHMSA) produced 1.8 million tons, or 41%. AHMSA also produced 1.3 million tons of the national pig iron total, or 47%; this production established historic highs for AHMSA in both categories.

Hojalata y Lámina, S.A. (HYLSA), was readying plans for another direct reduction plant of 450,000-ton capacity to be located in Monterrey; eventual capacity could attain 600,000 tons annually. The Export-Import Bank of Washington and the Girard Trust Co. made loans of $2.25 million each to finance 90% of U.S. costs and Mexican sources are expected to supply the remainder. Swindell-Dressler Co. of Pittsburgh had begun construction at yearend. It was reported that the new plant would operate on iron ore pellets from HYLSA's property at Colima. Future imports of scrap, mostly from the United States, would no longer be necessary to HYLSA's operations in Monterrey.

Construction was in progress at the site of the new steel mill, Siderúrgica Lázaro Cárdenas-Las Truchas (SICARTSA). The new complex is located at the mouth of the Balsas River at the town of Melchor Ocampo. It was reported that several thousand workers were clearing ground and building various shops for use in construction of the main plant. British Steel Corp. (BSC) was acting as the technical adviser for the project. BSC was to furnish technical assistance in design, construction, training, and initial operation of the plant. Initial capacity of the plant was planned for 1.5 million tons of steel by 1976. Eventual capacity may attain 10 million tons per year. Financing was being furnished by the World Bank, the Interamerican Development Bank, and various private financial institutions of the international banking community. The Mexican Government was to own 88% of the completed complex, with private capital participating in the remaining 12%.

Iron Ore.—Fundidora de Monterrey, S.A. (formerly known as Cía. Fundidora de Fierro y Acero de Monterrey, S.A.), shipped 1,310,764 tons of iron ore from four mines in 1972; this was an increase of 22% over shipments in 1971. The following tabulation lists 1971 and 1972 shipments, by mine, in tons.

	1971	1972
Durango	804,422	859,146
Hercules	201,005	360,029
El Mamey	43,870	51,704
Zaniza	24,380	39,885
Total	1,073,677	1,310,764

Source: Skillings Mining Review. V. 61, No. 14, Apr. 1, 1972, p. 15; v. 62, No. 12, Mar. 24, 1973, p. 12.

The longest distance that any ore was shipped was from the Zaniza mine in Oaxaca—1,050 miles from Monterrey. Fundidora was studying proposals for an iron ore pelletizing plant to be built in Monterrey to process ore from its mines in Durango and Coahuila. Based on preliminary estimates, the plant would produce about 1.5 million tons of pellets annually for an investment of $30 million. It was reported that Allis-Chalmers Corp. and Arthur G. McKee & Co. were readying final bids for actual construction of the plant.

Under financial reorganization plans, Japanese steel interests took a 14% participation in Fundidora for a total of $15 million. Nippon Steel Corp. contributed $6 million to the combine, and Mitsui & Co. Ltd. and Mitsubishi Metal Corp., $4.5 million each. This, plus other financing, allowed Fundidora to begin expansion of its works to capacity of 1.5 million tons of steel by 1976, and to 2 million tons by 1980.

Las Encinas, S.A., an affiliate of HYLSA, produced 1.3 million tons of iron ore pellets at its plant in the state of Colima, thus reaching productive capacity in the third year of operation. Pellets averaged 66.8% iron and 2.2% silica. Of total output, 506,200 tons and 497,100 tons were shipped to HYLSA plants in Monterrey and Puebla, respectively. The remaining 312,500 tons went to Tubos de Acero de Mexico, S.A., in Vera Cruz.

The U.S. Treasury Department started an investigation as to whether deformed

concrete reinforcing bars made of nonalloy steel were being dumped (sold at less than fair-value) in the United States. The study was still in progress at yearend.

Tungsten.—Tungsten concentrates were produced by various firms in three states of Mexico.[5]

The following tabulation lists the chief producers, by state.

State and firm	Average annual tons W content produced	Approximate percentage of average national output
Sonora:		
Tungsteno de Baviácora, S.A.	143	41
Galas Acosta Lucas	22	6
Cía. Minera Cíbola, S.A. de C.V.	21	6
Martínez Barceló-Santos	17	5
Minerales América, S.A.	16	5
Other	66	19
Chihuahua:		
Cía. Minera La Perla, S.A.	45	12
Baja California:		
Lostanau Martínez Isaias	10	3
Other	10	3
Total	350	100

The following firms had beneficiation plants that produced concentrates containing 65% to 67% WO_3.

Firm and location	Daily capacity (tons)
Tungsteno de Baviácora, S.A.:	
Baviácora, Sonora	100
Cía. Minera Cíbola, S.A. de C.V.:	
La Colorada, Sonora	100
Minerales América, S.A.:	
Sa uaripa, Sonora	80
Cía. Minera La Perla, S.A.:	
Potrero de Bohórques, Sonora	50

The tungsten ore that was being worked contained 0.3% to 1.0% WO_3. National reserves had not been extensively studied, but were estimated at about 172,000 tons averaging 0.5% WO_3. Tungsten was known to occur in other states of Mexico, but deposits were small, and many had not been appraised.

NONMETALS

Cement.—Cementos Veracruz, S.A., was in the process of expanding its cement output from 250,000 tons to 600,000 tons annually. The use of obsolete equipment, which accounted for 100,000 tons per year, was to be discontinued. The plant was located in Orizaba, Veracruz, and was 80% owned by Mexican interests and 20% by Holderbank of Switzerland; the latter firm had a long-term contract to supply Veracruz with technical, engineering, and managerial assistance. Completion of the expansion program was expected in 1974. Total cost, estimated at $23.9 million, was to be supplied as follows: The International Finance Corp., $10.5; Banque Française du Commerce Exterieur, $6.5 million; a wholly owned subsidiary of Cementos Veracruz, $6.9 million.

It was noted that over the last decade, Mexico's annual cement consumption grew at a rate of close to 10%; the future growth was expected to be maintained close to the same rate.

Fluorite.—Met-Mex Peñoles, S.A., and Allied Chemical Corp. completed the expansion of their fluorite mill at Rio Verde, San Luis Potosí. Capacity was raised from 150 tons of concentrate per month to 450 tons per month. Concentrates of both acid and metallurgical grade were produced.[6]

Fluorita de Rio Verde, S.A. was building a mill to produce 36,000 tons of acid grade fluorspar concentrates per year at its mine in Alamos de Martínez, Guanajuato.[7]

Sulfur.—Mexicanization of the sulfur industry was virtually completed when the State Development Bank purchased the outstanding 34% of the stock of Azufrera Panamericana, S.A., for about $10 million. The purchase gave Mexico complete control of the country's principal sulfur-producing company. Azufrera controlled about 75% of domestic production and had 40% of known reserves. Azufrera, and Exploradora del Istmo, S.A., were formerly owned by Pan-American Sulphur Co.

MINERAL FUELS

Petroleum.—Petróleos Mexicanos (Pemex) reported that production of crude oil, condensate, and liquids totaled 185.0 million barrels, a gain of 4% over the production level of 1971. Gas production increased by 2.6% to 660,232 million cubic feet. Reserves of crude oil, condensate, and gas converted to liquid equivalent

[5] Consejo de Recursos Naturales No Renovables. Departamento de Estudios Economicos. Estudio de Mercado del Tungsteno. Mexico, D. F., 1973, pp. 1-6.

[6] World Mining. V. 8, No. 9, August 1972, p. 99.

[7] Industrial Minerals. No. 59, August 1972, p. 44.

were 5.4 billion barrels at December 31, 1972, a net loss of 40.5 million barrels. The reserve represents nearly 18 years requirement at the present rate of production.

The following tabulation presents salient statistics for Pemex during 1972:

Production:	
Crude oil—million barrels	161.3
Natural gas liquids—do	23.7
Gas—million cubic feet	660,232
Petrochemicals—million tons	2.3
Reserves—billion barrels	5.4
Refinery capacity barrels per day throughput	625,000
Refinery output—million barrels per year	193.4
Imports:	
Crude oil—million barrels	11.5
Diesel fuel—do	2.6
Employees	69,000
Tanker fleet:	
Number of ships	21
Deadweight tons, total	362,846
Capacity—million barrels	2.7
Pipelines billion tons per kilometer per year	15.3
Highway tank trucks, all rented	936
Railway tank cars [1]	1,163
Airplanes	20
Helicopters	14

[1] Additional 2,217 rented by Pemex.

Pemex continued its planned investment at the Tula refinery, which was to lead to total expenditure of about $168 million by 1976. This figure included housing for the workers and rail and highway connections to main transportation arteries. Other refinery additions were in progress at Ciudad Madero, Salamanca, and Minatitlán.

Pemex drilled 143 exploration tests and 288 development wells; of the total 431 wells drilled, 171 were unproductive. The 431 wells drilled in 1972, compared with 516 drilled in 1971; average depth per well in 1972 was 2,637 meters and 2,552 meters in 1971.

Significant new discoveries were made in Chiapas. Sitio Grande No. 1 was located 6 kilometers south-southeast of Reforma. Cactus No. 1, the second discovery, was located 3 kilometers north-northeast of Reforma. The discoveries produced a total of 3,500 barrels of oil per day, with some gas. Production was from a Cretaceous limestone, which heretofore had not been found to be productive in the Southern Zone. Other valuable discoveries were made in the states of Taumalipas, Vera Cruz, and Oaxaca.

During 1972 Pemex had 70 exploration parties in the field. These parties included 23 devoted a seismograph work and 22 and 17 doing surface and subsurface geology, respectively; the remaining parties were made up of gravity, magnetometer, and magnetometer-gravitymeter crews. In addition, there were five offshore exploration crews active. Exploration was carried out in 18 states.

In order to better appraise the growing volume of geophysical data, the Digital Computer Center was established in the Institute of Mexican Petroleum. Analog processing centers were active in Reynosa, Tampico, Poza Rica, and Coatzacoalcos. In addition, a special group was established to study and interpret geologic conditions under which petroleum source beds and reservoir rocks might have been deposited in Mexico. Such knowledge was considered indispensable to successful petroleum exploration.

The Mineral Industry of Morocco

By Ted C. Briggs [1]

The mineral industry in general and the phosphate rock industry in particular were major sources of foreign exchange for Morocco in 1972. Mineral production, led by a 25% gain in phosphate rock production, recovered somewhat from the stagnation of recent years. Prices of nonferrous metals strengthened in 1972 and the production of a number of minerals, in addition to phosphate rock, also increased.

The movement of minerals under the control of the Bureau de Recherches et de Participations Minières (BRPM), which was concerned with the production and role of minerals other than phosphate rock, was up 20%. The production and sales of phosphate rock were handled as a Government monopoly by the Office Chérifien des Phosphates (OCP) which was founded in 1920. The Moroccan Minister of Finance predicted further increases in mineral production, especially output of iron ore and development of new copper, fluorite, and lead mines.

The BRPM was still receiving requests from petroleum companies for petroleum concessions on both land and offshore. Most of the area immediately offshore on the Atlantic side was already covered by concessions, but concessions were available in the area farther out in the Atlantic and off the Mediterranean Coast. None of the petroleum exploration conducted during 1972 appeared to have been successful, and there was a gradual decline in Morocco's already insignificant petroleum production.

In 1972 Morocco's international monetary reserves reached the highest level since independence. Overall, exports were up by 16% in value over those of 1971 and minerals, especially phosphate rock, accounted for a significant part of the increase. It was estimated that in 1972 Morocco achieved a 4.9% rate of growth in its gross domestic product, and the average annual growth rate was about 5% for the 1968–72 Economic Development Plan. This growth rate was considerably higher than the 4.3% average annual rate which was originally projected for the plan and was well above the 3.4% average annual growth rate during the 1960–67 period. A new Economic Development Plan was scheduled to be announced in May 1973. In the new plan, highest priority was to be given to industries utilizing a large percentage of labor in order to lower the growing unemployment in Morocco. Morocco was expected to be less interested in advanced technology and was expected to give priority to simple machinery employing a large amount of labor. Morocco was also expected to give priority to industries producing commodities for export.

Continued investment was expected in the construction industries, especially in the cement industry, if domestic demand is to be met. Domestic production of cement rose by only 5% in 1972, while consumption expanded approximately 12.5%. Substantial increases in imports into Morocco of mining and earthmoving equipment were predicted for the next 5 years. Increased mining activities could increase Moroccan imports of electric and diesel locomotives and other rolling stock. Electric power production, stimulated by strong demand from the minerals sector, grew by almost 13% in 1972. Morocco had adequate electric power at yearend, but the Office National d'Electricité was expected to invest in additional facilities under the next plan.

The preparation of a new Moroccan investment code had been under consideration for several months and was reportedly nearing completion. The new code was ex-

[1] Chemist, Division of Nonmetallic Minerals.

Table 1.—Morocco: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Antimony concentrate:			
Gross weight	4,328	4,266	4,476
Metal content	[r] 1,948	1,920	2,014
Cobalt concentrate:			
Gross weight	6,039	9,777	11,444
Metal content	604	978	1,144
Copper:			
Concentrate:			
Gross weight	[r] 12,194	15,111	13,612
Metal content	2,873	3,150	3,212
Matte (byproduct of lead smelter)	201	198	--
Iron ore, direct shipping, gross weight, thousand tons	872	623	234
Lead:			
Concentrate:			
Gross weight	120,911	122,630	[e] 137,472
Metal content	73,063	74,069	90,000
Smelter, primary	24,901	18,716	--
Manganese ore, chemical grade	112,376	101,456	[e] 83,120
Nickel:			
Content of cobalt ore	121	100	200
Content of nickel ore	17	--	--
Total	138	100	200
Silver: [2]			
Imiter, thousand troy ounces	NA	809	[e] 865
Other [e] [3], do	681	746	818
Total, do	681	1,555	[e] 1,683
Tin:			
Concentrate:			
Gross weight, long tons	26	12	11
Metal content, do	17	8	7
Smelter, primary [e], do	12	8	7
Zinc concentrate:			
Gross weight	31,871	22,015	36,700
Metal content	18,074	12,483	[e] 18,360
NONMETALS			
Barite	84,750	84,474	[e] 92,952
Cement, thousand tons	[r] 1,405	1,475	1,542
Clays, crude:			
Bentonite	6,486	3,801	[e] 4,000
Smectite	11,364	14,253	[e] 14,868
Other, including fuller's earth	8,200	4,880	[e] 7,128
Fertilizer materials: Crude, natural, phosphate rock, thousand tons	11,399	12,008	[e] 15,034
Goethite	36	37	[e] 11
Pigments, mineral, ocher	510	--	--
Pyrrhotite:			
Gross weight	291,041	440,549	421,100
Sulfur content	87,312	132,165	126,330
Salt, all types	57,075	53,102	[e] 15,312
Talc	226	--	--
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite, thousand tons	433	475	547
Briquets, do	[r] 17	21	17
Gas, natural, marketed, million cubic feet	1,539	1,680	[e] 1,880
Petroleum:			
Crude oil, thousand 42-gallon barrels	335	172	[e] 187
Refinery products:			
Gasoline, do	2,581	2,895	NA
Jet fuel, do	[r] 285	536	
Kerosine, do	[r] 649	333	
Distillate fuel oil, do	3,352	2,941	
Residual fuel oil, do	3,082	3,178	
Other, do	[r] 710	992	
Refinery fuel and losses, do	[r] 622	1,444	
Total, do	[r] 11,281	12,319	NA

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

[1] In addition to the commodities listed, Morocco also produces manufactured phosphatic fertilizers, fluorspar, and a variety of crude construction materials, but available information is inadequate to make a reliable estimate of output levels.

[2] Silver production has been separated into two elements; that produced from wastes at the old Imiter mine (which has not been reported in previous editions of this chapter) and other silver output (which has been reported previously).

[3] Content of domestically processed and exported lead concentrates.

pected to simplify investment procedures, reduce arbitrary decisions, and make granting of fiscal incentives more automatic. In the meantime, a variety of fiscal incentives were being granted to investors under the existing code.[2]

PRODUCTION

Production of phosphate rock rose significantly in 1972 and sales rose proportionately. Most of the work outlined in the Moroccan 5-year plan (1968–72) for phosphate rock production facilities was completed. The plan called for the investment of about $145 million [3] for the modernization and expansion of production capacity to 18 million tons per year of phosphate rock.

Anthracite production was also up significantly, but long-range production goals were reduced to 900,000 tons in 1975 rather than 1.1 million tons as previously projected. Future coal production will not be sufficient to keep up with rising demand, and Moroccan plans now call for part of the powerplants, and possibly some cement plants, to shift from coal to fuel oil.

The two crude oil-producing areas, in the Rharb and near Essaouira, were both expected to cease production in 1973 due to complete exhaustion of the crude oil reserves. Output of natural gas rose with new production of natural gas from the Douar Jabar field.

Iron ore production dropped sharply because of the declining quality of the ore which was mined from marginal deposits. There was no forward movement during the year on the proposal to build a small steel mill at Nador.

Lead production increased as the Zeida lead mine began operation in January and production was projected at about 33,000 tons per year of 70% concentrate. The Zeida mine had reserves of at least 12 million tons of 3 percent ore, including 180 grams of silver per ton. The Touissit lead mine was to suspend operations at the beginning of 1973 when complete exhaustion of its present deposit was expected to occur. The recent discovery of a new deposit of ore containing 7.8% lead will enable the Touissit mine to resume lead production in 1974 or 1975 at about the 1972 rate.

Copper production rose and future production could increase significantly with the opening of new mines. The rate of future increases in copper production will depend on the international price of copper, as a number of economically marginal deposits were known to exist.

Manganese production declined because of limited marketing possibilities. Virtually all of Morocco's manganese output came from the Imini mine and there were no plans to expand or add facilities.

Cobalt production increased significantly from a new vein discovered by Soviet geologists. Proven reserves were enough for 3 or 4 more years of production.

Antimony and barite production increased 5% and 10%, respectively; while pyrrhotite production decreased 5%.

TRADE

Phosphate rock was the major mineral commodity exported from Morocco and in 1971 exports of phosphate rock reached 11.9 million tons, an increase of 3% over the 1970 exports. Iron ore was second to phosphate rock in tonnage exported, but the amount exported in 1971 plummeted by 43% from 1970 exports.

Barite exports increased by 24%, antimony ore and concentrates exports increased by 20%, and lead ore exports increased by 13% in 1971. Coal and coke exports declined by 21% and zinc ore exports declined by 48% in 1971.

As in past years, the most significant mineral imports into Morocco in 1971 were petroleum and nitrogenous and potassic fertilizers.

[2] U.S. Embassy, Rabat, Morocco. State Department Airgram A–21, Feb. 14, 1973, 10 pp.

[3] Where necessary, values have been converted from Moroccan Dirhams (MD's) to U.S. dollars at the rate of MD's 4.66=US$1.00.

Table 2.—Morocco: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, metal, including alloys, all forms	r 491	816	France 418; Italy 158; Portugal 89.
Antimony, ore and concentrate	3,383	4,070	France 1,098; Belgium-Luxembourg 918; United States 630.
Chromium, chromite	13	--	
Cobalt, ore and concentrate	8,750	4,750	All to France.
Copper:			
Ore and concentrate	9,127	12,323	West Germany 5,817; Belgium-Luxembourg 3,302; People's Republic of China 3,000.
Scrap, including alloys	1,342	1,043	France 501; West Germany 325; Italy 143.
Iron and steel:			
Ore and concentrate—thousand tons	801	457	West Germany 167; Czechoslovakia 126; United Kingdom 86.
Roasted pyrites	238	60	All to France.
Metal:			
Scrap	43,393	30,775	People's Republic of China 9,800; Italy 9,329; Portugal 3,280.
Semimanufactures	r 2,053	10	France 5.
Lead:			
Ore and concentrate	75,224	85,014	France 42,072; West Germany 8,097; Hungary 7,974.
Crude, unalloyed	22,562	16,071	France 12,278; Arab Republic of Egypt 2,994.
Manganese, ore and concentrate	115,455	91,787	United States 21,844; France 20,468; Netherlands 18,604.
Nickel, including alloys, all forms	133	60	Algeria 56; Libya 4.
Silver, all forms—troy ounces	567,209	492,976	All to France.
Tin, all forms—long tons	5	7	France 3; Senegal 2.
Zinc:			
Ore and concentrate	37,501	19,456	Belgium-Luxembourg 7,534; France 5,573; Italy 3,700.
Metal scrap	22	23	All to France.
Other:			
Ore and concentrate	6,575	16,128	Mainly to France.
Ash, slags and residues	2,360	848	France 430; Italy 352
Oxides	3	3	Algeria 2.
NONMETALS			
Abrasives, grinding and polishing wheels and stones	(1)	--	
Barite	70,792	87,477	United Kingdom 48,440; United States 24,384.
Cement	12,732	452	NA.
Clays and clay products (including refractory brick):			
Bentonite	533	288	Ship stores 178; United Kingdom 110.
Fuller's earth	4,220	2,899	Tunisia 2,042; Algeria 854.
Refractory	3,726	2,456	NA.
Smectic	8,828	9,520	Spain 6,306; France 3,000.
Other	220	--	
Fertilizer materials:			
Crude, phosphatic—thousand tons	11,537	11,868	France 1,501; Spain 1,422; United Kingdom 1,170; Belgium-Luxembourg 1,066.
Manufactured:			
Phosphatic—do	105	197	Bulgaria 50; France 44; Algeria 35; Cuba 34.
Potassic	(1)	--	
Other, including mixed	14,793	61,312	France 23,426; Turkey 15,772; Cuba 7,028.
Fluorspar	10	8	France 5; West Germany 3.
Gypsum and plasters	104,659	105,762	Japan 60,100; Portugal 24,210; Uruguay 8,800.
Lime	320	172	NA.
Pigments, mineral, including processed iron oxides	66	--	
Salt and brine	3,061	160	All to ship stores.
Sodium and potassium compounds, n.e.s.	234	22	Ship stores 16; United States 5.
Stone, sand and gravel:			
Dimension, crude and partly worked	r 6,436	4,237	Italy 2,444; Belgium-Luxembourg 1,072; West Germany 531.
Gravel and crushed rock	32,227	38,245	NA.
Sand, excluding metal bearing	26,477	29,047	NA.
Quartz and quartzite	5	20	West Germany 16; France 4
Sulfur, elemental, all forms	134	83	All to France.
Other nonmetals, n.e.s. ash and slag	11	--	

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	59,979	47,397	Algeria 21,807; Italy 13,150; France 8,500.
Petroleum refinery products:			
Gasoline (including natural) 42-gallon barrels	r 54,334	12,915	All to ship stores.
Kerosine and jet fuels do	r 26,302	77,741	Do.
Distillate fuel oils do	r 31,969	25,526	Mainly to ship stores.
Residual fuel oils do	3	3	All to ship stores.
Lubricants do	2	2	Mainly to ship stores.
LPG gases do	789	852	All to Gibraltar.
Other do	21	9	All to ship stores.

r Revised. NA Not available.
1 Less than ½ unit.

Table 3.—Morocco: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Ore (bauxite) and concentrate	489	2,070
Oxide and hydroxide	r 728	774
Metal, including alloys, all forms	3,478	2,934
Antimony, metal, all forms including alloys	5	5
Arsenic:		
Natural sulfides	1	--
Trioxides, pentoxides and acids	16	16
Metal, including alloys, all forms	(1)	(1)
Bismuth, crude kilograms	102	93
Cadmium, metal, all forms do	511	205
Chromium:		
Oxide and hydroxide	14	7
Metal, including alloys, all forms kilograms	48	153
Copper:		
Matte	--	3
Copper sulfate kilograms	512	335
Metal, including alloys, all forms	r 3,472	2,889
Gold, metal, including alloys troy ounces	2,120	1,327
Iron and steel:		
Roasted pyrites	1,250	--
Metal:		
Scrap	1	30
Pig iron, ferroalloys, etc	2,528	1,449
Semimanufactures	28,121	17,488
Lead, metal:		
Unwrought	8	225
Semimanufactures	87	136
Magnesium, metal, including alloys, all forms	r 1	214
Manganese, oxides and dioxides	107	127
Mercury 76-pound flasks	r 58	87
Molybdenum, all forms, including alloys kilograms	328	32
Nickel:		
Scrap	4	5
Unwrought	3	18
Semimanufactures	408	586
Platinum-group metals, including alloys, all forms troy ounces	28	(1)
Silver, metal, including alloys do	12,524	9,331
Tin, metal, all forms long tons	227	293
Titanium oxides	659	736
Zinc:		
Oxides	608	483
Metal:		
Unwrought	782	1,084
Blue powder kilograms	r 64	193
All forms, including alloys	439	197
Other n.e.s.:		
Ash and residue of metals, n.e.s	--	17
Oxides, hydroxides, etc. of metals, n.e.s	r 44	10
Metals, including alloys, all forms 2 kilograms	r 491	202

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS			
Abrasives, natural n.e.s		r 378	404
Asbestos		3,551	3,638
Barite		3	1
Boron materials:			
Crude natural borates		1,321	1,150
Oxide and acid		5	9
Cement		35,362	102,705
Chalk		2,717	3,265
Clays and clay products:			
Crude clays:			
Bentonite		(1)	1
Fuller's earth		r 34	14
Kaolin and refractory		12,169	15,447
Kyanite and sillimanite		26	20
Smectic		4,068	6,459
Others		370	18
Cryolite and chiolites		10	--
Diatomite and other infusorial earths		678	421
Feldspar		113	274
Fertilizer and fertilizer materials:			
Crude and manufactured:			
Nitrogenous		67,485	111,134
Potassic		31,562	37,892
Mixed		7,160	1,667
Ammonia		13,518	14,921
Graphite, natural		12	4
Lime		765	279
Magnesite		113	271
Mica:			
Crude, including splittings and waste		27	21
Worked including agglomerated splittings		2	1
Pigments, mineral, including processed iron oxides:			
Natural		998	554
Iron oxides, processed		r 458	570
Precious and semiprecious stones (except diamond)	kilograms	489	963
Salt		30	49
Sodium and potassium, n.e.s		10,577	6,252
Stone, sand and gravel:			
Dimension stone		1,233	828
Dolomite		1,030	1,106
Gravel and crushed rock		71	509
Quartz and quartzite		26	105
Sand, excluding metal bearing		r 17,623	13,858
Sulfur:			
Elemental		r 6,742	361
Sulfur dioxide		50	100
Sulfuric acid		40	28
Talc, steatite, soapstone, pyrophyllite		1,097	1,324
Other n.e.s., oxides and hydroxides of strontium, magnesium, barium		r 16	18
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		10	80
Gas carbon		2,061	1,878
Coal and coke, including briquets		65,343	67,100
Hydrogen, helium and rare gases		13	12
Peat, including peat briquets and litter		33	1,079
Petroleum:			
Crude	thousand 42-gallon barrels	r 11,307	12,175
Refinery products:			
Gasoline	do	60	39
Kerosine and jet fuel	do	r 398	232
Distillate fuel oil	do	254	489
Residual fuel oil	do	573	1,089
Lubricants	do	196	181
Other:			
Liquefied petroleum gas	do	331	533
Asphalt and bitumen	do	r 5	7
Mineral jelly and waxes	do	120	143
Other	do	r 2	2

r Revised.
[1] Less than ½ unit.
[2] Includes tungsten, tantalum, and rare-earth metals.

COMMODITY REVIEW

METALS

Copper.—A Moroccan and Romanian joint venture for exploitation of the Talaat N'Ouamane and Ouansimi copper ore deposits in southern Morocco was at the construction stage. Reserves totaled 3 million tons of ore which contained about 2% copper. Production, which was scheduled to start in 1972 or 1973, was scheduled to reach 15,000 tons per year of copper concentrate containing 25 to 30% copper. A Moroccan and French joint venture was expected to exploit the Oumjerane copper deposit at a substantial rate within the next few years. The Oumjerane deposit consisted of about 2.6 million tons of ore which contained 2.7 percent copper. The Bleïda copper ore deposits, with several million tons of ore containing 2.5% copper, were still under study by international mining companies. The Bou Kerzia copper ore deposit, however, was reportedly dropped from consideration by the Japanese firm, Nittetsu Mining Co. Ltd.[4]

Iron Ore.—More than 100 Soviet experts arrived to conduct prospecting and development work in northern Morocco. Some of the Soviets were to prospect along the northern coast of Morocco, but main attention was to be focused on the iron ore mines at Uixan, about 30 miles from the Spanish-controlled port of Melilla on the Moroccan northern coast. The mines were formerly owned and operated by Cia. Española de Minas del Rif which had to stop all operations when the Moroccan Government took over the Uixan mines. Since then, the iron ore shipments via Melilla, where Minas del Rif operated an ore-loading pier, have declined from about 1.5 million tons in 1960 to 420,000 tons. The Soviet experts were looking into the possibility of building a new ore-loading pier near Nador, on Moroccan soil, in order to make future production less dependent on Melilla. Reportedly, the Soviets offered to finance the construction of a port for the dispatch, in addition to the Uixan ores, of ores and general dry cargo from other northern Moroccan regions. The Moroccans were also negotiating with the Soviets for setting up a pelletizing plant and a steel plant near Uixan.[5]

Iron ore production has declined in recent years but was expected to pick up again when an iron ore pelletization plant at Nador is completed. Morocco and Algeria announced an agreement on the joint exploitation of iron ore deposits at Gara Djebilet near Tindouf, Algeria. It appeared that a railway would be constructed from the mines to Morocco's Atlantic coast to transport the ore.[6]

Tin.—Morocco's tin production was estimated by the International Tin Council at only 1 long ton per month from the small open pit mine of El Karit, near Oulmes, at the foot of the Middle Atlas mountains. The mine was worked by the Sociètè de Mines d'Étain d'Oulmes.[7]

NONMETALS

Fertilizer Materials.—Dorr-Oliver, Inc., announced it had received a contract to design and construct a new phosphate rock calcination plant in Morocco. The new plant was to be constructed for the Youssoufia mine. The plant was to include a Dorr-Oliver calciner designed for 60 tons per hour of product. The unit will have five compartments instead of the conventional three in order to maximize heat recovery, as the cost of fuel is high in Morocco. The project was scheduled for completion early in 1974. The Export-Import Bank of the United States was to finance 90% of the United States dollar portion of the contract.[8]

According to information from West Germany, an agreement in principle was concluded between a West German group and a Polish firm to construct a plant in Morocco for the production of phosphoric acid and monoammonium phosphate. This was to be one of Morocco's largest industrial projects and was to be financed by World Bank and West German credits. This was the first time a Polish firm had been associated with a West German group. The Polish company had already

[4] U.S. Embassy, Rabat, Morrocco. State Department Airgram A-125, May 6, 1972, p. 7.
[5] World Mining. Morocco. V. 8, No. 2, February 1972, p. 54.
[6] U.S. Embassy, Rabat, Morocco. State Department Airgram A-189, Aug. 12, 1972, p. 7.
[7] Mining Magazine. Moroccan Tin. V. 127, No. 3, September 1972, p. 283.
[8] Engineering and Mining Journal. Morocco. V. 174, No. 1, January 1973, p. 147.

been charged with the construction and financing of an additional sulfuric acid plant.[9]

According to OCP the Safis fertilizer complex produced 383,930 tons of sulfuric acid and 112,607 tons of phosphoric acid in 1971, compared with 247,010 tons of sulfuric acid and 76,528 tons of phosphoric acid in 1970. The fertilizer complex produced 203,763 tons of triple superphosphate, 42,768 tons of diammonium phosphate, and 50,195 tons of ammonium sulfate and ammonium phosphate mixture in 1971, against totals of 126,377 tons, 36,514 tons, and 32,878 tons, respectively, in the preceding year.

Of these quantities, Morocco consumed 9,086 tons of triple superphosphate, 410 tons of diammonium phosphate, and 49,343 tons of ammonium sulfate ammonium phosphate mixture. Algeria, Iran, Cuba, Italy, and Kenya were the major export markets for the balance.[10]

Despite a 70-day strike by miners at Khouribga late in 1971, phosphate rock production totaled 12 million tons or 5.3% above that of 1970. Morocco continued to be the world's leading phosphate rock exporting country in 1971, as 11.9 million tons was exported. France, Spain, Belgium, the United Kingdom, and Poland each imported between 1 and 1.5 million tons of Moroccan phosphate rock.

Moroccan phosphate rock production was divided between the Khouribga area which included Khouribga, Beni Idir, Sidi Daoui, and Meraa el-Arech, and Youssoufia. Underground mining was being progressively mechanized, especially at Youssoufia, and open pit operations at Sidi Daoui and Meraa el-Arech were greatly expanded. Extensive investment in equipment such as draglines, power shovels, trucks, and conveyor belts resulted in open pit mining accounting for two-thirds of total output. Increased open pit output was planned.

Processing facilities in the Khouribga area were being expanded to beneficiate a second layer of phosphate rock which contained 69 to 72% tricalcium phosphate equivalent and would not otherwise be marketable. Some 4 million tons of ore mined from the second layer of phosphate rock, in the process of mining the first layer, was stockpiled pending completion of the beneficiation facilities.

A 3-million-ton-per-year washing plant was to be completed late in 1972 to upgrade, to 75% tricalcium phosphate equivalent, the ore in the second layer at Sidi Daoui. A 400,000-ton-per-year calcination plant, which was to be completed by the end of 1972, was under construction at Beni Idir, and a 300,000-ton-per-year dry enrichment plant was virtually completed. The calcinator would raise the concentration of the ore from the second layer at Meraa el-Arech to 78% tricalcium phosphate equivalent, and dry enrichment would raise the concentration to 72%.

A contract to construct a 420,000-ton-per-year calcination plant at Youssoufia had been agreed upon. The plant was to calcine phosphate rock, which included considerable organic material, raising the tricalcium phosphate equivalent of the rock from 67% to about 75%. Additional capacity was to be installed if the project proved profitable. Production from Youssoufia, which had declined in 1970, was increased in 1971 to offset reduced output at Khouribga caused by the strike.[11]

Marble.—The Zellidja Mining Company took over several small marble quarries in Morocco which it was going to try to develop. Morocco has a great deal of high-quality marble and has numerous quarries in the Atlas region as well as around Rabat and Casablanca. Zellidja planned to export its production to Europe, particularly France.[12]

MINERAL FUELS

Petroleum.—The new Cherifienne Petroleum Company refining units were inaugurated at Sidi Kacem. Operation of the new units was to raise the refinery's total capacity to 1 million tons of petroleum annually by 1973 as compared with the 1972 capacity of 400,000 tons. The processing capacity for Moroccan refineries, Mohammedia and Sidi Kacem, will thus be raised to 3.5 million tons by 1973, which will supply the Moroccan market for hydrocarbons until 1976, at which time the two refiner-

[9] U.S. Department of Commerce. Translations on Africa. No. 1278, JPRS 58450, Mar. 12, 1973, p. 35.
[10] European Chemical News. Morocco Boosts Fertilizers in 1971. V. 21, No. 527, Apr. 7, 1972, p. 6.
[11] U.S. Bureau of Mines. Mineral Trade Notes. V. 69, No. 8, August 1972, pp. 20–21.
[12] U.S. Department of Commerce. Translations on Africa. No. 1243, JPRS 57774, Dec. 14, 1972, p. 42.

ies will have to be expanded again, or a third refinery will have to be built.[13]

BRPM and the American Petrofina Exploration Company (APEX), which were linked by an agreement on oil research and development concerned especially with concessions in the Rharb area, signed a contract with Aquitaine Maroc and another company on August 25, 1972. The new agreement provided for a comprehensive program of projects to be carried out in two precisely defined areas of the Rharb concessions. The program involved deep deposits and would require considerable investment. The involvement of new partners, who would be responsible for all of the research cost, did not affect the extent of BRPM participation, which remained at 50%. The BRPM was linked with a number of international oil companies and was conducting a country-wide program of prospecting, including seismological surveying and drilling, both at offshore sites along the Atlantic coast off Tarfaya, Sidi Ifni, Sous, Safi and Oualidia, to be followed by Rabat, Larache and Tangier, and on land. On land, the project was concentrated in the Rharb area, where three drill holes were started and gas had been detected, and in the Doukkala and in Guercif, where seismological surveys had determined sites for drilling. Also, surveying and drilling at medium depth were in progress in the plains of Beni Mellal and Boujad. The BRPM was also negotiating with other companies regarding offshore prospecting in the Atlantic and the Mediterranean.[14]

[13] U.S. Department of Commerce. Translations on Africa. No. 1229, JPRS 17341, Oct. 25, 1972, p. 9.

[14] British Broadcasting Corporation. Summary of World Broadcasts. Part 4, The Middle East and Africa. Weekly Economic Report. Sept. 5, 1972, p. ME/W689/A1/5.

The Mineral Industry of the Netherlands

By Norman A. Matthews [1]

The foreign trade of the Netherlands showed a surplus during 1972 for the first time in recent years, promoted by a 12% growth in exports and a modest (4%) increase in imports compared with 1971 figures. The gross national product (GNP) increased a strong 12% at current prices but only 3.5% at 1970 prices, reflecting the marked inflationary trend of wages and prices. Because of government efforts to curb inf .tion and a poor-investment and profit climate, several major industrial expansion programs in the petroleum, chemical, and metallurgical industries were delayed or abandoned. Strong environmental issues also have been raised which have delayed plant location decisions and construction authorizations in the overcrowded industrial triangle bounded by Amsterdam, Rotterdam, and The Hague.

There is increasing concern on the part of the Netherlands public regarding the quality of the environment. The Government is establishing a comprehensive system of water-monitoring stations on rivers and canals and, with the Governments of Belgium and West Germany, a network of air-quality monitoring stations. Such concern for air and water quality in the overcrowded industrial sectors has been voiced that selective investment taxes were proposed by the Government to encourage industrial expansion inland in areas relatively devoid of industry and with relatively high unemployment.

Expansion of petroleum refining and natural gas production and exports from the Groningen fields continued to lead the industrial economy, which experienced an 8% overall growth in 1972 over that of 1971. Closure of coal mines continued on a planned schedule with utilities and industrial and commercial establishments converting to natural gas as a more economical and cleaner fuel. Natural gas sales increased 33% over those of 1971 with 57% consumed domestically and the remainder exported to the adjacent European Community (EC) partners, West Germany, Belgium-Luxembourg, and France.

Steel production increased 10% in 1972 compared with that of 1971 and ability to serve Western European markets was strengthened by the merger of the Netherland's Hoogovens with the West German firm Hoesch A.G. to form Estel N.V. Hoesch-Hoogovens (ESTEL). ESTEL became Europe's third largest steelmaker with a 12-million-ton annual capacity and one of the lowest cost operations in Western Europe The Netherlands became a net exporter of steel for the first time in its recent history.

The poor investment climate forced delays in expansion or modernization in the oil refining, steel, and shipbuilding industries to such a degree that the industrial construction activity index declined in 1972 compared to 1971.

Export volume increased compared to that of 1971 in most product categories except nonferrous metals. Foremost in export monetary value were agricultural products, natural gas, petroleum products, chemicals, steel products, instruments, and electrical machinery. The decline in investment spending in 1972 reduced U.S. share of exports to the Netherlands to 8% since traditionally capital goods constitute most of the import trade from the United States.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

PRODUCTION

Production of most mineral commodities increased significantly in 1972 compared with that of 1971, particularly production of petroleum and petrochemical products and of natural gas. Production of coal and fuel briquets declined 22% as the planned closing of mines continued on schedule. Production of steel products reached an alltime high of over 5 million tons (a 10% increase over that of 1971). Primary aluminum production increased 43% to about 166,000 tons as a new pot line came into production. Production of rolled aluminum products increased 28% to 77,000 tons. Production of copper and copper alloy ingots declined marginally, and production of copper and copper alloy semimanufactures declined about 6%. Primary lead, and lead products production declined to 22,000 and 15,800 tons, respectively.

In nonmetallic minerals, cement production decreased 1% compared with that of 1971. The chemical and chemical products industry continued its dynamic growth as exemplified by plastic raw materials and products, an increase of 18%; synthetic

Table 1.—Netherlands: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum metal primary	75,148	116,387	166,353
Cadmium metal [e]	120	120	120
Iron and steel:			
Sintered ore (from imported ore)—thousand tons	3,191	3,289	3,642
Pig iron including blast furnace ferroalloys—do	3,594	3,760	4,289
Crude steel—do	5,042	5,083	5,585
Semimanufactures—do	4,006	4,429	5,077
Lead metal primary	17,613	23,743	21,981
Tin metal primary—long tons	[r] 5,843	824	--
Zinc metal primary	46,223	41,400	50,300
NONMETALS			
Cement—thousand tons	3,830	4,045	4,023
Fertilizer materials, manufactured:			
Nitrogenous, nitrogen content—do	809	991	--
Phosphatic, phosphorus pentoxide content—do	249	280	--
Salt, all types—do	[r] 2,871	3,167	2,803
Sand, industrial—do	21,559	4,200	23,500
Sulfur:			
Elemental byproduct	33,200	33,500	[e] 34,000
Sulfuric acid (100 % H_2SO_4)—thousand tons	587	559	556
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	86,000	92,500	93,400
Coal, anthracite and bituminous—thousand tons	4,334	3,609	2,811
Coke, coke oven—do	1,997	1,900	1,994
Fuel briquets, all grades—do	886	585	465
Gas:			
Manufactured, all types [2]—million cubic feet	72,293	74,479	82,426
Natural:			
Gross production—do	1,118,304	1,546,669	2,063,073
Marketable—do	1,107,427	1,536,499	2,052,443
Peat [e]—thousand tons	400	400	400
Petroleum:			
Crude oil—thousand 42-gallon barrels	13,080	11,727	10,885
Refinery products:			
Aviation gasoline—do	1,967	2,011	1,958
Motor gasoline—do	39,228	41,081	44,965
Jet fuel—do	16,440	17,544	24,896
Kerosine—do	9,300	9,602	9,757
Distillate fuel oil—do	127,827	126,246	145,664
Residual fuel oil—do	169,430	157,016	177,163
Lubricants—do	3,297	3,906	3,346
Bitumen—do	4,818	5,618	5,909
Liquefied petroleum gas—do	8,166	9,106	9,953
Other—do	47,202	50,727	61,158
Refinery fuel and losses—do	35,571	31,642	34,129
Total—do	463,246	454,499	518,898

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

[1] In addition to the commodities listed the Netherlands presumably produces a variety of crude construction materials such as (clays, stone, sand, and gravel) but no data are published.

[2] Coke oven and blast furnace gas only.

rubber, an increase of 30%; and urea, an increase of 38% compared with 1971 figures.

Expansion of fertilizer productive capacity continued as new phosphoric acid and ammonia plants came into production. The Netherlands has the highest utilization of fertilizer per acre in the world. Nevertheless, it exports approximately 60% of the nitrogeneous and phosphatic fertilizers that it produces.

Ready availability of natural gas, excess petroleum derivatives, and geographical location have promoted one of the most efficient and integrated petrochemical industries in Europe. Total value of petrochemical products approximated $4 billion, or about 10% of the Netherlands GNP.

TRADE

From a traditional substantial trade deficit typified by $472 million in 1971, the Netherlands foreign trade achieved a substantial surplus of $468 million in 1972; such marked improvement during 1 year was possible because of a 12% increase in export value and a modest 4% increase in import values.[2] Export expansion was highlighted by food products (11%), refined petroleum products (20%), natural gas (39%), semifinished and finished steel products (16%), and chemical products (11%). The relatively low increase in value of imports was influenced by a poor investment climate (low profits) attributed to inflation which reduced imports of heavy capital equipment substantially.

The value of Netherlands exports in 1971 totaled $14.3 billion, of which 82% involved shipments to European countries and 61% to the other five EC countries.[3] West Germany was the largest customer with purchase of 36% of the Netherlands exports by value.

The Netherlands and the U.S.S.R. concluded an agreement in July 1972 to promote cooperation in industry, services, and agriculture between the interested economic organizations, associations, and companies of the Netherlands and the interested organizations in the U.S.S.R.

The Netherlands trade mission which visited the People's Republic of China in 1972 concluded there were no apparent channels for improving trade except perhaps in the agricultural specialty field where Netherlands expertise in specific products could be useful in establishing pilot projects in the People's Republic of China.

[2] Where necessary, values have been converted from the Netherlands guilders (f) to U.S. dollars at the rate of f3.245=US$1.00.

[3] Central Bureau voor de Statistiek (The Hague). Maandstatistiek van de Industrie. Supplemental data. December 1971.

Table 2.—Netherlands: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite	4,234	1,433	West Germany 1,190; Switzerland 63; Sweden 62.
Oxide and hydroxide	11,593	13,777	Japan 5,429; Italy 2,585; West Germany 1,926.
Metal including alloys:			
Scrap	14,382	20,033	West Germany 13,637; Belgium-Luxembourg 4,379; France 1,677.
Unwrought	64,053	88,748	Belgium-Luxembourg 36,067; West Germany 30,372; Italy 10,713.
Semimanufactures	40,109	47,864	West Germany 21,382; Belgium-Luxembourg 7,861; France 5,476.
Bismuth including alloys, all forms	94	43	West Germany 17; France 12; Italy 4.
Cadmium including alloys, all forms	167	74	France 23; West Germany 20; United Kingdom 8.
Chromium:			
Chromite	4,231	5,437	West Germany 1,723; Italy 1,537; France 803.
Oxide and hydroxide	198	141	West Germany 110; France 10.
Cobalt:			
Oxide and hydroxide	41	24	West Germany 23.
Metal including alloys, all forms	7	29	United States 13; Japan 8.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Columbium and tantalum: Tantalum including alloys, all forms	8	3	United Kingdom 2.
Copper metal including alloys:			
Scrap	31,316	28,213	West Germany 14,745; Belgium-Luxembourg 11,231; France 946.
Unwrought	8,275	5,393	West Germany 2,453; Italy 864; France 844.
Semimanufactures	16,919	23,003	West Germany 7,086; United States 5,488; Belgium-Luxembourg 3,048.
Gold[1] thousand troy ounces	3,690	3,071	West Germany 2,580; France 253; United Kingdom 237.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	92	21	West Germany 18.
Roasted pyrite do	87	28	United Kingdom 20.
Metal:			
Scrap do	816	668	West Germany 494; Belgium-Luxembourg 107.
Pig iron and ferroalloys[2] do	11	10	United Kingdom 3; West Germany 3.
Steel, primary forms do	1,028	1,372	Belgium-Luxembourg 295; France 242; West Germany 187.
Semimanufactures:			
Bars, rods, angles, shapes, sections thousand tons	465	492	West Germany 148; United Kingdom 111; Belgium-Luxembourg 67.
Universal plates and sheets do	1,220	1,447	United States 313; West Germany 286; United Kingdom 216.
Hoop and strip do	133	138	West Germany 107; Belgium-Luxembourg 7; Italy 6.
Rails and accessories do	31	11	West Germany 8; Indonesia 1.
Wire do	33	32	West Germany 12; France 7; Belgium-Luxembourg 4.
Tubes, pipes and fittings do	238	257	West Germany 104; Belgium-Luxembourg 68; France 28.
Castings and forgings do	7	8	Belgium-Luxembourg 5; West Germany 2.
Lead:			
Oxides	2,655	836	Czechoslovakia 708; West Germany 38; Netherlands Antilles 35.
Metal:			
Scrap	9,388	7,766	Belgium-Luxembourg 4,241; West Germany 2,227; France 1,269.
Unwrought	16,147	18,309	West Germany 14,002; France 1,338; Italy 995.
Semimanufactures	1,526	1,883	Norway 435; Belgium-Luxembourg 323; United Kingdom 145.
Magnesium including alloys, all forms	421	518	United Kingdom 223; United States 154; West Germany 87.
Manganese:			
Ore and concentrate	34,255	37,998	West Germany 9,628; France 5,709; Italy 5,574.
Oxide	1,664	490	Peru 148; Pakistan 124; West Germany 84.
Mercury 76-pound flasks	232	377	West Germany 145; Romania 87.
Molybdenum including alloys, all forms	339	192	Belgium-Luxembourg 119; West Germany 30.
Nickel:			
Oxide and hydroxide	759	1,504	U.S.S.R. 699; Czechoslovakia 448; Italy 81.
Metal including alloys:			
Scrap	1,882	2,201	West Germany 845; United Kingdom 309; Austria 212.
Unwrought and semimanufactures	5,254	7,951	Sweden 3,332; People's Republic of China 1,264; Italy 749.
Platinum-group metals, all forms troy ounces	13,150	267,912	West Germany 1,672; France 1,479; Hong Kong 1,190.
Silver metal including alloys, all forms thousand troy ounces	6,377	2,385	Czechoslovakia 828; West Germany 669; France 390.
Tellurium elemental, and arsenic	5	--	
Tin:			
Ore and concentrate long tons	994	39	All to United Kingdom.
Metal including alloys:			
Scrap do	1,176	715	United Kingdom 324; West Germany 234; Denmark 119.
Unwrought do	5,642	3,096	West Germany 2,043; Austria 293; United States 203.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Tin—Continued			
Metal including alloys—Continued			
Semimanufactures—long tons	422	400	Belgium-Luxembourg 115; West Germany 101.
Titanium dioxide	20,284	20,861	West Germany 7,278; Italy 4,410; France 3,155.
Tungsten:			
Ore and concentrate	120	345	West Germany 226; United Kingdom 82.
Metal including alloys, all forms	253	240	West Germany 124; Austria 51; France 20.
Zinc:			
Ore and concentrate	16,169	13,374	Belgium-Luxembourg 13,097.
Oxide	10,376	10,858	Belgium-Luxembourg 1,830; West Germany 1,345; Italy 572.
Metal including alloys:			
Scrap	6,243	9,496	France 7,262; West Germany 1,266; Belgium-Luxembourg 951.
Dust (blue powder)	287	270	West Germany 257; Switzerland 12.
Unwrought	26,272	31,008	West Germany 16,873; Denmark 3,567; Switzerland 2,175.
Semimanufactures	970	787	West Germany 236; Norway 232.
Other:			
Ore and concentrate	205	76	West Germany 72.
Ash and residues containing nonferrous metals:			
Aluminum	3,903	6,124	West Germany 4,948; France 1,157.
Iron and steel—thousand tons	133	32	West Germany 31.
Lead	5,578	2,543	Belgium-Luxembourg 2,083; West Germany 212; Spain 200.
Zinc	6,561	5,765	West Germany 3,287; Belgium-Luxembourg 1,096; France 672.
Other	5,306	3,040	West Germany 689; United Kingdom 649; Sweden 616.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum	5,607	5,163	France 787; West Germany 666; Belgium-Luxembourg 177.
Dust and powder of precious and semiprecious stones including diamond—thousand carats	2,571	2,147	France 458; Italy 394; United Kingdom 358.
Grinding and polishing stones	1,508	1,673	West Germany 646; United Kingdom 260; France 156; Switzerland 111.
Asbestos	275	861	Belgium-Luxembourg 323; France 301; Sweden 120.
Borates, crude natural	308,325	322,568	West Germany 77,275; United Kingdom 62,007; France 59,103.
Cement	112,879	115,605	West Germany 100,519; Belgium-Luxembourg 10,906; Norway 2,466.
Chalk	34,955	31,773	Belgium-Luxembourg 31,022; West Germany 390; Surinam 112.
Clays and clay products:			
Crude clays:			
Kaolin	45,680	47,094	Belgium-Luxembourg 46,906; West Germany 108.
Refractory	5,888	7,122	West Germany 2,926; Sweden 1,310; Belgium-Luxembourg 916.
Other including bentonite	114,792	107,328	West Germany 72,892; Belgium-Luxembourg 24,231; France 8,171.
Products:			
Refractory including nonclay bricks	24,183	21,337	West Germany 5,954; Bahrain 3,725; Iran 2,396.
Nonrefractory—thousand tons	557	598	West Germany 497; Belgium-Luxembourg 79.
Diamond, not set or strung, except dust and powder—thousand carats	1,410	943	NA.
Diatomite and other infusorial earths	442	396	Indonesia 240; West Germany 99; Belgium-Luxembourg 25.
Feldspar and leucite	184	172	Belgium-Luxembourg 99.
Fertilizer materials:			
Crude:			
Nitrogenous	16	55	West Germany 55.
Phosphatic	6,379	370	West Germany 345; Belgium-Luxembourg 25.
Other	47,011	35,262	Belgium-Luxembourg 21,860; West Germany 8,914; France 4,073.
Manufactured:			
Nitrogenous—thousand tons	841	958	Brazil 229; People's Republic of China 98; United States 86.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Fertilizer materials—Continued			
Manufactured—Continued			
Phosphatic:			
Thomas slag	156	180	Belgium-Luxembourg 94.
Other—thousand tons	246	199	France 119; West Germany 7; Belgium-Luxembourg 6.
Potassic	302	282	United Kingdom 115; Belgium-Luxembourg 10.
Other including mixed—thousand tons	596	679	France 324; Belgium-Luxembourg 16; Kenya 12.
Ammonia, anydrous	371,289	392,681	Belgium-Luxembourg 176,443; West Germany 89,830; Finland 42,191.
Fluorspar	41	82	Portugal 40.
Lime	3,204	2,949	West Germany 1,286; Belgium-Luxembourg 920; France 360.
Magnesite	22,469	23,417	West Germany 7,933; United Kingdom 3,885; France 2,852.
Mica	92	67	Ghana 18; United States 8; Belgium-Luxembourg 6.
Pigments, mineral including processed iron oxides	867	589	Sri Lanka 133; Indonesia 111; Yugoslavia 84.
Precious and semiprecious stones, except diamond—kilograms	13,743	33,515	United States 14,500; West Germany 10,759.
Salt—thousand tons	2,065	1,938	Belgium-Luxembourg 664; Sweden 487; West Germany 376.
Stone, sand and gravel:			
Dimension stone:			
Unworked and partly worked	7,729	3,678	West Germany 1,734; Belgium-Luxembourg 1,509.
Worked	1,777	2,966	Belgium-Luxembourg 1,634; West Germany 1,127.
Gravel and crushed stone—thousand tons	3,618	3,929	Belgium-Luxembourg 3,660; West Germany 266.
Quartz and quartzite	4,674	8,301	West Germany 4,602; Belgium-Luxembourg 3,256.
Sand excluding metal bearing—thousand tons	8,077	940	Belgium-Luxembourg 303; West Germany 266; France 235.
Sulfur:			
Elemental, all forms	927	296	West Germany 227; Belgium-Luxembourg 67.
Sulfur dioxide	1,016	1,052	Belgium-Luxembourg 49.
Sulfuric acid, oleum—thousand tons	145	116	Belgium-Luxembourg 67; West Germany 7.
Talc and steatite	398	497	Belgium-Luxembourg 201; Venezuela 77; Ghana 44.
Other nonmetals, n.e.s.—thousand tons	234	180	West Germany 76; Belgium-Luxembourg 50.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	33	21	Belgium-Luxembourg 8.
Carbon black	76,603	75,722	France 28,825; West Germany 14,904; Belgium-Luxembourg 7,970.
Coal and briquets:			
Anthracite and bituminous coal—thousand tons	1,647	8,582	France 431; West Germany 406; United Kingdom 53.
Briquets of anthracite and bituminous coal—do	689	450	Belgium-Luxembourg 193; West Germany 127.
Lignite briquets—do	225	--	
Coke and semicoke—do	691	632	Algeria 165; Belgium-Luxembourg 123; France 111.
Gas hydrocarbon:			
Natural including liquefied petroleum gas—do	565	560	Belgium-Luxembourg 208; West Germany 83; United Kingdom 73.
Hydrogen, helium, and rare gases	640	2,171	Belgium-Luxembourg 920; West Germany 570; United Kingdom 516.
Petroleum:[3]			
Crude—thousand 42-gallon barrels	52,640	92,255	West Germany 28,777; Belgium-Luxembourg 28,000; United Kingdom 13,523.
Refinery products:			
Gasoline—do	50,643	51,119	West Germany 30,949; United Kingdom 10,481; Belgium-Luxembourg 3,068.
Kerosine and jet fuel—do	12,152	16,337	West Germany 4,822; United Kingdom 4,717; Ship stores 1,671; Denmark 1,488.
Distillate fuel oil—do	88,520	100,561	West Germany 69,878; Belgium-Luxembourg 7,647; Ship stores 6,612.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum [2]—Continued			
Refinery products—Continued			
Residual fuel oil-----thousand 42-gallon barrels	124,089	122,344	Ship stores 47,013; United Kingdom 27,965; Sweden 14,046; West Germany 12,920.
Lubricants-----do----	3,339	4,025	United Kingdom 851; Belgium-Luxembourg 439; Sweden 320.
Mineral jelly and wax---do----	521	609	West Germany 267; Morocco 121; United Kingdom 57.
Bituminous mixtures----do----	254	218	West Germany 91; Belgium-Luxembourg 52.
Other-----do----	1,401	1,786	West Germany 476; Denmark 282; United Kingdom 279.
Mineral tar and coal-, petroleum-, or gas-derived crude chemicals----------	213	212	Belgium-Luxembourg 56; West Germany 46; United Kingdom 24.

NA Not available.
[1] Excluding gold coin and gold, and alloys shipped by post.
[2] Including sponge iron, shot grit, pellets, powder, spiegeleisen, and ferromanganese.
[3] Includes bunkers.

Source: United Nations Commodity Trade Statistics 1971. V. 21, No. 3; Maandstatistiek Van de Buitenlandse Handel per Goederensoort, December 1970 and January 1972.

Table 3.—Netherlands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite----------	83,825	71,077	Greece 63,439; Guyana 7,191.
Alumina----------	188,218	291,004	Surinam 188,313; West Germany 74,541; France 27,662.
Metal, including alloys:			
Scrap----------	10,897	9,790	West Germany 5,041; France 1,122; East Germany 1,107.
Unwrought including alloys----	45,356	46,717	Norway 22,987; West Germany 7,389; France 5,100.
Semimanufactures----------	51,343	58,251	West Germany 25,959; Belgium-Luxembourg 16,733.
Antimony:			
Ore and concentrate----------	--	1	NA.
Metal including alloys, all forms----	159	55	Italy 20; Belgium-Luxembourg 19.
Arsenic, oxides and acids----------	839	414	Belgium-Luxembourg 333; France 43; United Kingdom 32.
Bismuth including alloys, all forms------	341	145	Mexico 34; Belgium-Luxembourg 27; West Germany 23.
Cadmium including alloys, all forms----	147	101	Belgium-Luxembourg 22; West Germany 22; Japan 17.
Chromium:			
Chromite----------	5,600	9,645	Finland 4,281; Republic of South Africa 3,009; West Germany 1,372.
Oxides and hydroxides----------	994	774	West Germany 449; U.S.S.R. 184; Italy 100.
Metal including alloys, all forms----	43	9	West Germany 4; France 3.
Cobalt:			
Oxides and hydroxides----------	321	210	Belgium-Luxembourg 147; United Kingdom 46; France 10.
Metal including alloys, all forms----	372	118	Belgium-Luxembourg 56; Australia 15; United States 14.
Columbium and tantalum, tantalum-----	7	4	United States 3.
Copper metal including alloys:			
Scrap----------	9,579	6,982	West Germany 2,827; Belgium-Luxembourg 2,062; East Germany 665.
Unwrought----------	43,586	46,743	Belgium-Luxembourg 14,990; Zaire 7,499; Zambia 6,244.
Semimanufactures----------	71,312	58,441	Belgium-Luxembourg 33,008; West Germany 16,415; France 4,827.
Gold [1]----------thousand troy ounces--	76	53	Denmark 53.
Iron and steel:			
Ore and concentrate, except roasted pyrite----------thousand tons--	5,416	5,991	Liberia 1,863; Canada 1,181; Sweden 945.
Metal:			
Scrap----------do----	298	214	Belgium-Luxembourg 122; West Germany 53; United Kingdom 23.
Pig iron [2]----------do----	133	79	West Germany 53; Canada 6; Norway 5.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Ferroalloys---thousand tons	53	48	Norway 28; Republic of South Africa 8; France 5.
Steel, primary forms---do	285	504	West Germany 158; Belgium-Luxembourg 128; Spain 89.
Semimanufactures:			
Bars, rods, sections-do	1,356	1,154	Belgium-Luxembourg 554; West Germany 358; France 140.
Universal plates and sheets do	810	814	Belgium-Luxembourg 359; West Germany 316; France 53.
Hoop and strip---do	232	152	West Germany 93; Belgium-Luxembourg 43; France 10.
Rails and accessories do	52	50	West Germany 31; France 17; Belgium-Luxembourg 2.
Wire---do	88	100	Belgium-Luxembourg 64; West Germany 30.
Tubes, pipes and fittings do	678	757	West Germany 479; France 130; Belgium-Luxembourg 50.
Castings and forgings do	12	12	West Germany 6; Belgium-Luxembourg 4.
Lead:			
Ore and concentrate	5	--	
Oxides	13,927	11,064	Mexico 4,333; West Germany 2,667; Belgium-Luxembourg 2,416.
Metals including alloys:			
Scrap	3,938	6,287	West Germany 4,953.
Unwrought	62,272	70,762	United Kingdom 23,823; Australia 23,312; Belgium-Luxembourg 11,991.
Semimanufactures	2,503	2,532	Belgium-Luxembourg 1,682; United States 394.
Magnesium metal including alloys:			
Scrap	191	302	Norway 110.
Unwrought	577	786	U.S.S.R. 260; Norway 150; West Germany 109.
Semimanufactures	121	173	West Germany 72; United Kingdom 58; United States 39.
Manganese:			
Ore and concentrate	111,398	119,021	West Germany 5,506; U.S.S.R. 3,704; Belgium-Luxembourg 230.
Oxide	2,584	2,430	Belgium-Luxembourg 2,386; Japan 32.
Mercury---76-pound flasks	1,799	1,102	Yugoslavia 406; Mexico 145; Turkey 145.
Molybdenum including alloys, all forms	73	56	West Germany 33; United Kingdom 7; United States 6.
Nickel:			
Matte, speiss and similar materials	359	2	All from United Kingdom.
Metal including alloys:			
Scrap	2,582	3,019	United States 1,050; West Germany 778; United Kingdom 542.
Unwrought	3,520	4,751	Mozambique 1,677; United Kingdom 826; Norway 618.
Semimanufactures	4,718	4,997	Sweden 2,068; West Germany 1,542; United Kingdom 443.
Platinum-group metals, all forms thousand troy ounces	78	110	West Germany 41; France 25; United Kingdom 20.
Silver metal including alloys, all forms do	6,520	7,606	West Germany 3,342; France 1,176; East Germany 1,059.
Tellurium elemental, and arsenic	15	8	All from Sweden.
Tin:			
Ore and concentrate---long tons	9,997	1,188	Zaire 495; Republic of South Africa 308; Bolivia 256.
Oxide---do	72	41	Belgium-Luxembourg 20; West Germany 20.
Metal including alloys:			
Scrap---do	291	61	West Germany 52; Belgium-Luxembourg 5.
Unwrought---do	5,273	5,660	Thailand 2,075; People's Republic of China 1,362; United Kingdom 1,094.
Semimanufactures---do	137	185	West Germany 137; Belgium-Luxembourg 30.
Titanium:			
Ore and concentrate	159	729	Australia 712.
Dioxide	5,958	5,458	West Germany 4,237; Italy 595; France 341.
Tungsten:			
Ore and concentrate	378	467	United Kingdom 133; Portugal 81; People's Republic of China 50.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Tungsten—Continued			
Metal including alloys, all forms	104	146	West Germany 95; United States 20; United Kingdom 14.
Zinc:			
Ore and concentrate	90,366	95,640	Canada 50,505; West Germany 11,933; Peru 9,901.
Oxide	3,391	3,495	Belgium-Luxembourg 1,114; France 896; West Germany 779.
Metal including alloys:			
Scrap	1,814	1,167	West Germany 1,062.
Dust (blue powder)	2,824	2,321	West Germany 1,638; Belgium-Luxembourg 296.
Unwrought	15,964	23,078	North Korea 6,241; West Germany 5,771; Belgium-Luxembourg 2,184.
Semimanufactures	5,150	5,365	Belgium-Luxembourg 2,289; North Korea 1,452; West Germany 1,171.
Other:			
Ores and concentrates:			
Columbium, molybdenum, tantalum, vanadium, zirconium	18,827	19,675	United States 15,563; Australia 1,372; United Kingdom 723.
Not specified	1,135		
Ash and residues containing nonferrous metal:			
Aluminum	452	802	East Germany 642; West Germany 138.
Lead	3,793	8,960	Sweden 5,943; West Germany 1,966; Norway 550.
Zinc	40,717	43,388	West Germany 26,659; United Kingdom 5,872; Norway 2,041.
Other	r 76,053	71,978	Canada 52,758; U.S.S.R. 13,785; Norway 1,074.
Metals including alloys, all forms:			
Metalloids:			
Phosphorus	145	62	West Germany 48; Sweden 12.
Selenium	8	6	West Germany 2.
Silicon	879	973	France 739; Norway 201.
Alkali, alkaline-earth and rare-earth metals	369	232	West Germany 223.
Oxides of barium, strontium and magnesium	931	3,535	Belgium-Luxembourg 2,427; United States 545; West Germany 240.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.—thousand tons	376	557	West Germany 546.
Dust and powder of precious and semiprecious stones—thousand carats	2,410	2,432	Ireland 2,067; United Kingdom 246; West Germany 78.
Grinding and polishing stones	2,213	2,041	West Germany 1,070; Austria 251; United Kingdom 146.
Asbestos	22,063	23,870	Canada 16,865; U.S.S.R. 2,803; Italy 1,502.
Barite and witherite	26,584	41,292	West Germany 35,934; Ireland 2,622; Spain 1,758.
Boron materials:			
Crude natural borates	309,327	374,237	United States 367,338; Turkey 5,174.
Oxide and acid	1,863	2,002	United States 771; Turkey 752; France 401.
Cement—thousand tons	2,219	2,386	Belgium-Luxembourg 1,221; West Germany 1,125.
Chalk	143,881	151,654	Belgium-Luxembourg 84,633; France 45,621; West Germany 14,260.
Clays and products:			
Crude clays:			
Bentonite—thousand tons	24	29	United States 13; West Germany 12.
Kaolin—do	229	229	United Kingdom 155; United States 23; Czechoslovakia 16.
Refractory—do	179	208	West Germany 177; France 11; United Kingdom 6.
Other—do	436	440	West Germany 411; United Kingdom 17.
Products:			
Refractory including nonclay bricks—do	100	113	West Germany 39; United Kingdom 30; Belgium-Luxembourg 17.
Nonrefractory—do	218	202	West Germany 109; Belgium-Luxembourg 57; Italy 17.
Cryolite and chiolite	914	2,078	Denmark 1,843; France 200; Belgium-Luxembourg 21.
Diamond, all grades:			
Gem, not set or strung—thousand carats	1,805	1,468	NA.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Diamond, all grades—Continued			
Industrial—thousand kilograms	159	179	Brazil 163; United Kingdom 6; United States 5.
Diatomite and other infusorial earths	8,869	9,626	West Germany 2,560; Denmark 2,549; Spain 1,630.
Feldspar and leucite	29,866	39,343	Norway 19,769; Belgium-Luxembourg 9,058; Canada 3,784.
Fertilizer materials:			
Crude:			
Nitrogenous	26,063	31,375	Chile 27,706; Belgium-Luxembourg 3,669.
Phosphatic—thousand tons	1,583	1,624	United States 559; Togo 425; Morocco 385.
Potassic salts—do	42	28	West Germany 14; France 13.
Other—do	37	39	West Germany 35.
Manufactured:			
Nitrogenous—do	52	19	Belgium-Luxembourg 13; West Germany 4.
Phosphatic:			
Thomas slag (P_2O_5 content)—do	r 20	118	Belgium-Luxembourg 101; West Germany 16.
Other (P_2O_5 content)—do	r 20	21	Tunisia 8; Belgium-Luxembourg 7; France 4.
Potassic—do	415	439	West Germany 187; France 63; East Germany 56.
Other including mixed—do	52	74	Belgium-Luxembourg 24; United States 21; West Germany 17.
Ammonia	31,795	4,255	Belgium-Luxembourg 2,493; France 1,307; West Germany 289.
Fluorspar	35,559	24,265	Italy 3,700; France 1,938; West Germany 1,215.
Graphite, natural	311	612	Argentina 270; West Germany 134.
Gypsum and plasters—thousand tons	270	255	France 158; West Germany 93; Belgium-Luxembourg 4.
Lime—do	933	985	Belgium-Luxembourg 501; West Germany 465.
Magnesite	39,626	31,301	Greece 17,120; India 5,257; People's Republic of China 2,706.
Mica:			
Crude including splittings and waste	1,321	1,129	United Kingdom 502; United States 253; Norway 192.
Worked including agglomerated splittings	66	47	Switzerland 24.
Pigments, mineral:			
Natural crude	1,887	1,524	West Germany 892; Austria 315; United States 101.
Iron oxides, processed	13,390	12,625	West Germany 10,375; France 1,045; Spain 690.
Precious and semiprecious stones, except diamond—kilograms	162,959	190,479	Brazil 163,882; United Kingdom 10,878; United States 5,473.
Pyrite—thousand tons	111	86	Cyprus 83.
Salt	416,619	86,491	West Germany 37,590; Italy 27,713; Tunisia 13,221.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	37,876	104,760	West Germany 63,799; France 15,064; Belgium-Luxembourg 12,141.
Caustic potash	4,224	6,942	France 3,964; Belgium-Luxembourg 2,153; West Germany 263.
Stone, sand and gravel:			
Dimension stone:			
Unworked and partly worked thousand tons	2,592	2,214	Belgium-Luxembourg 1,300; Sweden 470; West Germany 390.
Worked	33,518	45,419	Italy 16,329; Belgium-Luxembourg 14,792; West Germany 5,998.
Dolomite—thousand tons	740	753	Belgium-Luxembourg 693; West Germany 38.
Gravel and crushed rock—do	14,857	12,266	West Germany 9,204; Belgium-Luxembourg 1,944; France 636.
Limestone—do	1,103	800	Belgium-Luxembourg 750; United Kingdom 30.
Quartz and quartzite	25,339	32,850	Norway 13,382; Belgium-Luxembourg 12,545.
Sand excluding metal bearing thousand tons	7,566	7,446	West Germany 6,954; Belgium-Luxembourg 449; United Kingdom 41.
Sulfur:			
Elemental—do	416	444	United States 302; Poland 70; France 67.
Sulfur dioxide	1,845	542	West Germany 542.

Table 3.—Netherlands: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Sulphur—Contined			
Sulfuric acid, oleum	42,814	55,089	West Germany 22,183; France 18,344; Belgium-Luxembourg 14,560.
Talc and steatite	18,839	13,375	Norway 5,617; Austria 3,546; France 1,237.
Other nonmetals, n.e.s.:			
Crude—thousand tons	2,977	3,322	West Germany 1,821; Belgium-Luxembourg 1,450.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture—thousand tons	3,416	2,824	West Germany 1,548; Belgium-Luxembourg 1,143.
Slag and ash, n.e.s.—do	574	580	West Germany 393; Belgium-Luxembourg 186.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,863	1,943	West Germany 858; United States 606; Trinidad 401.
Carbon black (including gas carbon)	15,045	11,142	West Germany 6,501; United Kingdom 1,588; Belgium-Luxembourg 1,526.
Coal and briquets:			
Anthracite and bituminous coal—thousand tons	4,773	3,219	West Germany 1,233; United States 1,168; Poland 448.
Briquets of anthracite and bituminous coal—do	4	1	West Germany 1.
Lignite and lignite briquets—do	49	29	West Germany 28.
Coke and semicoke—do	915	1,243	West Germany 1,070; United States 146.
Gas, hydrocarbon: Natural including liquefied petroleum gas—thousand tons	96	85	West Germany 70; U.S.S.R. 6; Belgium-Luxembourg 5.
Peat—do	148	159	West Germany 157.
Petroleum: [3]			
Crude—thousand 42-gallon barrels	456,696	487,807	Kuwait 114,638; Saudi Arabia 114,345; Iran 88,294.
Refinery products:			
Gasoline—do	13,388	17,009	U.S.S.R. 5,444; Italy 3,849; United Kingdom 1,603.
Kerosine and jet fuel—do	3,531	3,792	Italy 1,644; United Kingdom 830; Belgium-Luxembourg 723.
Distillate fuel oil—do	21,067	23,283	United Kingdom 5,378; Italy 3,494; France 2,769.
Residual fuel oil—do	14,819	9,863	West Germany 2,941; Kuwait 1,540; Belgium-Luxembourg 1,124.
Lubricants—do	3,121	3,737	Netherlands Antilles 1,958; Belgium-Luxembourg 390; United Kingdom 340.
Mineral jelly and wax—do	171	185	West Germany 72; United States 45; France 30.
Bituminous mixtures—do	53	99	Belgium-Luxembourg 80; West Germany 11.
Other—do	4,590	5,223	United States 2,483; Belgium-Luxembourg 1,653; West Germany 526.
Mineral tar and coal-, petroleum-, or gas-derived crude chemicals—thousand tons	169	105	West Germany 25; Belgium-Luxembourg 18; Sweden 16.

r Revised. NA Not available.
[1] Excluding gold coin and alloys shipped by port.
[2] Including spiegeleisen, sponge iron, shot, grit and pellets.
[3] Includes bunkers.

COMMODITY REVIEW

METALS

Iron and Steel.—The merged Netherlands-West German steel firm ESTEL operated at Ijmuiden during 1972 at 85% of capacity, building rapidly towards yearend to an annual production rate of 6 million tons. Further 10% expansion is projected in 1973 with completion of the fourth bank of new coke ovens and the seventh blast furnace. Additional production as semifinished slabs will be shipped to Dortmund in West Germany for conversion into hot- and cold-rolled sheet products. Future integrated expansion plans are being developed for 1975–76.

Nonferrous.—The aluminum smelter at Delfzijl operated at its expanded capacity

during most of 1972. With the newest smelter of the Péchiney group at Flushing also in production, total primary aluminum output climbed to an estimated 166,000 tons from 116,000 in 1971. Further announced expansion plans have been shelved temporarily until demand increases. In providing parallel aluminum fabricating facilities, Lips Aluminium N.V. of Drunen has completed strip cold-rolling and coating lines for the construction and packaging markets and Finish and Swedish interests have constructed extrusion facilities at Hoogazand. Conversion facilities in the Netherlands were expanded to about 110,000 tons of rolled and extruded products annually, with domestic consumption estimated at 75,000 tons in 1972. Primary market growth areas are in construction and packaging.

N.V. Kempensche Zink Maatschappij at Budel will complete construction of a 150,000-ton-per-year electrolytic zinc plant late in 1973, providing much excess capacity above domestic needs and increasing the export potential to adjacent EC countries and the United States. Zinc concentrates from Australia will be provided by the collaborating companies, Conzinc Riotinto of Australia Ltd., and New Broken Hill Consolidated, Ltd.

The project of Shell Minerals-Netherlands N.V. to solution mine magnesium from deep brine fields (2,400 meters) in Friesland province in the northeast was postponed for several years because of the depressed price structure in light metals.

Uranium.—The first commercial (450 megawatt) nuclear-fueled powerplant of the pressurized water reactor type (PWR) is being completed by Siemens for operation in 1973. The Borsselle station, located in Zeeland province, will be operated by N.V. Provinciale Zeeuwse Energie-Maatschappij. The site for the initial powerplant was chosen because of the high baseline power requirements of new metallurgical plants producing phosphorus with electric furnaces and aluminum by the electrolytic process. A second nuclear powerplant of 600-megawatt output is planned in the Maas estuary for operation late in the decade.

The Tripartite Gas Centrifuge Uranium Enrichment Project at Almelo with West Germany and the United Kingdom was in operation. The Netherlands and West German pilot cascade centrifuge lines installed at Almelo phased into operation in 1972 and early in 1973. From the results of the pilot centrifuge operations, second generation designs will develop in time for the expected demand for large numbers of centrifuges for production facilities in 1977–80. The Netherlands, United Kingdom, and West German Governments provide grants to support development activity in uranium enrichment and in other highly technical fields such as space, aircraft, and nuclear energy.

NONMETALS

Fertilizer Materials.—Hoechst Vlissingen N.V. was completing a 90,000-ton-per-year electric furnace phosphorus facility at Flushing. The phosphorus is converted into phosphoric acid and sodium-tripolyphosphate. Three established fertilizer and intermediate products producers (Dutch State Minerals at Geleen, VKF-Mekog-Albatros at Ijmuiden, and Compagnie Néerlandaise de l'Azote S.A. (CNA) at Sluiskil) brought modern ammonia plants into production during 1971–72 involving a capacity of 1 million tons per year or a 30% increase in total national capacity. VKF-Mekog-Albatros during 1972 also modernized its fertilizer facility at Pernis with the construction of new phosphoric acid and sulfuric acid facilities of 200,000 and 300,000 tons per year capacities, respectively.

Mergers have taken place during the last 2 years so that five major fertilizer companies with broad bases of operations and overseas marketing experience remain. Further major facility expansions will probably await a market resurgence following the stagnated-climate and price problems of the last 2 years.

MINERAL FUELS

Coal.—Coal production continued to decline with the planned closing of coal mines. Substantial receipts of coking coal on long-term contracts with Australian producers arrived in the Netherlands in 1972. The Netherlands steel producer, Hoogovens, acquired 25% capitalization in a new coal mine in West Virginia which will be in production in 1974.

Petroleum and Natural Gas.—Major petroleum refinery expansions were on sched-

ule and will be completed in 1973 with enlarged capacity of 85 million tons annually (compared to 67 million tons in 1970). But with the rapid growth of natural gas production and environmental concerns, further refinery expansions may be delayed.

Natural gas production expanded from 41 billion cubic meters in 1971 to 58 billion cubic meters in 1972, of which 57% was consumed domestically. Announced plans call for production to continue to expand to approximately 80 billion cubic meters per year by 1975 with about 50% of the total exported, principally to West Germany, Belgium-Luxembourg, France, and Italy. There is growing concern in the Netherlands regarding the rate of depletion of gas reserves and it is likely that total production per year will not be permitted to exceed the figure of 80 billion cubic meters projected annually in 1975.

In December 1972 the Minister of Economic Affairs allotted the remaining concessions for Continental Shelf oil and natural gas exploration in the Netherlands sector of the North Sea. Numerous subsidiaries of American and West European oil and exploration companies are involved in the last of the available exploration blocks in areas of prime interest.

The city of Groningen located in the northern major natural gasfield is proceeding with plans to convert city buses and some private delivery trucks to natural gas fuel. Testing to yearend had confirmed more economic operation and cleaner emissions as compared with gasoline usage. The economics of large-scale conversion requiring liquified natural gas distribution facilities have not been evaluated.

Chemical.—The General Electric Company (Plastics Division) placed contracts for construction of a polycarbonate plant of a 25,000-ton to 30,000-ton annual capacity at Bergen op Zoom. The plant will include facilities for production of the phosgene raw material. The product will be shipped to service and distribution centers in the United Kingdom, West Germany, Sweden, and Italy.

The Mineral Industry of New Zealand

By Robert A. Clifton [1]

The value of New Zealand's mineral production increased 17% in 1972 to $48 million.[2] There was a respectable increase all across the board but metals, with nearly a fourfold increase in iron sand production value, led the way with an 83% increase. This brought metals up to 10% of total mineral production value. Nonmetallic minerals, in spite of a 12% increase in value, dropped to 61% of the total value. Fuels with a 14% increase had 29% of the mineral value.

Value of total mineral production by year is shown in the following tabulation:

Year	Percent			Tota value, million U.S. dollars (1972)
	Metals	Non-metals	Fuels	
1971	7.0	64.0	29.0	40.8
1972	10.0	61.0	29.0	47.8

New Zealand's efforts to produce more of its mineral needs and to increase domestic processing and manufacturing are apparently still doing well. The Bluff smelter, for example, was producing aluminum at capacity in 1972 and supplying domestic manufacturers as well as providing material for export.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Unless otherwise indicated, values herein are in U.S. dollars converted from New Zealand dollars at the rate of $NZ1 = US$1.3397 as of May 29, 1973.

Table 1.—New Zealand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum, smelter production	--	22	e 87
Cadmium, mine output, metal content [1]	10	14	14
Copper, mine output, metal content [2]	47	85	123
Gold, mine output, metal content [3] troy ounces	11,283	9,418	13,511
Iron and steel:			
Iron ore, gross weight	684	93	141
Iron sands, gross weight [4]	143,436	575,882	1,380,328
Sponge iron e thousand tons	23	100	100
Crude steel do	e 68	100	100
Lead, mine output, metal content [2]	778	1,246	1,155
Silver, mine output, metal content [2] troy ounces	16,428	66,398	31,290
Tungsten, mine output, metal content	5	7	13
Zinc, mine output, metal content [1]	1,459	1,969	1,653
NONMETALS			
Cement, hydraulic thousand tons	829	823	900
Clays:			
Bentonite	20,039	11,761	620
Fire clay	256,902	284,478	206,496
Kaolin, including china clay	11,641	20,243	9,489
Diatomite	5,883	6,338	4,996
Kauri gum	25	26	12
Magnesite	484	1,047	960
Perlite	2,032	2,032	2,540
Pumice	19,207	13,010	129,611
Salt	52,793	43,263	59,438
Sand and gravel:			
Glass sand	135,628	124,520	110,075
Common sand and gravel [5] thousand tons	r 26,873	25,878	27,274
Stone: [5]			
Dolomite	10,273	8,311	11,875
Greenstone	4	4	5
Limestone:			
For agriculture thousand tons	r 1,159	1,281	1,541
For industry, except cement do	124	116	123
For cement do	1,523	1,535	1,467
Serpentine do	78	73	96
Unspecified:			
Dimension	19,366	31,222	23,407
Rock for harbor work thousand tons	1,251	2,197	625
Sulfur	122	--	--
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous thousand tons	450	389	382
Subbituminous do	1,746	1,573	1,647
Lignite do	190	162	152
Total do	2,386	2,124	2,181
Coke:			
Metallurgical do	6	e 6	4
Gas house do	36	e 36	22
Fuel briquets do	17	15	13
Gas, natural:			
Gross production million cubic feet	NA	10,627	12,484
Marketed production do	3,769	8,592	e 9,000
Petroleum:			
Crude [6] thousand 42-gallon barrels	467	804	1,119
Refinery products:			
Gasoline do	10,394	10,029	11,042
Distillate fuel oil do	5,327	4,886	5,029
Residual fuel oil do	5,220	5,385	7,536
Other do	1,101	1,049	784
Refinery fuel and losses do	1,588	1,529	1,769
Total do	23,630	22,878	26,160

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Contained in zinc concentrate.
[2] Contained in lead-copper concentrate.
[3] Includes that contained in led-copper concentrate.
[4] Average 60% iron.
[5] Crushed rock for building aggregate, roads, and ballast is included with sand and gravel.
[6] Includes natural gas liquid condensate.

TRADE

During 1970–71 New Zealand's exports of mineral commodities increased $NZ 0.6 million and imports increased $NZ 20.0 million compared with those of 1969–70. Iron sands again accounted for the major portion of the increase of exports.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal destinations, 1970–71
METALS			
Aluminum:			
Ore and concentrate	--	1	All to Australia.
Metal, including alloys:			
Scrap	1,372	993	Australia 660; Japan 264.
Unwrought and semimanufactures	510	660	Japan 352; Australia 212; Philippines 52.
Copper:			
Metal, including alloys:			
Scrap	1,428	1,215	Australia 575; Japan 384; Belgium-Luxembourg 149; West Germany 107.
Unwrought and semimanufactures	3,961	2,467	Australia 980; Japan 791; West Germany 158.
Gold, refined [2] value	$29,074	$2,507	NA.
Iron and steel:			
Ore and concentrate	30,985	61,539	All to Japan.
Metal:			
Scrap	7,099	8,323	Japan 6,926; Australia 1,284.
Steel, primary forms	42	296	Taiwan 230; United States 66.
Semimanufactures:			
Bars, rods, angles, shapes, sections	4,829	3,814	Fiji 3,183; Tonga 210.
Universals, plates, sheets	3,139	17,157	Papua New Guinea 5,255; United States 4,411; Fiji 3,950.
Hoops and strips	8	109	Mainly to New Caledonia.
Wire	422	565	Hong Kong 336.
Tubes, pipes, fittings	254	336	Fiji 209.
Castings and forgings, rough	30	45	Australia 41.
Lead:			
Ore and concentrate	1,935	2,835	All to Japan.
Metal, including alloys:			
Scrap	1,020	599	Australia 413.
Unwrought and semimanufactures	539	267	Australia 186.
Nickel metal, scrap	7	20	Australia 17.
Platinum-group metals and silver ores [2] value	$91,922	$68,878	Australia $30,392; United Kingdom $29,561.
Tin metal, including alloys:			
Scrap long tons	--	8	NA.
Unwrought and semimanufactures do	3	5	Mainly to United States.
Zinc:			
Ore and concentrate of base metals, n.e.s	3,528	3,989	Japan 3,987.
Metal, including alloys:			
Scrap and ash	264	278	Japan 170; Australia 99.
Unwrought and semimanufactures	44	61	Mainly to Australia.
Other:			
Ore and concentrate of base metals, n.e.s	145	157	Australia 152.
Ash and residue containing nonferrous metals [2] value	$375,237	$203,781	Australia $124,417; West Germany $30,411; Japan $28,005.
NONMETALS			
Asbestos articles and building materials [2] value	$503,883	$645,351	Fiji $354,051; Papua New Guinea $128,440; Western Samoa $52,879.
Cement	828	418	Norfolk Island 216; Western Samoa 122.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	1,592	3,132	Australia 2,584; Japan 498.
Products [2] value	$125,187	$265,819	Australia $169,813; Fiji $47,761.
Fertilizer materials:			
Crude	1,828	718	Japan 303; Malaysia 235; Singapore 152.
Manufactured:			
Nitrogenous	128	17	British Solomon Islands 12.
Phosphatic	253	119	Fiji 41; Tonga 31; Western Samoa 24.
Potassic	7	--	
Other	415	26	French Polynesia 11; Australia 8.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal destinations, 1970–71
NONMETALS—Continued			
Kauri gum	22	19	United States 10; Italy 4.
Lime	23	22	French Polynesia 10; Tonga 9.
Precious and semiprecious stones, except diamond [2]—value	$1,135	$482	Hong Kong 398.
Pumice	872	685	Australia 501.
Salt	5	117	New Hebrides 102; Tonga 11.
Stone, sand and gravel	341	787	American Samoa 671; Fiji 64.
Stone, monumental [2]—value	r $25,338	$16,627	Western Samoa $7,689; Fiji $5,276; New Caledonia $2,257.
Other minerals	63	27	Australia 14; Singapore 11.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	952	New Caledonia 764; American Samoa 131.
Coal and coke, including briquets	5,403	901	Singapore 624; Malaysia 193.
Petroleum:			
Refinery products:			
Gasoline, including natural 42-gallon barrels	154	20	Norfolk Island 11; Pitcairn Island 9.
Distillate fuel oil—do	957,074	1,068,614	Ships stores 1,062,472; Australia 2,902; Japan 1,676.
Residual fuel oil—do	1,031,045	1,152,729	Ships stores 881,698; Singapore 139,690; Australia 127,117.
Lubricants—do	r 3,756	4,393	Ships stores 4,046; Tonga 138; Fiji 134.
Other—do	14,277	5,184	New Caledonia 2,296; French Polynesia 2,107; Australia 716.

r Revised. NA Not available.
[1] Fiscal period July 1 through June 30.
[2] Converted from $NZ at a prorated value of U.S. $0.995310 for 1969–70 and 1970–71.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal sources, 1970–71
METALS			
Aluminum:			
Oxides and hydroxides	3,048	10,178	Australia 5,585; Japan 4,146.
Metals and alloys:			
Unwrought	13,258	16,294	Canada 8,305; Australia 4,635; United State 1,306
Semimanufactures	7,115	6,472	Canada 3,729; Australia 1,447.
Antimony, metal [2]—value	$33,336	$81,464	Japan $37,425; People's Republic of China $22,432.
Arsenic, trioxide, pentoxide, acid	138	131	People's Republic of China 75; Hong Kong 25; Sweden 20.
Chromium oxides and hydroxides	215	141	West Germany 56; U.S.S.R. 50; United States 21.
Copper metal, including alloys:			
Unwrought	171	897	Australia 676; United Kingdom 214.
Semimanufactures	11,670	11,576	Australia 9,141; United Kingdom 1,294; Canada 1,097.
Gold metal, unworked—troy ounces	13,479	12,265	Australia 8,938; United Kingdom 3,175.
Iron and steel:			
Pig iron, including cast iron	7,623	6,603	All from Australia.
Sponge iron, powder, shot	616	680	United Kingdom 353; Sweden 149.
Spiegeleisen	126	256	Republic of South Africa 205; India 51.
Ferroalloys	3,286	1,907	Republic of South Africa 762; Japan 319; Norway 305.
Steel, primary forms	125	17,685	United States 12,587.
Semimanufactures:			
Bars, rods, angles, shapes, sections	150,496	160,472	Australia 72,739; Japan 40,754; Canada 15,348.
Universals, plates, sheets	247,086	219,540	Japan 145,269; Australia 47,950.
Hoop and strip	13,429	12,735	United Kingdom 4,517; Australia 4,246; Japan 3,252.
Rails and accessories	9,065	14,794	United Kingdom 8,918; Australia 5,299.
Wire	21,061	23,830	Australia 10,983; United Kingdom 7,751; Japan 4,738.
Tubes, pipes, fittings	52,328	51,614	Australia 27,320; United Kingdom 15,707; Japan 7,294.
Castings and forgings, rough	35	35	Australia 19; United Kingdom 16.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal sources, 1970–71
METALS—Continued			
Lead:			
Ore and concentrate	--	12	All from Australia.
Oxides	650	570	Australia 515.
Metal, including alloys:			
Scrap	6	9	Fiji 7; Western Samoa 2.
Unwrought	5,921	4,116	Australia 4,073.
Semimanufactures	24	7	United Kingdom 4.
Magnesium metal, unwrought	60	61	United States 55.
Manganese:			
Ore and concentrate	17	--	
Oxides	533	596	United States 359; Australia 83; Japan 69.
Mercury, 76-pound flasks	272	178	United States 51; Spain 32; Japan 30.
Nickel metal, including alloys:			
Unwrought	29	132	Canada 90; United Kingdom 42.
Semimanufactures	224	199	United Kingdom 128; Australia 35; Canada 29.
Platinum-group metals and silver:			
Metal, including alloys:			
Platinum group, thousand troy ounces	2	3	United Kingdom 2.
Silver, do.	1,266	1,348	Australia 916; West Germany 359.
Tin:			
Oxides, long tons	13	10	United Kingdom 8.
Metal, including alloys:			
Unwrought, do.	334	314	Australia 182; Malaysia 114.
Semimanufactures, do.	r 35	22	Australia 13; United Kingdom 8.
Titanium oxides	990	1,122	Australia 637; Japan 425.
Zinc:			
Oxide and peroxide	24	36	United Kingdom 15; Australia 10; West Germany 10.
Metal, including alloys:			
Scrap and blue powder	152	289	Australia 256.
Unwrought	15,196	15,706	Australia 15,687.
Semimanufactures	r 537	356	Australia 188; United Kingdom 138.
Other:			
Ore and concentrate	738	547	Australia 543.
Oxides, hydroxides and peroxides of metal, n.e.s.	124	121	United Kingdom 33; Norway 29; Japan 17; West Germany 15.
NONMETALS			
Asbestos	8,662	8,338	Canada 6,458; Republic of South Africa 1,525.
Barite	5,903	815	Australia 327; West Germany 321.
Cement	3,502	3,984	Japan 2,218; United Kingdom 1,322.
Chalk	750	738	France 405; United Kingdom 209.
Clays and clay products:			
Crude clays, n.e.s.:			
Fuller's earth, chinas, chamotte	498	407	United Kingdom 283; Australia 114.
Kaolin (china clay)	2,679	2,946	United States 2,164; United Kingdom 692.
Other	3,453	4,646	United States 1,850; Republic of South Africa 1,258; United Kingdom 830.
Products, refractory (including non-clay bricks)	1,330	4,814	Canada 2,063; United Kingdom 1,667.
Cryolite and chiolite	17	17	Denmark 16.
Diamond:			
Gem, not set or strung [2], value, thousands	$681	$752	Republic of South Africa $424; United Kingdom $265.
Industrial [2], do.	$62	$109	Republic of South Africa $96.
Diatomite and other infusorial earth	r 940	1,018	United States 958.
Feldspar, fluorspar, nepheline syenite	r 1,893	2,149	Sweden 1,290; People's Republic of China 251; Norway 207.
Fertilizer materials:			
Crude:			
Nitrogenous	457	139	Chile 112.
Phosphatic, thousand tons	1,071	990	Nauru 531; Australia 253; Gilbert Islands 206.
Other	2	--	
Manufactured:			
Nitrogenous	37,231	30,105	Japan 14,385; West Germany 7,489; Australia 4,386.
Phosphatic, including basic slag	15,897	8,317	Belgium-Luxembourg 6,612; United States 1,024.
Potassic	164,624	198,127	Canada 84,980; United States 74,809; U.S.S.R. 28,961.
Graphite, natural	123	130	Japan 76; Norway 14; United Kingdom 12.
Gypsum and plasters	104,552	106,240	Australia 105,410.
Lime	233	233	All from United Kingdom.

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

(Metric tons unless otherwise specified)

Commodity	1969–70	1970–71	Principal sources, 1970–71
NONMETALS—Continued			
Magnesite	265	117	Australia 59; People's Republic of China 30; India 25.
Pigments, minerals, including processed iron oxide	818	880	West Germany 363; Austria 205; Spain 138.
Precious and semiprecious stones, except diamond [2]—value, thousands	$290	$364	Australia $150; West Germany $114.
Salt and brine	r 37,424	31,879	United Kingdom 26,539; Australia 3,241.
Sodium and potassium compounds, n.e.s.	r 7,518	11,726	Netherlands 3,012; United Kingdom 2,541; Australia 2,053; United States 1,613.
Stone, sand and gravel:			
Dimension stone	1,116	1,073	Republic of South Africa 489; Italy 205.
Gravel and crushed rock	58	64	United Kingdom 62.
Limestone	12	11	All from United Kingdom.
Quartz and quartzite	887	1,187	Belgium-Luxembourg 773; Australia 262.
Sand, excluding metal bearing	705	72	Australia 47; United Kingdom 23.
Sulfur, elemental, all forms	246,897	190,027	Canada 130,221; United States 58,870.
Talc, steatite, soapstone, pyrophyllite	1,777	1,936	Australia 1,571; United States 214.
MINERAL FUELS AND RELATED MATERIALS			
Bitumen, natural	360	261	Trinidad and Tobago 221.
Carbon black and gas carbon	6,160	6,112	Australia 4,644; United States 1,365.
Coal and coke, including briquets	13	2,147	United States 2,146.
Gas hydrocarbon [2]—value, thousands	$127	$158	Australia $125; United States $30.
Peat, including peat briquets and litter	47	20	United Kingdom 14; Ireland 6.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 20,131	21,555	Kuwait 12,855; Iran 3,417; Brunei 2,125.
Refinery products:			
Gasoline—do	2,463	2,027	Iran 780; Australia 562; Bahrain 402.
Kerosine and jet fuel—do	1,694	1,649	Australia 956; People's Republic of Yemen 231.
Distillate fuel oil—do	1,790	1,442	Australia 558; Saudi Arabia 322; Bahrain 277.
Lubricants [2]—value, thousands	$3,457	$4,559	Australia $3,482; United Kingdom $552; United States $448.
Mineral jelly and wax [2]—do	$883	$633	United States $221; Japan $111; Australia $88.
Other [2]—do	$1,178	$1,635	United States $898; Australia $454; United Kingdom $118.
Mineral tar from coal-, petroleum- or gas-derived crude chemicals thousand 42-gallon barrels	r 63	27	Japan 26.

r Revised.
[1] Fiscal period July 1 through June 30.
[2] Converted from $NZ at a prorated value of U.S. $0.995310 for years 1969–70 and 1970–71.

COMMODITY REVIEW

METALS

Aluminum.—The Bluff smelter reached full-initial-design capacity of 112,000 metric tons per year in 1972. Further expansion will depend on the world market as well as the New Zealand Government's ability to honor its contract with Bluff smelter for more electricity. Some ecologists are fighting efforts to raise the level of Lake Manapouri 27 feet to give the necessary hydropower. The Maui gasfield has been proposed as an alternate energy source. This industry is already a major factor in New Zealand's economy as it is the largest employer in the country and supports 2,500 people directly or indirectly.

Gold.—New Zealand's West Coast was to be the scene of a new operation to recover gold. South Westland Minerals Ltd. announced the arrival in the country of the first of two dredges it will use on its 63,000-acre Gorge River area claim.

Iron and Steel.—Waipipi Iron Sands Ltd. began installation of its second offshore slurry loading system. This system can handle 70,000-deadweight-ton bulk ore carriers and will be able to load them with iron sands under winds of 40 knots velocity and wave heights of 20 feet. New Zealand steel exceeded, at it's Glenbrook plant, domestic demand for steel billets and found the export market a real problem area. Consolidated Silver Mining Co. of New Zealand Ltd., through its agent Joseph Nathan and Co. Ltd., is seeking technical and financial assistance in devel-

oping their magnetite, ilmenite, and vanadium deposit on South Island. There are reportedly minor occurrences of gold and cobalt in the deposit which is estimated to have reserves of 81 million metric tons of ore.

Silver.—A high-grade silver ore body was blocked out at the Silver Queen mine near Paeroa, North Island, and plans for a mill at Thames were reported.

NONMETALS

Asbestos.—Cassiar Asbestos Corp. Ltd. of Canada will undertake an exploration program at the Pyke Asbestos property, West Coast, South Island in conjunction with Kennecott Copper Corp. and Lime and Marble Ltd.

Perlite.—New Zealand Perlite Co. Ltd. was considering expanding its operation in the central plateau region of North Island. There are reported to be economic concentrations scattered over a wide area. Consolidated Silver Mining Co. reports that its deposit on Great Barrier Island has a conservative 1.3 million metric tons and is only a few miles from an all-weather port.

Phosphate Rock.—The journal, Economic Geology of New Zealand, reports on the imminent (1982) exhaustion of high-grade phosphate rock deposits. A major search for more ore is reportedly underway.

Sulfur.—New Zealand Farmers Fertilizer Ltd. has contracted for a 300-ton-per-day sulfuric acid plant to be built at Whangarei near Auckland which is to be completed early in 1974.

MINERAL FUELS

Coal.—The slight (less than 3%) increase in coal production during 1972 was not deemed significant, as a 12% increase would have been necessary to return to 1970 levels.

Peat.—The Commercial Bank of Australia issued a report that suggests that if the Chatham Island peat waxes were processed and blended with the montan waxes recently discovered in Otago and Southland lignite and shale deposits, a new $20 million export industry might arise. The blend would produce a wax with a higher melting point and other desirable characteristics than peat wax alone.

Petroleum and Natural Gas.—Natural gas production continued to rise with a 17% increase over that of 1971. All production was again from the Kapuni field. Shell-BP-Todd Oil Services, Ltd., the field operators, released a new study showing the reserves to be nearly double the original estimates, at 460 million Btu's. New Zealand Natural Gas Corp. was building a plant to liquefy 2,500 tons per year of the Kapuni gas; early 1973 completion was expected. At yearend the negotiations between the Government and Shell-BP-Todd Oil Services about ownership and price of the Maui gasfield seemed to be nearing conclusion. Petroleum exploration during 1972 was limited to 11 onshore drillings and none offshore. There were no conclusive results from the wells drilled.

Other Forms of Energy.—*Geothermal Energy.*—The Japanese firm Showa Denko, KK, announced that its feasibility study on using North Island's geothermal power for making heavy water had favorable results. The proposal is for a 400-ton-per-year plant at Broadlands, 35 miles south of Rotorua. Use of geothermal steam and geothermal electric power could result in a $30 per kilogram cost of the heavy water, the cheapest in the world.

The Mineral Industry of Nigeria

By K. L. Harris [1]

The rapid growth of the Nigerian economy, with the petroleum industry increasing at a higher rate than all other sectors, continued throughout 1972. Gross domestic production (GDP) rose about 9% in 1972 compared with a 12% increase in 1971. Population in 1972 was 57.5 million, 23% urban, and growing at an annual rate of 2.5%.[2] In 1971, the gross national product (GNP) was $6.7 billion [3] and $120 per capita compared with a GNP of $5.45 billion and $125 per capita in 1966, the last full year before the civil war.

With a production of over 1.9 million barrels per day at yearend 1972, Nigeria now ranks eighth in world production of crude oil. The increased oil production combined with higher prices per barrel greatly increased government revenue. The oil industry accounted for 75% of the budget revenue in 1972.

Nigeria maintained sixth place among free world tin-producing nations. The country continued as the third-ranking producer of columbite in the free world.

The indigenization program, requiring whole or part ownership of a selected group of business activities, moved ahead. The Government announced the creation of a new industrial and commercial bank to help finance greater Nigerian ownership in the economy. The bank, expected to open prior to October 1973, will have an initial capitalization of $228 million.

One of the declared aims of Nigeria's National Development Plan (1970–74) was fulfilled by the creation of a national mining body, the Nigerian Mining Corp. The corporation will engage in prospecting, mining, and refining of all minerals other than coal and petroleum. The Nigerian Government also set aside about $7 million for the mining sector during the current Development Plan to increase exploration for tin, columbite, crude petroleum, and other minerals.

Further reduction of import duties was announced in early 1972, aimed at maintaining price stability and providing encouragement for industrial expansion.

The Nigerian Port Authority announced plans to continue to improve the delta ports including Warri, Koko, Burutu, and Sapele to the extent of $17 million by 1974. The major part of the expenditure will be used for dredging channels to take larger tonnage vessels.

PRODUCTION

The petroleum industry dominated Nigerian mineral production in 1972, as the output of crude and refined petroleum continued to record substantial increases. The production of crude petroleum rose from 1.7 million barrels per day in January to 1.9 million in December. Refinery production increased 12% over 1971 output. Tin mine production fell 8% below the 1971 level, while smelter production increased 2%. Cement production was up two-thirds from that of 1971 as more repairs were completed on the industry's war damaged machinery. Despite an almost twofold increase over the previous year, coal production was still 54% below the pre-civil war peak of 740,000 tons in 1965.

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Agency for International Development. Economic Data Book. Revision No. 294, April 1973, p. 5.

[3] Where necessary, values have been converted from Nigerian pounds (£N) to U.S. dollars at the rate of £N1 = US$3.04.

Table 1.—Nigeria: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Columbium and tantalum:				
Columbite concentrate, gross weight		[r] 1,616	1,381	1,350
Tantalite concentrate, gross weight		4	4	1
Gold	troy ounces	123	40	12
Lead, mine output, metal content		--	215	321
Rare-earth metals, monazite concentrate		13	102	10
Tin:				
Mine output, cassiterite concentrate:				
Gross weight	long tons	[r] 10,755	9,899	9,102
Tin content	do	7,833	7,210	6,625
Smelter	do	[r] 7,942	7,243	7,405
NONMETALS				
Cement, hydraulic	thousand tons	[r] 596	664	1,112
Clays:				
Kaolin		579	153	--
Other		NA	NA	8,768
Feldspar		NA	NA	4,313
Stone:				
Limestone	thousand tons	678	474	1,189
Marble		1,098	3,326	757
Shale	thousand tons	NA	NA	114
MINERAL FUELS AND RELATED MATERIALS				
Coal	thousand tons	[r] 58	194	341
Gas, natural:				
Gross production	million cubic feet	[r] 285,804	446,840	601,237
Marketed production	do	3,920	6,509	9,609
Petroleum:				
Crude	thousand 42-gallon barrels	395,836	558,375	665,282
Refinery products:				
Gasoline	do	[r] 1,855	3,767	4,389
Kerosine and jet fuel	do	1,166	2,117	2,361
Distillate fuel oil	do	[r] 1,717	3,532	4,093
Residual fuel oil	do	[r] 2,315	4,665	4,976
Liquefied petroleum gas	do	[r] 8	24	104
Refinery fuel and losses	do	[r] 339	411	292
Total	do	7,400	14,516	16,215

[p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, additional crude construction materials such as sand, gravel, and other stone are produced, but output is not reported, and available general information is inadequate for the formulation of reliable estimates of output levels.

TRADE

Another year of growth in Nigeria's foreign trade was achieved in 1972. Exports increased and imports decreased, resulting in an overall rise in the favorable balance of trade to $621 million in 1972, a 108% increase over the 1971 trade surplus of $299 million. The total value of exports was $2.01 billion, up 11% compared with the $1.81 billion of 1971. Imports fell from $1.51 billion in 1971 to $1.39 billion in 1972.

Petroleum exports accounted for 83% of the total exports, compared with 74% in 1971. The value of petroleum exports increased 23% from that of 1971, reflecting not only increased output but also a 3% increase in price over the level of the previous year. The value of tin metal exported suffered a 23% drop in 1972 as the result of the combined effect of a 12% decrease in both volume and price.

The value of Nigerian exports received by the United States was up 32% from the 1971 level due mostly to the increased amount of crude petroleum purchased by the United States.

Despite changes in customs tariffs, which considerably liberalized the import trade in 1971, imports on the whole for 1972 declined 8% from that of 1971. The decline was attributed to decreased imports of manufactured goods and machinery and transport equipment.

Value of mineral trade and total trade in recent years follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1970	762	1,240
1971	1,369	1,810
1972	1,647	2,008
Imports:		
1970	178	1,059
1971	212	1,511
1972	187	1,387

Table 2.—Nigeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Columbite, ore and concentrate, gross weight	1,792	1,218	Japan 449; United Kingdom 276; United States 209.
Iron and steel:			
Scrap	12,536	17,082	Spain 8,208; United Kingdom 4,858; Italy 2,134.
Semimanufactures	3	--	
Lead, ore and concentrate, gross weight	5	150	All to Netherlands.
Platinum-group metals, including alloys	756	--	
Tantalum, ore and concentrate, gross weight	4	4	Netherlands 2; United Kingdom 2.
Tin:			
Ore and concentrate, gross weight long tons	3	--	
Metal, including alloys, unwrought do	10,731	8,433	United Kingdom 6,272; Netherlands 795; United States 686.
Zinc:			
Ore and concentrate, gross weight	61	--	
Metal, including alloys	32	(1)	All to Ivory Coast.
Other nonferrous base metals:			
Ore and concentrate, gross weight	1,485	81	Belgium-Luxembourg 41; West Germany 21.
Scrap	5,270	2,911	West Germany 1,373; Italy 530; Belgium-Luxembourg 324.
NONMETALS			
Cement, hydraulic	4	--	
Fertilizer materials, crude	86	138	Togo 92; Dahomey 23; Ivory Coast 15.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,819	--	
Petroleum, crude and partly refined thousand 42-gallon barrels	377,046	512,317	United Kingdom 99,824; France 99,626; United States 92,893.
Petroleum refinery products:			
Gasoline, including natural do	--	8	Equatorial Customs Union 5; Niger 3.
Jet fuel do	134	6	Equatorial Customs Union 5.
Kerosine do	(1)	(1)	Mainly to Niger.
Distillate fuel oil do	(1)	26	Niger 12; Togo 7; Equatorial Customs Union 5.
Residual fuel oil do	9	571	United States 481; Ships stores 31; Cameroon 18.
Lubricants do	474	(1)	Mainly to Ghana.
Other do	6	(1)	All to Niger.

[1] Less than ½ unit.

Table 3.—Nigeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum, metal and alloys:			
Unwrought	248	250	West Germany 212; Netherlands 16; United States 15.
Semimanufactures	8,128	9,879	Switzerland 2,834; United Kingdom 2,017; West Germany 1,490.
Copper, metal and alloys:			
Unwrought	20	45	All from United Kingdom.
Semimanufactures	1,707	2,309	United Kingdom 1,140; Belgium-Luxembourg 371.
Iron and steel:			
Pig iron, ferroalloys, and other similar materials	611	469	United Kingdom 327; West Germany 141.
Spiegeleisen	91	782	United Kingdom 776.
Steel, primary forms	14,816	32,891	United Kingdom 16,764; West Germany 11,697; Belgium-Luxembourg 2,036.
Semimanufactures	564,075	586,990	Japan 199,775; United Kingdom 116,124; United States 82,992.
Lead, metal, including alloys:			
Unwrought	417	1,250	United Kingdom 1,068.
Semimanufactures	113	899	United States 359; Italy 277; United Kingdom 149.
Nickel, metal, unwrought and semimanufactures	76	52	United Kingdom 17; Netherlands 9; Belgium-Luxembourg 9.
Platinum-group metals, unworked troy ounces	46,647	71,071	United Kingdom 42,587; West Germany 22,805; Italy 5,237.

See footnotes at end of table.

Table 3.—Nigeria: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Silver, metal, unworked or partly worked thousand troy ounces	1,390	1,925	United Kingdom 1,912.
Tin, metal and alloys, all forms long tons	191	1,570	United Kingdom 588; Italy 406.
Zinc, metal, all forms, including alloys	4,854	4,494	Zaire 2,476; West Germany 692.
Other:			
Ore and concentrate of nonferrous base metals, n.e.s., gross weight	386	78	United Kingdom 60; Japan 14.
Nonferrous metal scrap	903	4,142	West Germany 3,666; United Kingdom 518.
Oxides, hydroxides and peroxides of metals	9,416	10,529	United Kingdom 6,965; West Germany 1,898; Sweden 407.
Miscellaneous base metals, nonferrous, all forms	7	23	United Kingdom 17; West Germany 5.
NONMETALS			
Abrasives:			
Natural	210	488	United States 404.
Grinding and polishing wheels and stones	4,747	575	United Kingdom 313; United States 106; Italy 57.
Asbestos	34,443	50,598	All from Canada.
Cement	446,055	977,523	U.S.S.R. 197,229; Lebanon 150,098; Spain 145,118.
Clays, construction materials	14,157	17,184	United Kingdom 5,536; Sweden 2,550; United States 2,391.
Fertilizer materials:			
Crude	5,988	13,803	NA.
Manufactured:			
Nitrogenous	7,233	5,215	West Germany 4,242; United Kingdom 541.
Phosphatic	14,329	14,760	United Kingdom 10,670; West Germany 2,407.
Potassic	1,335	483	France 308; West Germany 98.
Other, n.e.s	5,210	83,580	West Germany 78,183; Netherlands 3,146.
Ammonia	1,655	535	United Kingdom 229; United States 167; France 53.
Lime	5,053	7,044	All from United Kingdom.
Mica	311	283	West Germany 236.
Salt	143,638	273,871	United Kingdom 218,574; Poland 29,256.
Stone, dimension, worked	534	955	West Germany 776; United Kingdom 114.
Stone, sand and gravel	40,833	42,337	France 21,982; United Kingdom 11,399; Morocco 2,909.
Sulfur, all forms	342	465	United Kingdom 358; France 95.
Other, n.e.s	5,770	13,399	United Kingdom 7,028; Morocco 1,696; Israel 1,457.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	62,263	101,065	Greece 39,884; United Kingdom 15,097; Ireland 10,577.
Coal, coke and briquets	5,280	14,331	India 8,124; United Kingdom 5,012.
Petroleum refinery products:			
Aviation gasoline thousand 42-gallon barrels	r 61	17	Netherlands 10; United Kingdom 7.
Motor gasoline do	r 836	176	Italy 65; Netherlands Antilles 46; Netherlands 33.
Kerosine do	r 516	19	Algeria 9; Netherlands Antilles 7; United States 1.
Jet fuel do	r 561	41	Netherlands Antilles 32; Algeria 8.
Distillate fuel oil do	r 1,321	14	Netherlands Antilles 9; Dahomey 2; Cameroon 2.
Residual fuel oil do	r 800	(1)	Mainly from Dahomey.
Lubricants do	218	187	United Kingdom 66; Netherlands Antilles 37; United States 23.
Mineral jelly and wax do	17	26	Netherlands 10; United States 7; United Kingdom 4.
Other do	165	251	Netherlands Antilles 83; Netherlands 65; United Kingdom 64.

r Revised. NA Not available.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Tin.—Production of tin in Nigeria, concentrated in the region around Jos, declined to 6,625 long tons, its lowest level since 1959. Rising costs of production, lower quality ore bodies, and weak world prices all contributed to this year's low output.

A wholly owned Nigerian mining company, the United Nigeria Miners Co., Ltd., was formed by the All-African Miners Association with an initial capital of $235,000. Located in Jos, the company will emphasize tin exploration and mining.

Gold and Base Metal Mines, Ltd., may become the first lode tin mining operation in Nigeria, subject to the satisfactory outcome of discussions with the Nigerian Government. The company's Liruie Lode, located in Kano State, Northern Nigeria, is expected to provide 600 long tons of ore per day yielding about 1,000 long tons of tin concentrate per year. Indicated ore reserves were 2 million long tons. If the anticipated production rate materializes, the company would be second only to Amalgamated Tin Mines of Nigeria, Ltd., in tin concentrate output. Amalgamated Tin Mines reported production of 3,720 long tons of tin concentrate for 1972, up 5% compared with that of 1971.

All tin produced is refined by the Makeri Smelting Co. in Jos. Although the smelter has a capacity of 18,000 long tons per year, production of metal in 1972 was 7,405 long tons, down from a peak of 9,869 long tons in 1966. Exports of metal, at 6,741 long tons, were 20% below the 1971 level of 8,433 long tons.

NONMETALS

Cement.—Nigerian cement production increased two-thirds to 1,112,000 tons, and imports decreased 27% to 710,000 tons in 1972, as the cement industry continued to recover from civil war damage. The Nigerian Cement Co., Ltd., placed the fourth of its six war-damaged kilns back into operation, raising the company's capacity to 500,000 tons per year. The Calabar Cement Co., Ltd., announced plans to expand its capacity threefold to 300,000 tons per year.

MINERAL FUELS

Coal.—In late May, Nigeria shipped its first load of 1,500 tons of coal to Ghana as part of a 4-year agreement calling for shipment of 20,000 tons of coal per year. The coal was produced by the Nigerian Coal Corp. from mines near Enugu. Production came to a virtual halt during Nigeria's civil war, and the mines were severely damaged through neglect and flooding when the pumps became inoperative. The Nigerian Coal Corp. has been slowly rehabilitating the mines and pumping out the water. Production in 1972 was 341,215 tons, compared with a high of 740,000 tons in 1965, the last normal year before the civil war.

It is unlikely that Nigeria's coal production will come close to the earlier levels. The subbituminous coal is of low quality. The major consumer was the Nigerian Railroad Administration, which now uses primarily diesel locomotives. Coal was also used for generation of thermal electric power. Nigeria now relies on electric power from the Kainji hydroelectric powerplant supplemented by thermal generating stations powered by natural gas, notably in Ughelli and Afam. Some coal is still used at the Lagos generating station on Ido Island for peak power needs and in a few other generating stations in Nigeria, such as the one on the Oji River. Cement plants continue to use coal, although some have converted to fuel oil.[4]

Natural Gas.—Production of natural gas in association with crude oil averaged over 1.6 billion cubic feet per day in 1972, a 34% increase compared with the 1.2-billion-cubic-foot per-day average for 1971. An average of 10.9 million cubic feet per day was used by petroleum companies to generate electric power for their own needs, 15.4 million cubic feet per day was sold to industrial consumers, including the Nigerian Electric Power Authority for its power generation, a small amount was reinjected into wells, and the remainder was flared at the wellhead.

With over 98% of Nigeria's natural gas production being flared at the wellhead, the establishment of the Nigerian Gas Products Co. Ltd. was a welcome asset. The company, owned 60% by the Government and 40% by the Guadalupe Gas Products Corp. of the United States, plans to extract and export liquefied petroleum gas from its proposed plant at Port Harcourt. The plant will have an initial capacity of 12,000 to 15,000 barrels per day.

In November, the Government announced that negotiations were progressing with Shell-BP Petroleum Development Co. of Nigeria, Ltd. (Shell-BP), on the establishment of an 800-million-cubic-foot-per-day liquid natural gas project to be built at Bonny, Rivers State, by 1977.

[4] U.S. Embassy, Lagos, Nigeria. State Department Airgram A-172, June 8, 1972, p. 1.

Petroleum.—Although petroleum production continued the post-war upward trend, total output rose only 19% in 1972, compared with a 41% increase in 1971. Crude oil production averaged 1.5 million barrels per day in 1971 and 1.8 million barrels per day in 1972, making Nigeria the eighth largest producer in the world. At yearend, production was over 1.9 million barrels per day. Production totaled 665 million barrels in 1972, of which United States firms produced 29%. Exports, at 636 million barrels, were up 24% from those of 1971. The United States, which took 23% of the exports, was the largest single market for Nigerian crude oil. Deliveries to the refinery were 16.0 million barrels, up from 14.5 million barrels in 1971, and refinery output rose 12% from that of 1971.

As of February, all areas not covered by existing oil mining leases, oil prospecting licenses, or oil exploration licenses were vested in the Nigerian National Oil Corp. (NOC). No further concession to foreign or indigenous firms will be granted by the Government. The NOC will accept suitable companies as contractors or minority partners in working its concessions. The Government awarded its final two concessions to Monsanto Oil Co. of Nigeria Ltd. and Niger Oil Resources, a local firm. Monsanto and Niger will share 49%, with the NOC reserving 51% interest in the venture operating in a 616-square-mile area in the delta region of Mid-Western State.

The Government's share of the Nigerian Petroleum Refinery Corp.'s Port Harcourt refinery was increased to 60% in May. Formerly, the Government owned 50% of the 55,000-barrel-per-day facility and Shell and BP owned 25% each. The new agreement calls for complete Nigerianization of the corporation by 1976. A feasibility study on a second refinery was submitted to the Government for review, but at yearend, no decision had been reached as to the construction or location of the refinery.

The Government conducted negotiations with Shell-BP for participation in oil concessions. Shell-BP, with an output of 1,208,185 barrels per day in 1972, was still the most important producer of crude oil in Nigeria. However, its relative importance has decreased since 1970 when Shell-BP production accounted for 76% of the total crude oil production in Nigeria, falling to 72% in 1971 and 67% in 1972. Other principal producers are Nigerian Gulf Oil Co., Ltd.; Mobil Exploration Nigeria, Ltd.; Safrap (Nigeria), Ltd.-NOC; Nigerian AGIP Oil Co., Ltd.-Phillips Petroleum Co., Nigeria-NOC; and Texaco Overseas (Nigeria) Petroleum Co.-Chevron Oil Co. (Nigeria).

Gulf, Nigeria's largest offshore oil producer, commissioned its first onshore field, Abiteye, in October. The field is expected to produce approximately 15,000 barrels per day from 10 wells. Mobil's production increased from 72,412 barrels per day in 1971 to 166,539 barrels per day in 1972 by bringing onstream three more marine fields during the year.

Occidental Petroleum Co. discovered two zones in its 90–B–1 block, 40 miles south of Port Harcourt. The area has a combined output of 18,600 barrels per day, making it Nigeria's largest recorded discovery through 1972. Occidental later discovered another zone with an output of 6,122 barrels per day in a block adjacent to its previous discovery area. Plans calling for oil production by late 1973 or in 1974 were being made.

Texaco-Chevron recorded discoveries in two of its offshore concessions, and Japan Petroleum Co. (Nigeria) Ltd. recorded one discovery.

The Mineral Industry of Norway

By F. L. Klinger [1]

Although faced with rising costs of production, relatively low demand from export markets, and falling prices for some commodities such as aluminum and copper, the Norwegian mineral industry increased production and exports of many commodities in 1972. A net surplus was generated in mineral commodity trade for the first time since 1969, owing in part to significant increases in exports of crude oil and primary aluminum compared with the levels of 1971.

Two new copper mines began operating in 1972, and improved production facilities were completed at several other metal and nonmetal mines, quarries, and processing plants. Construction of a second iron ore pelletizing plant, a large ferromanganese smelter, and a new petroleum refinery was expected by mid-1975. The Knaben molybdenum mine, which has operated almost continuously since 1885 and in which considerable expenditures had recently been made to increase productivity, became a casualty of the cost-price squeeze and was scheduled to close by mid-1973. Exploration of the Svea coal deposits was continued on Spitzbergen, and exploration and development of oil and gas deposits in the North Sea was intensive. The Phillips Petroleum Group continued to develop the Ekofisk and adjacent oil- and gasfields for full production by 1975. It was likely that most of the oil and condensate would be piped to Teesside, England, and most of the gas would be piped to Emden, West Germany.

The level of investment in the mining industry declined to an estimated $25 million in 1972 as several projects were finished or nearing completion. A further decline of 8% was expected in 1973. In October, Norwegian voters rejected membership for Norway in the European Economic Community (EEC). This development was expected to slow down investments in the mining and minerals processing industries because it created uncertainties about the future competitive position of Norwegian products in domestic and export markets.

The average hourly wage of adult male workers in the mining industry increased about 8% in the first 9 months of 1972, to the equivalent of approximately $2.65 compared with an average industrial wage of $2.50, and $3.10 in private construction.[2]

In May 1972, A/S Elkem and Christiania Spigerverk merged to form Elkem-Spigerverket A/S. The new company was reported to be Norway's largest industrial enterprise.

[1] Physical scientist, Division of Ferrous Metals.
[2] Central Bureau of Statistics (Oslo). Statistisk Manedshefte. No. 2, 1973; pp. 71, 83–87. (Conversion rate stated for 1972 was Norwegian Kroner (NKr) to U.S. dollars at the rate of NKr 6.59=US$1.00).

PRODUCTION

Volume indices of production for various branches of the mineral industry in 1970–72 are shown in the following tabulation.

Industry sector	1961 = 100		
	1970	1971	1972
Mining and quarrying:			
Coal mines	140	131	136
Metal mines	234	240	245
Mineral quarries	145	149	143
Stone, sand and gravel	213	241	213
Mineral processing:			
Primary metals	198	205	210
Nonmetallic mineral manufacturing	159	171	176
Coal and petroleum	211	215	228
Chemicals	174	179	185
All mining and quarrying	209	227	257
All industry	159	165	171

Source: Statistisk Sentralbyrå (Oslo). Statistisk Månedshefte (Monthly Bulletin of Statistics). V. 91, No. 2, 1973, pp. 18–20.

The volume of production increased in 1972 for all branches of the mineral industry except mineral quarries and production of stone, sand and gravel. Declines in those sectors were probably due to decreased activity in building construction and reduced production of cement. Higher volume in the metal mining sector was primarily due to the opening of two new base-metal-sulfide mines in 1972, and also to larger volumes of crude ore mined for production of iron ore and ilmenite concentrates even though output of those concentrates was less than that of 1971. In the primary metals sector there was record production of crude steel and refined nickel and zinc.

The index for all mining and quarrying shows a gain of 13% in 1972 compared with that of 1971. Since the gains in individual sectors were less, it is possible that the high overall figure was generated by the heavy increase in output of crude oil from the Ekofisk field in the North Sea.

Production data for individual commodities is given in table 1.

Table 1.—Norway: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
METALS				
Aluminum:				
Alumina e		2,500	NA	NA
Metal:				
Primary ingot		r 522,308	528,631	548,319
Secondary ingot		16,982	r e 17,000	e 17,000
Superpure e		3,000	NA	NA
Cadmium, smelter production		98	92	187
Cobalt, metal		782	869	320
Copper:				
Mine output, metal content:				
In copper concentrate		r 13,307	15,293	17,525
In cupriferous pyrite		r 6,444	7,196	7,850
Total		r 19,751	22,489	25,375
Metal:				
Primary:				
Blister		r 32,288	34,257	33,903
Refined		r 25,807	27,717	26,449
Secondary		9,037	r e 9,000	e 9,000
Iron and steel:				
Iron ore and concentrate	thousand tons	r 4,008	4,056	3,922
Roasted pyrite	do	135	r e 140	e 140
Pig iron	do	r 636	627	648
Ferroalloys:				
Ferrosilicon (75% basis)	do	r 244	243	213
Ferromanganese	do	159		
Ferrosilicomanganese	do	r 130	514	425
Ferrochrome	do	r 34		
Other	do	12		
Total	do	r 579	757	638
Crude steel	do	r 869	863	916
Semimanufactures:				
Rolled	do	617	618	e 650
Finished castings	do	15	20	e 20

See footnotes at end of table.

Table 1.—Norway: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Lead, mine output, metal content	r 3,719	3,712	3,820
Magnesium metal, primary	35,343	36,105	36,491
Molybdenum, mine output, metal content	r 269	292	e 280
Nickel:			
Mine output, metal content	297	360	e 390
Metal, primary	38,478	41,783	43,308
Platinum-group metals (exports)—troy ounces	19,805	28,068	e 43,000
Selenium, elemental	26	28	e 30
Silicon, elemental (exports)	26,330	26,651	e 44,000
Titanium:			
Ilmenite concentrate	r 578,999	641,602	608,614
Dioxide e	17,000	17,000	17,000
Vanadium, mine output, metal content e	1,080	1,050	1,100
Zinc:			
Mine output, metal content	r 10,479	11,190	15,932
Metal, primary	r 61,709	62,380	73,347
NONMETALS			
Cement, hydraulic—thousand tons	r 2,609	2,722	2,648
Feldspar:			
Lump	152,145	r e 150,000	e 150,000
Ground and other	55,000	NA	NA
Fertilizer materials, manufactured:			
Nitrogenous:			
Elemental nitrogen (total)—thousand tons	519	534	585
Ammonia—do	541	NA	NA
Fertilizer, gross weight—do	955	NA	NA
Phosphatic—do	8	NA	NA
Compound and other—do	839	NA	NA
Graphite	r 10,357	8,321	8,655
Lime (quicklime and hydrated lime)	94,701	r e 95,000	e 95,000
Mica (exports)	r 4,348	3,478	4,000
Olivine	132,545	138,000	e 140,000
Pyrite and pyrrhotite:			
Gross weight	r 739,723	781,224	794,548
Sulfur content	r 339,230	358,262	364,373
Stone:			
Dimension stone:			
Syenite (labrador)	56,161	NA	NA
Slate—thousand square meters	384	NA	NA
Crushed and broken stone:			
Dolomite	r 352,036	362,838	e 360,000
Limestone—thousand tons	r 5,043	4,978	e 5,000
Nepheline syenite	147,044	160,091	161,064
Quartz and quartzite	465,458	NA	NA
Sulfur, sulfuric acid (100%)	r 312,362	289,762	352,815
Talc, soapstone, and steatite:			
Unground	75,886	r e 76,000	e 76,000
Other	70,553	r e 71,000	e 71,000
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades—thousand tons	r 484	455	455
Coke, all grades—do	r 310	329	310
Gas, manufactured—million cubic feet	1,149	1,051	1,021
Peat:			
For agricultural use	11,303	r e 11,000	e 11,000
For fuel use	4,573	r e 5,000	e 5,000
Petroleum:			
Crude oil—thousand 42-gallon barrels	--	2,081	10,805
Refinery products:			
Gasoline—do	4,994	5,406	NA
Jet fuel—do	1,504	856	NA
Kerosine—do	1,232	1,155	NA
Distillate fuel oil—do	11,802	12,913	NA
Residual fuel oil—do	18,361	17,789	NA
Lubricants—do	202	231	NA
Other—do	2,218	2,378	NA
Refinery fuel and losses—do	2,255	1,977	NA
Total—do	42,568	42,705	NA

e Estimate. p Preliminary. r Revised. NA Not available.

TRADE

Although statistics on trade in mineral commodities were available only for the first 11 months of 1972, it was apparent that Norway's balance of trade attributable to mineral commodities had improved compared with that of 1971. For the 11-month period, a net surplus of 147 million kroner (about $22.3 million) was generated in 1972 whereas a deficit of 686 million kroner (about $97.7 million) had been generated in the same period of 1971.

Exports of mineral commodities increased in both quantity and value for every major commodity group in 1972. The most striking changes, compared with 1971, were in liquid and gaseous fuels: exports of crude oil increased nearly sevenfold; those of gas nearly doubled; and exports of petroleum products rose 28%. To a large extent this was related to production of crude oil and condensate from the Ekofisk field. Exports of other major Norwegian commodities such as iron ore, ilmenite, pyrite, manufactured fertilizers, ferroalloys, and aluminum also increased, but the gains in volume were offset to some extent by unfavorable prices.

Import statistics presented a very different picture. The volume of liquid fuels, iron and steel, and nonferrous metals was higher than that of 1971, but gross value increased only in the iron and steel, manufactured fertilizer materials, and nonmetallic mineral manufacturers categories and the increases were relatively small.

Norway's trade in mineral commodities in 1970 and 1971 is detailed in tables, 2 and 3.

Table 2.—Norway: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys:			
Scrap	5,313	4,820	West Germany 2,550; Sweden 1,225; Netherlands 583.
Unwrought	429,750	415,328	West Germany 128,652; United Kingdom 111,681; United States 45,519.
Semimanufactures	33,980	37,070	United Kingdom 18,809; Sweden 6,990; Denmark 3,506.
Cadmium	85	78	NA.
Cobalt	720	762	NA.
Copper:			
Ore and concentrate	33,552	40,300	West Germany 17,473; Sweden 17,220; Spain 5,607.
Metal including alloys:			
Scrap	1,477	702	Belgium-Luxembourg 326; Sweden 203; West Germany 131.
Unwrought:			
Unrefined	6,376	6,382	All to West Germany.
Refined	26,101	25,956	West Germany 14,498; United Kingdom 3,452; France 3,002.
Semimanufactures	2,659	2,160	Sweden 1,543; Denmark 408; West Germany 44.
Gold metal unworked or partly worked troy ounces	2,443	2,058	Denmark 932; United Kingdom 547; Finland 482.
Iron and steel:			
Ore and concentrate except roasted pyrite thousand tons	2,964	2,742	West Germany 1,455; United Kingdom 811; Poland 235.
Roasted pyrite	152,812	160,040	West Germany 147,204.
Scrap	34,975	18,421	West Germany 11,699; Spain 3,898; Sweden 2,527.
Pig iron including cast iron	149,711	126,983	United Kingdom 47,656; West Germany 17,988; France 8,731.
Ferroalloys:			
Ferromanganese	155,077	187,542	United Kingdom 45,526; West Germany 38,307; Belgium-Luxembourg 25,042.
Other	379,956	346,911	United Kingdom 97,533; West Germany 86,994; United States 31,523.
Steel, primary forms	167,421	180,965	Netherlands 81,447; Denmark 66,651; India 11,728.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Iron and steel—Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections	187,120	197,066	United Kingdom 54,500; West Germany 38,343; Sweden 35,145.
Universals, plates, and sheets	82,482	92,365	Sweden 40,114; Denmark 19,227; United Kingdom 11,727.
Hoop and strip	708	1,253	Sweden 1,091.
Rails and accessories	883	184	Thailand 177.
Wire	8,976	7,702	United Kingdom 2,016; Iraq 1,419; Poland 1,031.
Tubes, pipes, and fittings	24,178	25,707	Sweden 14,146; Denmark 6,936; Ireland 723.
Castings and forgings rough	13,401	13,727	Sweden 10,631; Denmark 1,650; Liberia 934.
Total	317,748	338,004	
Lead:			
Ore and concentrate	6,476	5,380	United Kingdom 2,800; West Germany 2,453.
Metal including alloys:			
Scrap	4,389	4,276	Denmark 2,234; Sweden 1,101; West Germany 905.
Unwrought	418	218	Sweden 120; West Germany 63; Greece 19.
Semimanufactures	101	69	Denmark 42; Canada 18.
Magnesium metal, including alloys all forms value, thousands	$26,000	$20,008	NA.
Manganese ore and concentrate	945	100	All to United Kingdom.
Molybdenum ore and concentrate	506	550	NA.
Nickel:			
Ore and concentrate	6,666	8,212	Finland 7,701; West Germany 511.
Metal including alloys:			
Scrap	177	158	West Germany 77; Belgium-Luxembourg 62.
Unwrought	37,044	40,092	United States 12,041; West Germany 8,654; Sweden 5,247.
Semimanufactures	166	120	Sweden 39; Switzerland 32; Italy 28.
Platinum-group metals and silver:			
Waste and sweepings—kilograms	70,568	30,165	West Germany 8,482; Sweden 1,300; United Kingdom 49.
Metal including alloys:			
Platinum-group metals troy ounces	r 19,805	28,068	United States 15,786; United Kingdom 5,080; Netherlands 3,633.
Silver—do	112,142	321,603	Denmark 300,931; United Kingdom 7,008.
Silicon, elemental	26,288	26,648	United Kingdom 8,081; West Germany 7,891; U.S.S.R. 5,142.
Tin metal including alloys:			
Scrap—long tons	14	34	Denmark 27; West Germany 4.
Unwrought—do	225	200	Sweden 174; Denmark 12.
Titanium ore and concentrate (ilmenite)	532,126	513,835	NA.
Zinc:			
Ore and concentrate	11,430	11,249	Poland 5,841; West Germany 5,408.
Oxide	461	489	Sweden 385; West Germany 62; Denmark 33.
Metal including alloys:			
Scrap	175	92	Spain 80; Sweden 10.
Unwrought	46,254	48,547	Sweden 19,679; West Germany 11,519; United Kingdom 10,518.
Semimanufactures	542	748	Sweden 341; Netherlands 128; Hong Kong 58.
Other:			
Ash and residues containing nonferrous metal	22,622	19,164	Sweden 10,649; Netherlands 3,852; West Germany 2,742.
Oxides, hydroxides and peroxides of metals, n.e.s	2,298	2,935	NA.
Base metals, including alloys, all forms	806	845	NA.
NONMETALS			
Abrasives (grinding and polishing wheels and stones)	1,214	1,068	Poland 340; Sweden 196; Finland 83; Romania 83.
Cement	1,022,458	1,217,277	Ghana 545,960; United States 434,580; Liberia 98,219.
Clay products:			
Refractory (including nonclay bricks)	8,985	6,570	West Germany 4,560; Sweden 484; Denmark 455.
Nonrefractory—value, thousands	$531	$679	West Germany $541; Sweden $44; United Kingdom $26.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Feldspar and fluorspar	224,068	236,511	United Kingdom 60,170; West Germany 51,182; Netherlands 49,815.
Fertilizer materials: Manufactured:			
Nitrogenous	855,332	759,090	NA.
Phosphatic	16	15	NA.
Potassic	22	13	NA.
Other	463,828	480,001	NA.
Graphite, natural	10,620	8,566	NA.
Mica, all forms	4,348	3,478	France 861; West Germany 525; Sweden 325.
Pyrite (gross weight)	520,799	545,236	West Germany 408,772; Sweden 88,767; United Kingdom 47,697.
Salt	1,717	1,976	Sweden 1,393.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	3,974	2,744	West Germany 1,339; Sweden 429; Italy 338.
Slate	45,082	44,552	Netherlands 19,298; Denmark 7,561; West Germany 7,539.
Other	65,525	68,069	France 18,385; West Germany 17,776; Italy 17,665.
Worked all types	337	264	Denmark 161; Sweden 94.
Dolomite	64,842	66,916	NA.
Gravel and crushed rock	1,013,486	1,014,755	West Germany 648,907; United Kingdom 174,317; Denmark 112,555.
Limestone	11,195	11,344	Sweden 9,960; Denmark 594; United Kingdom 431.
Quartz and quartzite	5,231	7,663	Belgium-Luxembourg 2,400; United Kingdom 2,367; Denmark 1,529.
Sand, excluding metal bearing	9,095	3,790	Ivory Coast 510.
Sulfur:			
Elemental	5	--	
Sulfur dioxide	1,989	1,592	Sweden 1,439; Denmark 153.
Talc, steatite, soapstone and pyrophyllite	66,375	71,849	United Kingdom 17,885; Sweden 11,342; West Germany 9,896.
Other nonmetals, n.e.s.:			
Slag, dross and similar waste, not metal bearing	11,515	4,900	Netherlands 4,400; West Germany 500.
Other	555	801	Netherlands 198; West Germany 168; France 167.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	62	52	Sweden 35.
Coal and coke, including briquets:			
Anthracite and bituminous coal	101,644	85,343	West Germany 82,091; Sweden 1,309; Portugal 1,100.
Coke and semicoke	44,705	60,511	Venezuela 26,000; Denmark 13,085; Romania 11,000.
Peat, including peat briquets and litter	36	8	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	4,141	1,756	United Kingdom 896; West Germany 582; Denmark 278.
Refinery products:			
Gasoline, including natural do	1,672	1,593	Sweden 1,112; United Kingdom 229; Netherlands 169.
Kerosine and jet fuel do	1	63	Sweden 62.
Distillate fuel oil do	939	1,239	Sweden 1,196; West Germany 23; Denmark 19.
Residual fuel oil do	8,218	8,754	Sweden 3,934; United Kingdom 1,982; West Germany 167.
Lubricants do	104	112	Denmark 51; Belgium-Luxembourg 36; Sweden 19.
Mineral jelly and wax do	1	1	Mainly to Sweden.
Other:			
Nonlubricating oils, n.e.s. do	1	1	Do.
Liquefied petroleum gas do	163	164	United Kingdom 89; Finland 38; Portugal 13.
Pitch and pitch coke do	19	(1)	NA.
Bituminous mixtures, n.e.s. do	1	1	Mainly to Sweden.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	19,885	18,491	West Germany 6,046; Denmark 4,826; France 4,408.

r Revised. NA Not available.
1 Less than ½ unit.

Table 3.—Norway: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite	3,999	5,767	Greece 5,380; Guyana 387.
Oxide and hydroxide	1,014,732	1,156,970	Jamaica 390,704; United States 193,494; Surinam 174,884; Guinea 173,004.
Metal, including alloys:			
Scrap	27	64	Sweden 53.
Unwrought	23,714	33,663	U.S.S.R. 15,614; Sweden 9,816; Hungary 2,752.
Semimanufactures	14,106	18,370	Belgium-Luxembourg 5,635; Sweden 4,477; Switzerland 2,112.
Antimony metal including alloys	21	19	People's Republic of China 10; Netherlands 5; Japan 2.
Arsenic trioxide, pentoxide, and acid	82	128	Sweden 117.
Chromium:			
Chromite	78,598	82,072	Turkey 47,323; U.S.S.R. 11,781; Greece 11,344.
Oxide	196	164	West Germany 130; U.S.S.R. 14; Poland 12.
Cobalt:			
Oxide and hydroxide	3	2	All from Belgium-Luxembourg.
Metal including alloys, all forms	3	5	Do.
Copper metal including alloys:			
Scrap	152	247	United States 212; Netherlands 35.
Unwrought	1,186	1,052	United Kingdom 865; Finland 66; Sweden 65.
Semimanufactures	28,474	26,096	Sweden 9,415; United Kingdom 4,966; Canada 3,210.
Gold metal worked or partly worked troy ounces	62,662	60,475	United Kingdom 42,471; West Germany 13,343.
Iron and steel:			
Ore and concentrate	100,615	10,186	Sweden 9,249.
Scrap	46,112	51,963	U.S.S.R. 25,160; United Kingdom 16,046; Denmark 6,073.
Pig iron, ferroalloys and similar materials	18,627	18,409	Sweden 6,398; United Kingdom 4,089; West Germany 3,630.
Steel primary forms	92,416	90,964	Netherlands 84,994; Sweden 2,710; Denmark 2,181.
Semimanufactures:			
Bars, rods, angles, shapes, and sections	307,279	292,809	West Germany 80,723; Belgium-Luxembourg 41,929; France 41,123.
Universals, plates, and sheets	649,582	563,126	West Germany 110,452; United Kingdom 109,798.
Hoop and strip	85,476	59,699	Belgium-Luxembourg 31,996; West Germany 7,801; France 7,190.
Rails and accessories	13,631	16,684	Sweden 11,335; United Kingdom 2,315; Austria 1,548.
Wire	10,010	8,818	Belgium-Luxembourg 3,554; Sweden 1,926; West Germany 1,411.
Tubes, pipes, and fittings	86,394	82,530	West Germany 29,791; United Kingdom 14,856; Sweden 11,311; Canada 7,695.
Castings and forgings, rough	1,172	1,711	United Kingdom 833; Sweden 298; Denmark 254.
Total	1,153,544	1,025,377	
Lead:			
Oxides	1,989	1,955	Sweden 1,285; United Kingdom 351; West Germany 283.
Metal including alloys:			
Scrap	197	149	Sweden 135; Denmark 14.
Unwrought	11,138	11,050	United Kingdom 6,623; Sweden 1,386; Republic of South Africa 1,323.
Semimanufactures	1,236	1,113	Netherlands 440; Belgium-Luxembourg 310; West Germany 232.
Magnesium metal including alloys, all forms	593	18	NA.
Manganese:			
Ore and concentrate	544,709	735,699	Brazil 253,868; Ghana 222,967; Republic of South Africa 127,253.
Oxides	695	580	Netherlands 437; Belgium-Luxembourg 52; Japan 50.
Mercury 76-pound flasks	870	232	Yugoslavia 174; Spain 29; Sweden 29.
Nickel:			
Matte, speiss, and similar materials	94,575	100,036	Canada 99,662; Republic of South Africa 374.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Nickel—Continued			
Metal including alloys:			
Scrap	244	163	United Kingdom 95; West Germany 68.
Unwrought	152	155	All from United Kingdom.
Semimanufactures	308	317	United Kingdom 135; West Germany 113, Sweden 41.
Platinum-group metals and silver:			
Waste and sweepings—kilograms	3,850	21,184	Switzerland 17,451; Denmark 3,733.
Metal including alloys:			
Platinum group—troy ounces	2,764	6,494	United Kingdom 5,594; West Germany 386; Switzerland 257.
Silver—thousand troy ounces	4,105	3,070	United Kingdom 1,423; West Germany 1,347; Switzerland 267.
Tin metal including alloys:			
Scrap—long tons	107	53	All from Sweden.
Unwrought—do	625	665	United Kingdom 403; Denmark 93; Netherlands 79.
Semimanufactures—do	585	529	United Kingdom 432; Netherlands 41; West Germany 33.
Titanium:			
Ore and concentrate	264	283	All from Australia.
Dioxide	1,294	333	West Germany 165; United Kingdom 127.
Tungsten metal including alloys, all forms	2	1	NA.
Zinc:			
Ore and concentrate	147,971	82,471	Sweden 54,411; Australia 14,846; Canada 13,213.
Oxide	1,627	1,917	East Germany 1,208; Sweden 363.
Metal including alloys:			
Scrap	2,913	3,115	Sweden 1,516; Denmark 1,326; France 200.
Unwrought	2,070	1,131	Poland 1,038; U.S.S.R. 60; Denmark 31.
Semimanufactures	930	1,220	Belgium-Luxembourg 452; Netherlands 266; West Germany 169.
Other:			
Ore and concentrate	754	649	Australia 497.
Ash and residue containing nonferrous metals	171	137	Sweden 133.
Oxides, hydroxides and peroxides of metals, n.e.s	338	487	Finland 160; United Kingdom 124; West Germany 79.
Metals including alloys, all forms:			
Metalloids	143	36	All from Sweden.
Alkali, alkaline-earth, and rare-earth metals	43	51	All from United Kingdom.
Pyrophoric alloys	3	4	Australia 1; United Kingdom 1; United States 1.
Base metals including alloys, all forms n.e.s	422	565	Republic of South Africa 304; U.S.S.R. 95.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	1,101	2,435	Iceland 1,495; West Germany 723; Netherlands 65, United States 65.
Grinding and polishing wheels and stone	736	811	United States 183; Austria 149; Sweden 143.
Asbestos	7,982	5,753	Canada 3,476; U.S.S.R. 1,774; Republic of South Africa 205.
Barite and witherite	20,795	21,830	Ireland 7,402; Italy 6,288; Morocco 5,244.
Boron materials:			
Crude natural borates	1,195	1,732	United States 1,262; Netherlands 470.
Oxide and acid	345	192	United States 155; United Kingdom 5.
Cement	19,829	15,576	West Germany 3,870; Denmark 3,719; Netherlands 2,915.
Chalk	10,263	10,475	Denmark 4,381; France 3,351; Sweden 2,101.
Clays and products:			
Crude:			
Fuller's earth, dinas, chamotte	1,188	793	United Kingdom 720; West Germany 62.
Kaolin	80,399	83,507	United Kingdom 81,141; Finland 1,538; West Germany 368.
Other	62,517	56,056	United Kingdom 40,167; Sweden 3,553; Poland 2,959.
Products:			
Refractory	36,390	30,788	Sweden 11,596; West Germany 5,648; United Kingdom 4,307.
Nonrefractory—value, thousands	$3,454	$3,400	Sweden $758; Netherlands $678; West Germany $599.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Cryolite and chiolite	4,287	2,500	All from Denmark.
Diamond:			
Gem, not set or strung, thousand carats	r 5	10	Belgium-Luxembourg 5.
Industrial, do	r 30	25	NA.
Diatomite and other infusorial earths	2,421	2,097	Denmark 637; Belgium-Luxembourg 574; West Germany 501.
Feldspar	5	11	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	171	--	
Phosphatic	369,184	347,813	U.S.S.R. 206,948; United States 66,064; Morocco 57,379.
Manufactured:			
Nitrogenous	598	1,238	West Germany 856; Austria 305.
Phosphatic	16,650	8,795	Sweden 6,498; Belgium-Luxembourg 1,597; Netherlands 700.
Potassic	223,626	237,225	Spain 100,490; France 86,866; West Germany 30,041.
Other	7,238	11,830	Sweden 11,751; Netherlands 76.
Ammonia	40,849	3	NA.
Fluorspar	24,967	41,132	United Kingdom 16,942; Italy 16,479; Spain 4,545.
Graphite, natural	395	417	United Kingdom 210; Sweden 119; West Germany 84.
Gypsum and plasters	192,203	209,340	Poland 121,326; France 85,293; West Germany 1,664.
Lime	19,829	20,576	Denmark 18,287; Sweden 2,124.
Magnesite	4,963	3,699	North Korea 1,200; Austria 1,093; People's Republic of China 690.
Mica, all forms	4,462	3,778	India 1,943; Brazil 1,150; Republic of South Africa 602.
Pigments, mineral:			
Natural crude	352	490	Sweden 331; West Germany 88.
Iron oxides processed	2,180	2,118	West Germany 2,030; United Kingdom 48; Spain 33.
Precious and semiprecious stones, except diamond including synthetic stones, dust and powder, kilograms	708	8,898	United States 5,853; West Germany 1,628; United Kingdom 1,293.
Salt and brine	339,592	370,574	Netherlands 145,352; Tunisia 60,875; West Germany 37,921.
Sodium and potassium compounds:			
Caustic soda	22,298	20,608	Netherlands 13,872; France 2,185; Belgium-Luxembourg 1,925.
Caustic potash, sodic and potassic peroxides	1,021	875	West Germany 346; Sweden 297; France 185.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	578	562	Italy 334; Sweden 59; People's Republic of China 51.
Slate	4,210	4,658	Sweden 4,380; East Germany 248.
Other	1,315	2,123	Sweden 1,100; Portugal 480; East Germany 397.
Worked, all types	1,532	2,485	Portugal 1,371; Sweden 475; Finland 333.
Dolomite	2,898	3,562	Sweden 1,962; West Germany 917; United Kingdom 683.
Flint	1,025	1,246	Denmark 672; France 570.
Gravel and crushed rock	44,376	48,996	Sweden 46,641; Denmark 901, Netherlands 602.
Limestone	319,705	296,843	United Kingdom 282,672; Denmark 11,471; Sweden 1,496.
Quartz and quartzite	172,745	196,306	Spain 93,612; Portugal 48,961; Sweden 47,844.
Sand, excluding metal bearing	166,147	153,012	Belgium-Luxembourg 84,586; Sweden 37,502; Denmark 8,380.
Sulfur:			
Elemental	34,006	21,225	Poland 13,440; France 4,757; U.S.S.R. 2,445.
Sulfuric acid	1,062	41,384	Sweden 41,283; Netherlands 44.
Talc, steatite, soapstone, and prophyllite	2,766	2,922	India 1,168; United States 1,009; People's Republic of China 306.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Other, n.e.s.:			
Crude	63,844	63,531	West Germany 55,036; East Germany 4,792.
Slag, dross and similar waste, not metal bearing	70,671	56,002	Sweden 42,377; France 8,175; Denmark 4,384.
Oxides and hydroxides of magnesium, strontium, and barium	266	336	France 99; People's Republic of China 98; United Kingdom 46.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	459	394	United States 393.
Carbon black and gas carbon	4,577	4,842	Sweden 1,978; Netherlands 895; United States 641.
Coal, all grades, including briquets thousand tons	464	466	United States 143; United Kingdom 135; Poland 129.
Coke, all types do	840	615	United Kingdom 407; West Germany 90; France 48.
Gas, hydrocarbon	5,992	7,948	Sweden 3,952; Denmark 1,836; United Kingdom 1,448.
Peat including peat briquets and litter	4,353	4,849	Sweden 4,266; U.S.S.R. 456; Finland 117.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	47,787	41,247	Nigeria 10,983; Muscat-Oman 10,122; Saudi Arabia 7,476.
Refinery products:			
Gasoline (including natural) do	5,226	5,155	United Kingdom 1,655; Belgium-Luxembourg 721; Sweden 559
Kerosine and jet fuel do	2,485	3,378	United Kingdom 2,196; Belgium-Luxembourg 556; Trinidad and Tobago. 282.
Distillate fuel oil do	10,576	11,076	United Kingdom 3,221; U.S.S.R. 2,056; Belgium-Luxembourg 1,667.
Residual fuel oil do	8,496	6,172	United Kingdom 2,858; U.S.S.R. 1,486; Denmark 773.
Lubricants do	448	452	United Kingdom 130; Sweden 119; Denmark 104.
Mineral jelly and wax do	52	50	West Germany 32; U.S.S.R. 7.
Other:			
Nonlubricating oils, n.e.s. do	15	196	Netherlands 74; France 64.
Pitch and pitch coke do	529	462	United Kingdom 261; West Germany 180.
Petroleum coke do	1,783	1,543	United States 1,269; United Kingdom 236.
Bitumen and other residues do	888	884	Netherlands Antilles 370; Denmark 301; West Germany 105.
Bituminous mixtures, n.e.s. do	15	17	United Kingdom 6; Denmark 5.
Total do	30,513	29,385	

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Production of primary aluminum in 1972 was 2.2% more than that of 1971, but the output amounted to only about 80% of Norwegian productive capacity. Most producers cut back production during the first 9 months of the year because of exceptionally poor market conditions. According to A/S Årdal og Sunndal Verk (ASV), the largest Norwegian producer, the average export price realized for aluminum in 1972 was 18% less than that of 1970 when the decline in prices began. Government statistics for the first 11 months of 1972 indicated a 30% increase in exports of aluminum compared with the same period in 1971, but the average unit value (in kroner) for unwrought metal was nearly 15% lower. Utilization of smelter capacity increased in the last few months of the year, but no new capacity was installed in 1972.

Production of aluminum semimanufacturers increased about 10% in 1972 and exports were more than 15% higher than in 1971. At Holmestrand, A/S Nordisk Alu-

miniumindustri (Nordisk) was doubling production capacity for cold-rolled aluminum, to 40,000 tons annually. The expansion was scheduled for completion in mid-1973. At Hoyanger, ASV was building a plant to produce semimanufactures intended for use in the company's collapsible-tube and can factories, and also expected to begin production of cast motor vehicle components early in 1973. Norsk Hydro-Elektrisk Kvaelstofaktieselskab (Norsk Hydro) commissioned two small aluminum extrusion plants in 1972, one at Magnor, Norway and the other at Vorarlberg, Austria. In a joint venture with Standard Telefon og Kabelfabrik A/S, Norsk Hydro was also building a cable core and blank production line at Karmoy.

ASV commented that profitability of exports of primary aluminum and continuation of expansions of aluminum fabricating operations in Norway will be strongly affected by the type of trade agreement that can be negotiated with the EEC. The EEC was attempting to determine if imports of aluminum were having an adverse effect on production of aluminum in EEC countries.

Copper, Lead, and Zinc.—Despite declining prices for copper and sulfur concentrates during 1972, Norwegian output of mine copper was about 13% higher than that of 1971. Two new mines, the Grong mine near Røyrvik in Nord-Trondelag and the Repparfjord (Ulveryggen) mine south of Hammerfest in the far north, began production during the summer. Gains in production were also reported by most other producers, so that compared with those of 1971, the national output of copper concentrates increased 15% and that of cupriferous pyrite increased about 9% in 1972. The total mine output could increase 25% to 30% in 1973, if the new mines (including the Bidjovagge mine in Finnmark, which experienced difficult operating conditions in 1972) maintain planned levels of output. At yearend, indications were that these operations were functioning well.

Most of the mines producing copper were also sources of pyrite and zinc. Lead concentrate was produced at one mine (Mofjellet). The Bleikvassli mine produced lead, zinc, and pyrite concentrates but not copper. Output of crude ore and concentrates at these mines in 1972 is shown in the following tabulation, in metric tons:

Mine	Crude ore	Concentrates				
		Pyrite	Cupriferous pyrite	Copper	Zinc	Lead
Tverfjellet	600,899	232,262	--	22,979	9,735	--
Løkken	440,000		284,084	--	--	--
Sulitjelma	435,600	88,202	--	24,489	2,107	--
Skorovas	201,800	--	154,950	--	--	--
Bleikvassli	127,745	17,936	--	--	9,629	5,472
Mofjellet	103,000	5,220	--	1,000	3,640	725
Killingdal	41,492	--	--	2,967	2,942	--
Repparfjord	240,374	--	--	3,390	--	--
Bidjovagge	NA	--	--	[1] 3,339	--	--
Grong	75,855	NA	--	3,250	540	--
Lergruvbakken [2]	NA	--	--	3,868	--	--
Total	2,266,765	343,620	439,034	65,282	28,593	6,197

NA Not available.
[1] Fourth quarter only.
[2] Mine under development by A/S Røros Verk.

Sources: Bergverks-Nytt (Trondheim). V. 20, Nos. 1–3, 1973; and A/S Borregaard, Annual Report for 1972.
Note: Above table does not include 588 tons of copper concentrate produced as byproduct of iron ore mining by Fosdalens Bergverks A/S.

Ore reserves at the Repparfjord mine are estimated at 10 million tons containing an average of 0.7% copper. At full production the mine is expected to produce about 600,000 tons of crude ore per year, yielding 13,000 to 15,000 tons of concentrate averaging 30% to 33% copper. Higher grade concentrates can be produced (a shipment of 700 tons in August was reported to contain 50% copper), since the principal ore minerals include bornite, chalcocite, covellite, and cuprite, as well as chalcopyrite. Equipment used in the open pit mine includes two blast hole drills, two Caterpillar front-end loaders with 6- and 8-cubic-yard buckets, and four Kiruna 35-ton trucks. The crushing and ore-dressing plants were installed by the Swedish firm,

Sala Maskinfabriks AB. Total employment at Repparfjord will be about 100 men.

At the Grong mine, minable ore reserves are estimated at 6.8 million tons, containing an average of 1.7% copper, 1.1% zinc, and 32% sulfur. The principal ore minerals are pyrite, pyrrhotite, chalcopyrite, and zinc blende; the ore also contains traces of cobalt, arsenic, lead, gold, and silver. Planned annual production is 250,000 tons of crude ore, 18,000 tons of copper concentrate (25% copper), and 4,000 tons of zinc concentrate (50% zinc). Zinc concentrate will be shipped to the smelter at Odda operated by Det Norske Zinkkompani A/S. Half of the copper concentrate will be sold to the Swedish firm of Boliden AB, and half will go to the West German firm, Nord-deutsche Affinerie A.G. in Hamburg. Equipment used in the underground mine includes a self-propelled Tunnelbor-Jumbo DC 95 drilling rig equipped with Ingersoll-Rand drills mounted on two separate hydraulic booms, an Alimak STH-5LL raising hoist, two Eimco 915-H loaders with 4.5-cubic-yard buckets, and two Kiruna 35-ton trucks. Total employment at the Grong operation was expected to be 95.

In other developments, Orkla Grube-Aktiebolag was increasing productive capacity at Løkken. A new 3,000-foot vertical shaft with Koepe-type hoist was completed in 1972. The company also planned to build a flotation plant at the property. Elkem-Spigerverket A/S was also planning a flotation plant for the Skorovass mine. Both the Løkken and Skorovass mines produce cupriferous pyrite, which is exported to West Germany. Construction of these plants reportedly would increase Norwegian production capacity for copper concentrate to 130,000 tons (25% copper) annually.

A/S Sulitjelma Gruber produced a record 7,449 tons of blister copper in 1972, 14% more than in 1971. Most of the metal was exported to West Germany. Production of refined copper at Kristiansand by Falconbridge Nikkelverk A/S was slightly less than that of 1971. Exports of unwrought refined copper amounted to 23,894 tons valued at approximately $25 million.

The 17% increase in production of refined zinc in 1972 was accompanied by a 20% increase in exports. Exports of unwrought, unalloyed zinc in 1972 totaled 49,491 tons valued at about $18.8 million. Smelting of zinc concentrates was done only at the Eitrheim plant of Det Norske Zinkkompani A/S, near Odda on the Hardanger Fjord. Imports of zinc concentrates for smelting in Norway increased more than 40% in 1972, to about 120,000 tons, compared with 82,000 tons in 1971.

All lead concentrates continued to be exported because there was no lead smelter in Norway. Exports of concentrate in 1972 amounted to 6,015 tons. Imports of unwrought lead and alloys remained about the same as in 1971 (11,000 tons); exports of lead scrap rose about 20% to 5,500 tons.

Iron and Steel.—*Iron ore.*—Production of iron ore in 1972 was slightly more than that of 1971, but exports increased by an estimated 7%. A/S Sydvaranger, the principal producing company, increased shipments of iron ore to more than 2.5 million tons in 1972, but prices were reportedly lower than those of 1971.

Production of crude ore and concentrates in 1971 and 1972 by the principal Norwegian producers of iron ore were as follows, in thousand metric tons:

Company	Crude ore		Concentrates	
	1971	1972	1971	1972
A/S Sydvaranger	5,797	e6,000	2,324	2,456
A/S Norsk Jernverk	2,419	2,190	1,019	851
Fosdalens Bergverks A/S	1,038	1,077	470	500
Elkem-Spigerverket A/S	417	472	144	120

e Estimate.

Source: Bergverks-Nytt (Trondheim). V. 20, Nos. 1–3, 1973.

Additional production included an estimated 25,000 tons of iron ore concentrate from the Bråstad mine in southern Norway; 35,000 tons of byproduct magnetite from ilmenite ore processed at Tellnes; and 2,000 tons of byproduct magnetite recovered from cupriferous pyrite ore processed at Løkken.

A/S Sydvaranger began construction of a second pelletizing line at Kirkenes in 1972. Completion of this project was scheduled for 1974 and will increase the company's production capacity for pellets to 2.7 million tons annually. Production of pellets in 1972 was slightly more than 1.2 million tons, practically all of which was exported. Total shipments of iron ore from Kirkenes

in 1972 was 2,582,000 tons, including two separate vessel cargoes of 137,500 tons each.

The Sydvaranger Co. contracted with the British Steel Corp. for delivery of about 6 million tons of iron ore pellets over a period of 6 years. The quantity shipped will rise from about 600,000 tons in 1973 to 1.2 million tons in 1978. Shipments of pellets to West Germany were also expected to be about 1 million tons annually.

In mining developments, experimentation with a raise-boring machine at the underground mine of Fosdalens Bergverks was successful in 1972. A total of 720 feet of 6-foot-diameter raise was completed, and an additional 2,000 feet was scheduled for completion in 1973. At the Bjornevatn open pit mine of A/S Sydvaranger, new mining equipment being operated in 1972 included a Marion 191-M power shovel with 15-cubic-yard bucket, a Bucyrus-Erie 60-R rotary blast-hole drill using a 12 ¼-inch-diameter bit, and 13 diesel-electric (Unit Rig) trucks of 100-ton capacity each. Five additional trucks of the same type were scheduled to be delivered in 1973.

Ferroalloys.—Owing to reduced output of ferrosilicon, total output of ferroalloys declined by 15 percent in 1972, compared with that of 1971. Exports of all types of ferralloys increased, however, to a total of 603,000 tons valued at approximately $118 million. Imports of manganese ore and chromite during the year were 721,000 tons and 53,000 tons, respectively.

Production and exports of silicon metal increased sharply in 1972. Two furnaces for production of silicon were completed during the year; one by A/S Meraker Smelteverk, with a production capacity of 14,000 tons per year, and another at Svelgen by the Bremanger Smelteverk division of Elkem-Spigerverket A/S. Completion of these units raised Norwegian production capacity for silicon by about 50%, to an estimated 53,000 tons per year. Exports of silicon in the first 11 months of 1972 totaled nearly 41,000 tons, an increase of more than 50% compared with that of 1971.

In other developments, a new 30,000-kilowatt ferrosilicon furnace was being built by A/S Ila og Lilleby Smelteverker. The unit was scheduled to be in production by 1973. A similar furnace was expected to be completed by K/S A/S Fesil-Nord & Co. during 1972. Near Bodø, the new quartz quarry on Sandhornoya Island was brought into production in 1972. The quarry will supply all quartz required for the three large ferrosilicon furnaces operated at Salten by Elkem-Spigerverket A/S.

Norway's annual production capacity for ferroalloys at the end of 1972 was estimated as follows, in thousand metric tons: ferrosilicon (45% to 95% Si), 400; ferromanganese (mostly 74% to 76% Mn), 280; silico-manganese 165; ferrochromium, 46; silicon metal, 53; and ferrovanadium, 0.35.[3]

Steel.—There was little information available on 1972 developments in the iron and steel industry at the time of this writing. Production of pig iron increased 3%, and exports declined about 20% compared with those of 1971. Output of crude steel was up 6% and was the highest on record. The bulk of both metals continued to be produced by A/S Norsk Jernverks at Mo-i-Rana, with about 15% of the pig iron and 20% of the crude steel produced at Svelgen and Oslo, respectively, by Christiania Spigerverk. Exports of finished steel were improved compared with those of the previous year; imports also increased, however, and included more than 120,000 tons of ingots, slabs, and other crude forms; about 600,000 tons of plates and sheets; 280,000 tons of bars, rods, and sections; and about 85,000 tons of pipes and tubes. Exports of all iron and steel products[4] increased about 11% in volume and 5% in value compared with that of 1971; the increase for both categories of imports was about 4%.

The merger between Elkem A/S and Christiania Spigerverk, which was approved by stockholders in May 1972, was an important development that will combine the resources of a major manufacturer of electric furnaces and producer of ferroalloys with the largest privately owned producer of steel. The new firm, Elkem-Spigerverket A/S, will be the largest single industrial enterprise in Norway, having significant interests in Norwegian production of nonferrous metals and nonmetallic commodities in addition to ferroalloys and steel. The merger becomes effective January 1, 1973.

[3] Metal Bulletin (London). Ferroalloys. Special issue, 1971; pp. 134–137, 163 and 165. Totals for ferrosilicon and silicon include estimated increases in capacity due to furnace completions in 1972.

[4] Excluding iron and steel scrap but including all items covered by Section 67 of the Standard International Trade Classification (S.I.T.C.).

Magnesium.—For the fiscal year ending in June 1972, Norsk Hydro reported that profits of its magnesium division were lower than those of 1971 owing to rising costs of raw materials, low prices, and lower demand. Stocks of magnesium metal were reported to be increasing. Sales of magnesium may have increased during the last half of 1972, as the value of exports increased to approximately $27 million, about 34% more than in 1971.

Most of the dolomite used for production of magnesium by Norsk Hydro in south Norway is shipped from quarries near Fauske in the northern part of the country. The company was reportedly planning construction of a plant near the quarries for production of magnesium oxide. About 350,000 tons of dolomite is currently produced annually in this area.

Molybdenum.—After considerable investments in recent years for modernization and expansion of productive capacity, A/S Knaben Molybdaengruber announced that its molybdenite mining operation at Kvinesdal would be closed in 1973. Rising costs of production and the decline of world prices for molybdenum were cited as reasons for the closure. The company found it increasingly difficult to compete with lower-cost world producers because of the low grade of ore (0.15% to 0.18% MoS_2), the high cost of underground mining, lengthy transportation to markets, the much greater productive capacity of North American producers, and other factors.

The Knaben mine had operated almost continually since 1885, and in recent years it was the only operating molybdenum mine in western Europe. Production in 1972 was 323,000 tons of crude ore and approximately 1.05 million pounds of MoS_2. An estimated 108 employees will be affected by the closure. The operation was owned by the (Swedish) Axel Johnson Group, and all output of concentrate was exported to Sweden where it was used by Avesta Järnverks AB, a producer of special steels also owned by the Johnson Group.

Nickel, Cobalt, and Platinum-Group Metals.—The Kristiansand refinery of Falconbridge Nikkelverk A/S continued to account for all Norwegian production of refined nickel, cobalt, and platinum-group metals as well as refined copper. This production was based on nickel-copper matte, mostly imported from Canada. Imports of matte in 1972 were estimated at 95,000 tons, slightly less than the record quantity imported in 1971. Beginning in 1972, shipments of matte were also received from Western Platimun Mines Ltd. of South Africa, a company that is 25% owned by Falconbridge Nickel Mines Ltd.

Production of refined nickel reached a new record in 1972. Exports, about 40,000 tons valued at approximately $152 million, were essentially unchanged from the levels of 1971.

Production and exports of nickel-bearing sulfide concentrates, a byproduct of ilmenite-processing by A/S Titania at Tellnes, continued to rise. In 1972, production was 8,700 tons and exports were estimated at more than 8,500 tons. A further increase in production was expected in 1973. The concentrates contain about 5% nickel and are mainly exported to Finland.

The cobalt refinery was extensively damaged by fire on May 4, 1972, and production was stopped for the rest of the year. The plant was being rebuilt and operations were expected to resume in the spring of 1973; meanwhile, cobalt-bearing residues from the nickel refinery were stockpiled. Exports of cobalt in 1972 were estimated to be about 30% less than that of 1971.

Production of platinum-group metals was not available; however, exports of unwrought metal in the first 11 months of 1972 totaled more than 40,000 troy ounces, about 50% more than that of 1971.

Titanium.—Production of ilmenite concentrate in 1972 was about 5% less than that of 1971, but exports increased about 10% to more than 560,000 tons. Production in 1973 was expected to increase by about 30%, as expansion of production capacity at the mine and plant of A/S Titania was nearly completed. Completion of this project will raise the company's output capacity to 3 million tons of crude ore and 1 million tons of ilmenite concentrate per year by the end of 1973. As part of the expansion project, a large ball mill with a throughput capacity of 180 tons of ore per hour was being installed in 1972.

Exports of titanium dioxide and titanium-white from Norway in 1972 were valued at more than $6 million.

NONMETALS

Cement and Other Construction Materials.—The volume of building construc-

tion in 1972 was less than that of 1971. Production of cement was down slightly, but exports in 1972 again exceeded 1 million tons. Imports of gypsum rose about 10%. Exports of unworked building stone, principally slate and "labrador," an unusual variety of syenite, increased about 10% in quantity and value compared with that of 1971; the volume was about 125,000 tons, valued at about $10 million.

The nature and location of workable deposits of sand and gravel in southern Norway were described in a publication issued by the Norwegian Geological Survey.[5] The accompanying maps, on a scale of 1:1,000,000, show the extent and nature of glacial deposits and the location of pits south of 65° north latitude. Most of the pits are located within an 80-mile radius of Oslo, along the south coast, and in the vicinity of Stavanger, Alesund, and Trondheim.

Production of crushed stone for road metal (pukkstein) appeared to increase in 1972. The output of 10 firms for which data were available amounted to about 3 million tons or 10% more than that of 1971.

Exports of gravel and crushed stone in 1972 (slightly more than 1 million tons) were about the same as in the previous 2 years.

Feldspar, Quartz, and Mica.—Exports of feldspar (including nepheline syenite) may have increased slightly in 1972, compared with those of 1971. Production of nepheline syenite by the Norsk Nefelin division of Elkem-Spigerverket A/S, the only producer, was about the same as that of 1971, but the tonnage sold increased about 8% and the average f.o.b. value, approximately $18.90 per ton, was about 5% higher. Output of nepheline syenite was expected to increase 10% to 20% in 1973.

Production of flotation concentrates of feldspar and quartz by K/S Norfloat A/S & Co. at Lillesand increased about 15% in 1972. Output included 43,500 tons of sodium feldspar, 24,000 tons of potassium feldspar, and 29,500 tons of quartz. Output of mica was not reported. Exports of mica increased about 20%. Imports of quartz during the first 11 months of 1972 included 108,000 tons of quartz sand and 175,000 tons of quartz and quartzite, about the same as that of 1971.

Fertilizer Materials.—Production of nitrogen compounds continued to rise. Norsk Hydro, the major producer, reported that sales of nitrogen products totaled 551,000 tons (nitrogen content) in the year ended June 30, 1972, an increase of 5% over that of 1971. The company also produced 615,000 tons of ammonia during the same period. About two-thirds of the ammonia was produced from oil at Porsgrunn.

Norway's exports of manufactured fertilizer in 1972 were estimated at 1.4 million tons, about 20% more than in 1971. Norwegian imports of crude phosphate in 1972 were estimated at about 370,000 tons. Imports of potassium salts were about 220,000 tons. These materials were largely used for manufacture of complex fertilizers.

Norsk Hydro was expanding annual production capacity for complex fertilizers at Glomfjord to 450,000 tons. The expansion was to be completed by yearend 1972. Total production of complex fertilizer by the company was 950,000 tons during the year ended June 30.

Fluorspar.—ASV and Norsk Hydro were cooperating in exploration and evaluation of fluorspar deposits at the Lassedal mine in southeast Norway. Drilling and test work on the deposits were completed in 1972. Under an agreement with the H. Bjørum company, ASV obtained rights to additional deposits east of the mine. No further information was available.

ASV also produced aluminum fluoride at Odda, in cooperation with Det Norske Zinkkompani A/S. Sales of fluoride were reported to be 16,080 tons in 1972, compared with 21,534 tons in 1971.

Imports of fluorspar during the first 11 months of 1972 totaled 32,081 tons.

Olivine.—Production and sales of olivine increased in 1972. Slackened demand for foundry sand was reported partly due to cutbacks in production by Swedish consumers, but sales of refractory stone improved. A/S Olivin, the principal producer, was building a new coarse-crusher and silo at Aheim and was also improving the road from the quarry to permit haulage by larger capacity trucks. The company employed 180 persons in 1972.

Pyrite and Sulfur.—With increased production at the principal mines in 1972

[5] G. Holmsen. "Nyttbare sand—og grusforekomster i Syd-Norge." Norges Geologiske Undersokelse, (Oslo), No. 271, 1971, 112 pp., including five maps and English summary.

(see section on copper), exports of pyrite and cupriferous pyrite increased an estimated 8% to more than 560,000 tons. The increased volume was offset, however, by declining prices for copper and sulfur.

A/S Borregaard produced about 280,000 tons of sulfuric acid at Sarpsborg in 1972. The Sarpsborg plant had an annual production capacity of 300,000 tons. The company exported about 30,000 tons of acid to its pulp-making subsidiary in Brazil. Exports of sulfuric acid from Norway in 1972 were valued at $1.4 million, compared with $1.2 million in 1971. Imports in 1972 included 3,745 tons of sulfur dioxide, and 17,454 tons of elemental sulfur.

Talc and Steatite.—Exports of lump and ground talc and steatite in 1972 were estimated at 72,000 tons. Gross production of dolomite, talc, mica, and feldspar by A/S Norwegian Talc increased to 550,000 tons in 1972, including 122,000 tons of milled products. Dolomite produced for Norsk Hydro is believed to account for the largest share of gross output, and talc accounted for the bulk of the mill products. The company planned to increase production by 10% in 1973.

MINERAL FUELS

Coal and Coke.—All coal produced in Norway was mined on Spitzbergen Island by Store Norske Spitsbergen Kulkompani A/S (SNSK). Shipments of coal totaled 433,000 tons in 1972, with the largest share going to the state cokeworks at Mo-i-Rana and most of the remainder being exported to West Germany. Exports of coal in 1972 totaled 88,000 tons, and 417,000 tons were imported. Imports of coke included 516,000 tons of coke made from coal and 271,000 tons of petroleum coke.

SNSK continued to explore and survey the Svea coal deposits on Spitzbergen. Two 3,000-foot drifts were expected to be completed by the summer of 1973. The evaluation project will evidently be continued into the summer of 1974.

Petroleum.—*Exploration.*—The Frigg gasfield, discovered in 1971 by A/S Petronord, may be the largest gasfield yet found under the North Sea. Its commercial potential, however, was uncertain because of its relatively great distance from suitable markets. The field, which extends into the British sector of the North Sea, is 190 kilometers from Karmøy, Norway, and 370 kilometers from Peterhead, Scotland. Evaluation of the discovery was continued in 1972. Meanwhile, Norsk Hydro exercised its right to increase its share of ownership in the Frigg field, which was expected to be 32.87%.

Another gasfield (Heimdal) was found south of the Frigg field in 1972. Oil and gas were also found in exploration wells drilled in the Eldfisk and Edda structures south of Ekofisk; the wells were being evaluated.

The Phillips Petroleum Co. reported that a new well drilled on top of the Tor structure, 8 miles from the Ekofisk production facilities, was believed capable of producing 10,000 barrels per day of high-gravity crude oil. The new well was said to increase the magnitude of the Tor field's indicated reserves.

Drilling on land at Andøya in northern Norway (69° north latitude) by the Norminol Co. was reported to have found traces of natural gas at a depth of 400 meters.

In the Spitzbergen archipelago, Total Marine Norsk continued drilling at Krokaa on Edgeøya, but no results were announced. South of Krokaa, Norske Fina A/S started drilling at Plurdalen.

The Norwegian Government was expected to open 200 more concession blocks south of 62° north latitude for exploration during 1973. There was no indication, however, whether areas north of 62° would be opened.

Since July 1966, when exploration first began in the Norwegian sector of the North Sea, 75 wells are reported to have been drilled at a total cost of $230 million; twenty-seven of these were drilled by the Phillips Group.

A Government oil company was being organized in 1972. It will be formally established on January 1, 1973 and headquartered in Stavanger.[6]

Production.—Production of crude oil from the Ekofisk field in 1972 was estimated at about 11 million barrels, with a total of 13.5 million barrels produced since production began in 1971. Phillips Petroleum reported in mid-1972 that output from four wells was at the rate of 44,000 barrels per day "under operable weather conditions." The oil was loaded directly

[6] Chemical Age International. V. 104, No. 2762 (June 23, 1972), p. 5.

into tankers. Production was scheduled to reach 300,000 barrels per day in 1974.

The Norwegian Government was studying recommendations by the Ekofisk Committee that crude oil, natural gas liquids, and natural gas produced from the Ekofisk, West Ekofisk, Tor, and Cod fields be piped to British and other West European markets because of higher anticipated costs of landing the fuels in Norway and because of the limited capacity of Norwegian markets. Subject to approval by the Norwegian Parliament, the Phillips Group proposed piping crude oil and natural gas liquids about 345 kilometers to Teesside, England and natural gas about 420 kilometers to Emden, West Germany. The Ekofisk Committee estimated peak annual production levels from the group of four fields would be 24.5 million tons of oil, 3.3 million tons of natural gas liquids, and 10 to 12 billion cubic meters of natural gas. Peak production of crude oil and natural gas liquids was expected by 1975, and of natural gas by 1977 or 1978. At yearend, a 20-year contract was being negotiated for delivery of 1 billion cubic meters daily of natural gas to Emden for distribution to West German, French, Belgian, and Dutch consumers beginning in 1975.

At Stavanger, the Phillips Co. was building a double-shelled concrete storage tank with a capacity of 1 million barrels. The tank will be towed to the Ekofisk production area, probably in 1973, and will rest on the sea bottom in 230 feet of water and extend 70 feet above the surface of the sea.

Imports, Refining, and Consumption.— Imports of crude oil in 1972 totaled 6.4 million tons, about 13% more than that of 1971. Crude oil produced from the Ekofisk field was estimated at 1.64 million tons, most of which was exported. Total throughput of crude oil in Norwegian refineries in 1972 was estimated at 6.15 million tons, compared with 5.81 million tons in 1971.

The Ekofisk Committee estimated Norwegian consumption of petroleum products at about 8 million tons annually. Imports of products in 1972 totaled 4.33 million tons, and exports were 2.28 million tons.

The new refinery to be constructed at Mongstad for Norsk Hydro was scheduled for completion early in 1975. Initial throughput capacity will be 4 million tons annually. A turnkey contract for the plant was awarded to the Foster-Wheeler Co. of the United Kingdom. Cost was estimated at $37 million. The operating company, Rafinor A/S & Co., is owned 60% by Norsk Hydro and 40% by Norsk Braendselolje A/S.

Distillation capacities of the three refineries operating in Norway in 1972 were as follows, in barrels per day: Slagen 110,000; Sola 60,000; and Valloy 3,000. The Slagen and Valloy refineries are operated by A/S Norske Esso, and the Sola plant by A/S Norske Shell.

Inland consumption of refinery products in 1971 and 1972 was as follows, in thousand metric tons:

Refinery product	1971	1972
Aviation fuels	240	287
Gasoline	1,008	1,068
Kerosine	383	422
Gas/diesel oil	2,764	2,946
Residual fuel oil	2,083	1,933
Other	835	853
Total	7,313	7,509

Source: Organization for Economic Cooperation and Development (OECD), Paris. Provisional Oil Statistics by Quarters, 4th quarter, 1972; 1973, 21 pp.

The Mineral Industry of Pakistan

By Benjamin Petkof [1]

Pakistan's minerals-based industries continued to provide only a minor component of the country's overall economy. Partition of the country in 1971 did not greatly reduce Pakistan's overall mineral output as Bangladesh (the former east wing) supplied only a small portion of the country's total mineral production. Natural gas output from the Dhulian, Māri, and Sui natural gasfields comprised the major component of the nation's minerals-based industry. Sufficient natural gas reserves are available at these fields to maintain production in the foreseeable future. In addition, Pakistan produced significant quantities of minerals such as chromite, barite, clays, gypsum, rock and marine salt, sand, stone, and lesser quantities of a few other metallic and nonmetallic minerals. Some of these commodities have been exported in sufficient quantities to earn vitally needed foreign exchange. However, this is offset by large sums of foreign exchange that Pakistan has expended to import iron and steel, crude petroleum, and partially or completely refined petroleum products.

Pakistan Government statistical sources showed that for the fiscal year ending June 30, 1971, the mining and quarrying of crude minerals provided $18.5 million [2] in current dollars to the nation's gross national product (GNP) of $3,744 million. For the fiscal period ending June 30, 1972, the mining and quarrying of crude minerals increased 13% to $20.9 million, while the GNP increased 7% to $4,014 million. These data are not comparable with those presented in previous Minerals Yearbooks because of the removal of the contribution of the former east wing of Pakistan (Bangladesh) and the decreased value of the Pakistani Rupee.

Official government data does not provide information on the value added by the processing of both native and imported mineral commodities. However, it must be assumed that the processing of crude minerals adds significantly to their value. The petroleum and natural gas industry alone earns a large amount of money for the Government from the levy of duties and other special taxes on raw and processed fuels. In addition, the nation's use of native fuel and minerals allows the retention of large quantities of foreign exchange that would be required to import these commodities for domestic use.

PRODUCTION

Government sources reported production of a large number of mineral commodities in Pakistan's four provinces. The following minerals were produced in appreciable quantities during 1972: Sand and gravel, natural gas, rock and marine salt, barite, soapstone, chromite, marble, fluorite, and sulfur. Pakistan also continued to produce finished mineral products such as chemical fertilizers, chemicals, and cement. Some manufacturers of these products consumed indigenous raw minerals. Mineral and mineral-based production not required for domestic consumption was exported.

[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Where necessary, values have been converted from Pakistani Rupees (PRs) to U.S. dollars at the rate of PRs 11.031=US$1.00.

Table 1.—Pakistan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum, bauxite, gross weight	795	283	533
Antimony ore:			
Gross weight	148	157	223
Metal content e	30	31	45
Arsenic ore (orpiment), gross weight—kilograms	305	NA	NA
Chromium, chromite, gross weight	29,084	24,163	32,207
Iron and steel, mild steel products [1]—thousand tons	174	p 180	e 220
Lead ore:			
Gross weight	6	12	e 10
Metal content e	3	r 6	5
Manganese ore, gross weight	12	91	127
NONMETALS			
Abrasives, natural, emery stone	2,905	566	2,246
Barite	1,869	2,962	2,402
Cement, hydraulic—thousand tons	2,571	2,621	2,694
Chalk	599	925	1,089
Clays:			
Bentonite	291	108	481
Fire clay	28,281	27,608	26,566
Fuller's earth	6,947	10,737	11,246
Kaolin (china clay)	9,144	2,732	4,260
Other [2]	e 70,000	e 50,000	24,625
Feldspar	138	305	237
Fertilizer materials, manufactured:			
Nitrogenous:			
Gross weight [3]	263,590	265,442	571,624
Nitrogen content [3]	107,993	107,425	251,849
Phosphatic, gross weight	23,308	27,676	32,126
Fluorspar	528	4,770	2,332
Gypsum, crude	167,522	133,513	154,138
Magnesite, crude	472	220	294
Natron, manufactured (soda ash)	74,257	80,575	68,448
Pigments, natural mineral, ocher	2,672	1,546	4,455
Salt:			
Rock—thousand tons	316	345	618
Marine—do	221	266	234
Total—do	537	611	852
Sand and gravel:			
Gravel	e 60,000	e 71,000	69,052
Sand:			
Bajri [4]	e 7,500	e 8,600	7,550
Glass [5]	31,885	35,312	47,732
Common [6]	43,000	27,000	14,152
Stone:			
Aragonite	22,430	11,703	17,430
Dolomite	78	2,019	330
Limestone—thousand tons	1,658	2,523	2,754
Marble	265	2,217	1,252
Crushed [6 7]	12,099	214,951	67,145
Strontium minerals, celestite	135	399	343
Sulfur [8]	e 2,000	2,534	3,036
Talc and related materials, soapstone	e 3,500	e 4,700	4,396
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades e—thousand tons	1,270	1,250	1,250
Gas, natural, sales—million cubic feet	r 101,608	107,680	118,680
Natural gas liquids [9]—thousand 42-gallon barrels	e 56	NA	NA
Petroleum: [9]			
Crude oil—do	3,400	3,650	e 3,700

See footnotes at end of table.

Table 1.—Paistan: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum: [9]—Continued				
Refinery products:				
Gasoline, aviation	thousand 42-gallon barrels	[10] e 295	2,774	NA
Gasoline, other	do	[10] e 2,456		
Jet fuel	do	[10] e 2,783	3,358	
Kerosine	do	[10] e 4,453	2,482	
Distillate fuel oil	do	[10] e 7,171	6,169	
Residual fuel oil	do	[10] e 10,544	8,030	
Lubricants	do	[10] e 491	621	
Other	do	[10] e 2,652	1,571	
Refinery fuel and losses	do	[10] e 1,899	1,241	
Total	do	[10] e 32,744	26,246	e 27,000

e Estimate. p Preliminary. r Revised. NA Not available.

[1] As reported in source, types of products not specified.

[2] Sind Province only; additional quantities may be produced in other provinces.

[3] Data are for urea and ammonium sulfate only; ammonium nitrate presumably is still produced but recent data are not available owing to Pakistan Government restrictions. In the year ending June 30, 1965 (latest data available) ammonium nitrate output totaled 76,086 tons (gross weight) with a nitrogen content of 26,630 tons.

[4] As reported by North-West Frontier Province only, no details on the nature of this sand are available.

[5] Punjab, Sind, and North-West Frontier Provinces only, additional quantities may be produced in Baluchistan Province.

[6] Punjab and Sind Provinces only; additional quantities may be produced in other provinces.

[7] Reported in source as "ordinary stone."

[8] Produced in Baluchistan, type of sulfur not reported.

[9] Erroneously reported as 42-gallon barrels in 1971.

[10] Includes output of Chittagong refinery in Bangladesh; data inseparable from that of the three refineries in Pakistan (former west wing of Pakistan). The Chittagong refinery's rated capacity was about 29% of the total capacity for Pakistan and Bangladesh, but distribution of actual production is impossible owing to the lack of detailed information on individual plant operations.

TRADE

Official Pakistani trade data no longer include information relating to the former east wing (now Bangladesh). Thus current and future published data will not be comparable with data reported in previously published Mineral Industry of Pakistan chapters. These data indicate that the total value of exports and reexports showed a marked increase over that of the previous year while the value of imports declined slightly. During 1971–72 overall imports were valued at $731 million and overall exports (including reexports) at $716 million leaving a trade deficit of $15 million.

Cement, and petroleum and petroleum refinery products constituted almost three-fourths of the total value of mineral and mineral-based exports. If the value of petroleum and petroleum related products, and cement were excluded from the total mineral export value, then mineral exports would equal only $5.2 million for the fiscal year 1971–72.

Almost four-fifths of Pakistan's mineral and mineral based imports consisted of iron and steel, including ore and scrap, crude petroleum, and petroleum refinery products. The remainder consisted of fossil fuels, fertilizer materials, various metals, and other mineral materials.

Table 2, based on official trade information, supplies the best available quantitative export data. The leading export items were cement, salt, and chromium ores and concentrates.

The following tabulations show the value of recorded mineral commodity exports and reexports, and imports, respectively.

Commodity or commodity group	Value of exports and reexports (million dollars)	
	1970–71	1971–72
Chromite	0.7	0.8
Other metallic ores	--	.4
Metals, including scrap	.1	.1
Cement	4.2	8.9
Gem stones except diamond	.2	.3
Salt	.4	.4
Stone, sand and gravel	.8	1.1
Petroleum and petroleum refinery products	8.4	8.6
Other	.5	2.1
Total	15.3	22.7

Commodity or commodity group	Value of imports (million dollars)	
	1970–71	1971–72
Iron and steel, including ores and scrap	81.0	79.3
Other metals, including ores and scrap	19.1	14.4
Fertilizer materials	28.4	11.3
Coal and coke	3.6	7.9
Crude and partly refined petroleum	34.9	35.9
Petroleum refinery products	20.1	17.7
Other	6.3	4.1
Total	193.4	170.6

Table 2.—Pakistan (excluding Bangladesh): Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970–71	1971–72
METALS		
Aluminum metal, including alloys, semimanufactures	2	4
Chromium ores and concentrates	23,885	22,357
Copper metal, including alloys, all forms	1	13
Iron and steel:		
Pig iron	1	--
Semimanufactures	80	51
Lead metal, including alloys, all forms	--	1
Platinum, troy ounces	160	6,640
Tin, long tons	--	(1)
Other:		
Ores and concentrates, n.e.s	--	12,955
Scrap, nonferrous	216	--
NONMETALS		
Abrasives, natural:		
Dust and powder of precious and semiprecious stones, value	$1,016	$390
Grinding and polishing wheels and stones, do	$12,390	$57,907
Barite	356	--
Cement	307,077	569,759
Chalk, crude	16	9
Clays and products:		
Crude	23	125
Fire bricks	3,334	1,779
Other, n.e.s	--	557
Fertilizer and fertilizer materials:		
Crude	91	--
Manufactured	--	10,584
Gem stones other than diamond, kilograms	9,878	16,024
Gypsum	20,963	--
Mica, crude and worked	r 18	--
Salt	81,301	61,977
Stone, sand and gravel:		
Dimension stone	r 8,235	8,848
Crushed and broken stone	629	6
Sand	17	--
Strontium minerals, celestite	2	--
Other nonmetals, n.e.s	10	204
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	2,923	7,588
Coal and coke	985	686
Petroleum:		
Topped crude [2], thousand 42-gallon barrels	1,088	345
Refinery products:		
Gasoline, do	1	13
Kerosine and jet fuel [1], do	r 16	6
Distillate fuel oil, do	137	962
Residual fuel oil, do	3,045	2,441
Lubricants, do	11	178
Other, do	(1)	(1)

r Revised.
[1] Less than ½ unit.
[2] Reported in source as "topped crude—naptha."

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—The production of bauxite declined sharply from 2,213 tons in 1969 to 283 tons in 1971. However, in 1972 production began to increase and almost doubled over the quantity of the previous year. The province of Punjab was the only source of bauxite. Since there are no exports of bauxite, it must be concluded that all production is consumed by domestic industry. It is conjectured that the output of bauxite is used in conjunction with domestic industries such as clays, cement, and ceramics.

No announcement was made during the year of the production of aluminum metal from any native bauxite.

Chromite.—Production remained strong during the year and showed a significant increase over the quantities produced in 1970 and 1971. The bulk of the reported production came from the province of Baluchistan, with minor production reported from the North-West Frontier Province.

During the fiscal year 1971–72, 22,357 tons were exported; 19,968 tons to the United States and the remainder to the People's Republic of China.

Iron and Steel.—Pakistan industry continued to be dependent on imports of iron and steel to produce various manufactured and semimanufactured items. Production of these items in 1972 increased over that of the previous year. Production was reported by 145 factories.

The West Pakistan Industrial Development Corp. (WPIDC) proposed the construction of a pig iron steel plant in Baluchistan Province to provide steel for Pakistan's developing heavy industry. The WPIDC expects to base its proposed plant on the Chilghazi iron ore deposits, which contain reserves of 2.4 million tons of magnetite whose iron content varies from 32% to 55%. These reserves are thought to be adequate for the operation of a 200-ton-per-day plant for a period of 12 to 15 years.

Uranium.—The Pakistan Atomic Energy Commission continued its search for uranium ore and has commenced a drilling program in the Sulemanki mountain range in the Dera Ghāzi Khān area. Previous drilling operations in the area indicated several hundred tons of uranium ore.

On November 28, 1972, the Karachi nuclear powerplant was dedicated. The plant is the first nuclear powerplant in the country and is located on the beach, almost 27 miles west of Karachi. This facility was constructed with Canadian and Japanese assistance. This and similar plants that will be constructed in the future are expected to assist in supplying Pakistan's current and future power demands.

NONMETALS

Barite.—Although barite production remained strong, production declined below the level of the previous year. According to official government sources no exports of barite were reported. The lack of exports may indicate increased domestic demand for barite as a well-drilling medium. Production occurred primarily in the North-West Frontier Province. A minor quantity was produced in Baluchistan Province.

Cement.—Nine cement plants were in operation during the year with production showing a small increase over that of 1971. Exports of cement in the fiscal year 1971–72 almost doubled that of the previous fiscal period. Major recipients of Pakistan cement were Abu Dhabi, Dubai, Saudi Arabia, Somalia, Kuwait, and Muscat.

As of August 1972, all cement plants in Pakistan were using natural gas as a fuel to produce cement. The WPIDC's Maple Leaf plant in Duadkhel was the last cement plant to convert from coal to natural gas as an operating fuel. The cement industry was the nation's second largest consumer of natural gas. The industry currently has a production capacity in excess of 3 million tons per year.

Fertilizer Materials.—Five plants produced fertilizer materials such as urea, superphosphate, and ammonium sulfate during the year. The output of fertilizer materials was almost doubled the production of 1970 and 1971. Urea was the bulk of the chemical fertilizer production. Increased domestic production may decrease Pakistan's requirement for imported chemical fertilizers in the future.

The Dawood-Hercules plant near Lahore, with a urea production capacity of 345,000 tons per year, was the largest producer. This was followed by the plant at Daharki, with a capacity of 173,000 tons of urea per year, and the WPIDC's plant at Multan, with a capacity of 59,200 tons of urea per year and 103,000 tons of ammonium compounds. These plants use domestic natural gas for the production of fertilizers.

Salt.—Salt production was derived by solar evaporation of sea water and mining of rock salt. Sixteen facilities for the evaporation of salt were reported in operation during 1972. The major portion of the rock salt output was supplied by the province of Punjab, with a small quantity from the North-West Frontier Province. Total salt production increased 37% over that of 1971. The increase was primarily due to the increased output of rock salt. A significant quantity of salt was exported, primarily to Singapore.

MINERAL FUELS

Pakistan's consumption of all forms of commercial fuels in 1972 was estimated to be 6.4 million tons of fuel oil equivalent.

During 1972 the breakdown of national energy requirement by source was estimated as follows: Oil, 42%; natural gas, 34%; hydroelectric power, 13%; coal, 10%; and nuclear power, 1%.

Coal.—Production remained stable during the year and was unchanged from that of the previous year. The bulk of production was used to meet indigenous demand. Only a minor quantity was exported to other Asian countries.

Natural Gas.—The output of the Dhulian oilfield and Māri and Sui gasfields in 1972 increased 10% over that of the previous year. The industrial and other demands for this fuel continued to increase with the continued development of major gas transmission lines. The generation of electric power consumed almost 42 billion cubic feet of natural gas. In addition, almost 26 billion cubic feet was used for the manufacture of chemical fertilizers.

Petroleum.—Estimates of crude oil production indicated that production remained near that of 1971. The output of domestic crude oil was inadequate to meet domestic demand and large quantities were imported for processing to refined petroleum products in plants near Karachi and Rawalpindi. Large quantities of refined petroleum products were also imported to meet consumer demand.

The Pakistan Government continued negotiations with various oil companies for oil exploration concessions. Interest was greatest in the offshore Baluchistan coastal area. The West German oil firm Wintershall A.G. has drilled an exploratory well to a depth of 8,000 feet in this area and is expected to continue drilling to a depth of 16,000 feet.

The Mineral Industry of Peru

By F. W. Wessel [1]

The Peruvian economy showed distinct overall improvement from its 1971 performance; advances throughout the industrial sector were able to more than offset poor years for the agriculture and fisheries sectors. Increases in international commodity prices, including silver and zinc, had beneficial effects, and copper prices strengthened at the close of the year. The improved market for metals combined with promising showings of petroleum in the Amazon Basin, attracted additional venture capital.

Preliminary figures indicated a 10.3% increase in the gross national product (GNP), compared with a revised figure of 11.8% in 1971. The trade balance was estimated at a favorable $170 million,[2] up from the previous year's $144 million. Copper and iron ore were among the five leading export items.

The value of Peruvian mineral production was estimated at $517 million, a 15% increase over that of 1971 and equivalent to 6.8% of the GNP. Exports of minerals came to $480 million, a 19.7% increase due in large measure to increased world prices for zinc and silver.

Empresa Minera del Perú (Minero Perú) became much more active during 1972, having been directed by the Government to smelt and refine all ores and concentrates produced by state-owned mines and to expand its marketing of ores and metals produced by other companies.

Further explanatory detail concerning the implementation of Decree Law 18880 (June 9, 1971) was provided by Supreme Decrees 050–72–EF (April 6, 1972) and 050–72–EM (April 21, 1972). The important regulation states that certain specific exemptions allowed in calculating income for tax purposes were not applicable in calculating income for distributing profit to the mining community.

Decree Law 19299 of February 17, 1972, authorized the Executive Power to permit mining companies to defer payment of part of their income taxes in order to assist the companies to obtain foreign capital for development programs. The development projects to be so favored are limited to those included in the 1971–75 National Development Plan.

Decree Law 19453 of June 27, 1972, empowered the Ministry of Industy and Commerce, acting through its agent Corporación Financiera de Desarrollo (COFIDE), to choose when to begin negotiations for state purchase of firms classified as Basic Industry under the General Industries Law. The new law further provided that the negotiating period be not less than 1 month nor longer than 6 months, and that, if agreement is not reached, the state may expropriate the property under the Second Transitory Provision of Decree Law 19262, which provides that a "just price" be paid on terms to be determined in each case. Exempted from forced sale to the Government were those firms in Basic Industry of such limited size that they could not readily convert to advanced technology.

Decree Law 19482 of July 25, 1972, reserves for the Government all air services required for the exploration and exploitation of natural resources, and for the establishment of the infrastructure needed for those purposes.

On November 21 the General Mining Law (Decree Law 18880) was amended (1) to give Minero Perú authority to transfer concessions, and (2) to redefine a "Special Mining Company" to include joint participation with the Government in such a company by national or foreign in-

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from Peru Sol (S/) to U.S. dollars at the rate of S/38.8=US$1.00.

dividuals and private or public corporations. This opens the door to corporations formed by foreign governments, with immediate application to Poland and Romania.

Strikes interrupted production at Southern Peru Copper Corp.'s Toquepala mine and Ilo smelter during the first half of the year. In June an eight-man commission, representing government, labor, and management, was formed to help solve the firm's labor problems. Other strikes halted operations briefly at Marcona Mining Co. late in June, and at Cerro de Pasco Corp.'s Lourdes mine in September.

About midyear an agreement between Peru and the U.S.S.R. was signed, providing for technical cooperation in various sectors, including mining and metallurgy. Projects included geological surveys and feasibility studies for a new steel plant and a lead refinery. A group of 10 geologists arrived in December to study petroleum possibilities in the Marañon Region and mineral deposits in Ancash.

PRODUCTION

For almost all metals, Peru's mine production increased substantially in 1972. Copper, lead, and zinc mine production increased 9%, 14%, and 12%, respectively. Refined copper, lead, and zinc production were respectively 20%, 27%, and 14% higher than in 1971. Silver production increased 12%, but gold output declined slightly. Production of iron ore, pig iron, and steel all showed substantial advances in 1972.

Cement production increased by 11% over the previous year, reflecting increasing demand for construction materials generally. Barite production returned to its 1970 level after a poor record in 1971.

Crude petroleum output increased 4.7% while refinery throughput increased 2.0%. Major products, with the exception of diesel oil, increased correspondingly. Of the net refinery feed, 31% was imported in 1972, versus 33% in 1971.

Table 1.—Peru: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Antimony:			
Mine output, metal content	1,167	687	799
Metal (content of antimonial lead bars)	408	311	369
Arsenic, white	772	656	1,019
Bismuth:			
Mine output, metal content	806	642	677
Metal	763	600	664
Cadmium:			
Mine output, metal content	482	449	686
Metal	186	171	210
Copper:			
Mine output, metal content	220,225	207,346	225,010
Copper sulfate	764	687	867
Metal:			
Blister	140,741	133,792	134,550
Refined	36,178	32,561	39,213
Gold:			
Mine output, metal content—troy ounces	107,677	83,752	82,885
Metal—do	r 40,786	35,697	40,092
Indium—kilograms	1,557	1,868	2,398
Iron and steel:			
Iron ore and concentrate—thousand tons	9,713	8,849	9,414
Pig iron (excluding blast furnace ferroalloys)—do	86	143	171
Steel, ingot and casting—do	94	179	192
Lead:			
Mine output, metal content	156,770	165,814	189,009
Metal	r 72,509	67,515	86,009
Manganese:			
Ore and concentrate, gross weight	1,922	9,753	11,024
Metal content	r 577	2,926	3,066
Mercury—76-pound flasks	3,196	3,462	3,066
Molybdenum, mine output, metal content	607	802	777
Selenium—kilograms	6,755	7,069	8,021

See footnotes at end of table.

Table 1.—Peru: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Silver:			
Mine output, metal content—thousand troy ounces	39,835	39,952	44,898
Metal—do	21,906	19,367	24,000
Tellurium metal—kilograms	r 28,235	23,885	e 18,000
Tin, mine output, metal content—long tons	r 101	167	130
Tungsten, mine output, metal content	804	760	856
Zinc:			
Mine output, metal content	299,136	318,073	357,600
Metal, refined	r 71,011	59,143	67,161
NONMETALS			
Barite	236,321	102,516	e 236,000
Cement, hydraulic—thousand tons	1,144	1,466	1,627
Clays:			
Bentonite	35,578	29,478	e 36,000
Fire	32,245	10,555	e 10,000
Kaolin	1,549	395	e 400
Common	51,658	147,082	e 150,000
Diatomite	2,559	3,776	e 4,000
Feldspar	2,863	1,435	e 3,000
Gypsum:			
Crude	89,940	45,427	e 90,000
Calcined	56,595	e 57,000	e 57,000
Lime	9,715	9,700	e 10,000
Phosphate, guano	50,226	22,541	e 23,000
Salt, all types	190,577	185,170	e 191,000
Stone:			
Dimension:			
Marble [1]	1,092	1,132	e 1,200
Slate	16	12	10
Crushed and broken:			
Dolomite	5,123	4,015	e 4,000
Gravel and sand—thousand tons	2,422	2,158	e 2,200
Limestone—do	1,841	1,341	e 1,400
Quartzite	2,612	4,319	e 5,000
Silica	33,984	52,670	e 55,000
Talc and related materials, pyrophyllite	7,908	5,487	e 5,500
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite	20,069	10,718	e 20,000
Bituminous	136,000	r e 100,000	e 100,000
Coke, all types	29,412	33,433	e 11,000
Gas, natural, gross production—million cubic feet	e 74,818	67,227	64,430
Natural gas liquids—thousand 42-gallon barrels	949	e 900	e 900
Petroleum:			
Crude—do	26,269	22,589	23,644
Refinery products:			
Aviation gasoline—do	12	1	4
Motor gasoline—do	9,489	10,408	10,897
Jet fuel—do	1,536	1,419	1,513
Kerosine—do	3,963	4,314	4,427
Distillate fuel oil—do	6,761	6,968	6,680
Residual fuel oil—do	7,765	9,329	9,528
Liquefied petroleum gas—do	310	380	469
Lubricants—do	79	64	92
Asphalt—do	285	254	206
Other—do	137	197	153
Refinery fuels and losses—do	388	395	442
Total—do	30,725	33,729	34,411

e Estimate. p Preliminary. r Revised.
[1] Includes ground marble.

TRADE

Unofficial figures indicate that the value of total exports from Peru reached $944.4 million dollars in 1972, an increase of 5.8%. Of this total, copper exports, valued at $188.5 million, accounted for 20%, and zinc, iron ore, and silver, for another 21%.

Import figures for the first 10 months indicate a 7% increase over 1971 imports. Imports of mineral fuels increased more than 60%, but imports of raw and fabricated aluminum remained unchanged, and imports of iron and steel and of the major chemical and construction commodities were off sharply.

Specific trade agreements were concluded during the year with India and Czechoslovakia. Peru will supply India with 54,000 tons of copper and perhaps substantial quantities of lead and zinc. Textile and mining machinery and railroad equipment are mentioned as India's barter commodities. In October Minero Perú contracted to supply up to 150,000 tons of copper concentrate containing 38,000 tons of copper to Czechoslovakia over an 8-year period.

In consequence of a $41 million development loan, and the services of Chinese technical personnel, Peru will sell 90,000 tons of copper and 15,000 tons each of lead and zinc to the People's Republic of China during the next 3 years.

Table 2.—Peru: Selected mineral products exported (f.o.b.)

Mineral product (fine content)	1970 [1]		1971 [2]		1972 [3]	
	Quantity (metric tons)	Value (millions)	Quantity (metric tons)	Value (millions)	Quantity (metric tons)	Value (millions)
Copper	215,572	$269	193,519	$170	218,467	$188
Silver	1,171	62	1,025	47	1,289	62
Iron ore	10,050,000	66	9,010,000	62	8,618,000	65
Lead	159,040	35	145,698	27	165,743	33
Zinc	331,996	47	344,531	47	398,986	69

[1] U.S. Embassy, Lima, Peru. State Dept. Airgram A–88, Mar. 26, 1971.
[2] U.S. Embassy, Lima, Peru. State Dept. Airgram A–115, Apr. 6, 1972.
[3] U.S. Embassy, Lima, Peru. State Dept. Airgram A–62, Mar. 14, 1973.

Table 3.—Peru: Exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970 [2]	1971 [2]	Principal destinations, 1971
METALS			
Antimony, ore and concentrate [3]	759	711	NA.
Arsenic trioxide [4]	100	NA	
Copper:			
Ore and concentrate [4]	137,089	149,007	Japan 128,011; United States 8,162; Spain 7,563.
Matte and cement [4]	2,558	2,749	Spain 2,154; Japan 595.
Metal, including alloys:			
Blister [3]	138,416	113,875	United States 63,843; Belgium-Luxembourg 20,320; West Germany 16,008.
Refined [3]	32,797	30,002	Netherlands 11,970; Argentina 4,545; Brazil 3,407.
Gold:			
Ore and concentrate [5] troy ounces	45,357	43,237	NA.
Metal, unworked or partly worked do	[6] 97,325	6,056	NA.
Iron and steel, iron ore concentrates and pellets	9,278,515	9,120,068	NA.
Lead:			
Ore and concentrate [4]	144,409	123,884	West Germany 42,612; Japan 27,448; United Kingdom 22,448.
Metal, including alloys, all forms [4]	62,597	54,944	United States 32, 996; Italy 9,235; Sweden 4,568.
Mercury [4] 76-pound flasks	2,466	899	United States 609; Japan 290.
Molybdenum ore and concentrate [4 7]	1,299	1,038	France 432; Belgium-Luxembourg 414.
Silver:			
Ore and concentrate [5] thousand troy ounces	19,139	17,329	NA.
Metal, including alloys:			
Refined and electrolytic do	16,822	14,341	NA.
Blister and mixed bars do	3,217	3,432	NA.
Tin ore and concentrate [4] long tons	1,092	4,671	All to United Kingdom.
Tungsten ore and concentrate [4]	1,273	1,387	United Kingdom 588; Japan 459; Sweden 151.
Zinc:			
Ore and concentrate [4]	491,296	506,231	Japan 338,689; France 82,690; West Germany 19,218.
Metal, including alloys, all forms	[3 8] 59,834	53,936	United States 25,267; Brazil 12,407; Colombia 3,250.
Other base metals, including alloys, all forms, n.e.s	NA	363	France 296; United Kingdom 33.
NONMETALS			
Asbestos [4]	468	--	
Barite and witherite [9]	153,968	98,818	All to United States.
Cement	70,610	19,951	NA.
Fertilizer materials, crude and manufactured	1,900	1,921	All to West Germany.
Salt	NA	183	All to Italy.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude thousand 42-gallon barrels	1,767	1,111	Mainly to United Kingdom.
Refinery products:			
Distillate fuel oil do	99	86	NA.
Residual fuel oil do	100	140	NA.
Other do	145	28	NA.

NA Not available.

[1] Because official Peruvian trade returns were not available at the time this table was compiled, exports of a number of mineral commodities are not included. The tabulated data were obtained from Peruvian customs records.

[2] Source: Unless otherwise noted, Ministerio de Energia y Minas, Dirección General de Mineria, Anuario de La Mineria del Peru, 1971. Lima, 1971, 148 pp.

[3] Source: Metallgesellschaft A.G. Metal Statistics, 1962–72, 60th Edition, Frankfurt-am-Main, 1973, 328 pp.

[4] Source: Statistical Office of the United Nations. World Trade Annual, 1970 and 1971. V's. I, II, and III, New York, 1972 and 1973.

[5] Content in ores, concentrates, and refinery products of base metals included.

[6] Includes monetary.

[7] Includes ores of vanadium, zirconium, tantalum, and titanium, if any.

[8] Slab only.

[9] Source: Official trade returns of the United States.

Table 4.—Peru: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970 [2]	1971 [3]	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	2,808	1,557	All from West Germany.
Metal, including alloys:			
Scrap	290	854	All from United States.
Unwrought	2,874	3,118	Canada 2,269; United States 515; France 334.
Semimanufactures	1,939	1,685	France 395; West Germany 341; Austria 279.
Chromium, chromite	1,000	NA	
Copper metal, including alloys, all forms	494	429	West Germany 97; Sweden 89; Canada 62.
Iron and steel:			
Metal:			
Scrap	3,113	NA	
Sponge iron, powder and shot	263	249	All from United States.
Ferroalloys	612	439	Do.
Steel, primary forms	8,372	4,662	All from Japan.
Semimanufactures	98,947	186,476	Japan 123,462; United States 16,844; Canada 11,706.
Lead metal, including alloys, all forms	24	--	
Manganese:			
Ore and concentrate	407	687	All from United States.
Oxides	313	211	All from Japan.
Nickel metal, including alloys, all forms	49	49	West Germany 28; Canada 21.
Tin metal, including alloys, all forms long tons	93	--	
Titanium oxides	332	NA	
Zinc metal, including alloys, all forms	42	--	
Other:			
Ore and concentrate	1,005	54	All from Canada.
Scrap	164	--	
NONMETALS			
Abrasives, natural, n.e.s	88	--	
Asbestos	5,289	5,419	All from Canada.
Boric oxide and acid	636	--	
Cement	4,442	--	
Clays and clay products (including all refractory brick):			
Crude, n.e.s	5,282	4,143	United States 2,899; United Kingdom 1,244.
Products, refractory (including nonclay bricks)	[4] 2,449	4,195	Austria 2,190; Italy 959; West Germany 714.
Diamond:			
Gem, not set or strung value	$483,000	$564,000	All from Belgium-Luxembourg.
Industrial do	$60,000	$218,000	All from United States.
Feldspar and fluorspar	595	--	
Fertilizer materials:			
Crude, phosphatic	8,165	15,197	All from United States.
Manufactured:			
Nitrogenous	59,709	50,600	Netherlands 17,247; Belgium-Luxembourg 13,225; West Germany 10,392.
Phosphatic	--	1,818	All from United States.
Potassic	6,488	7,762	Belgium-Luxembourg 4,162; United States 2,000; France 1,600.
Other, including mixed	4,929	6,774	United States 3,852; West Germany 1,692; Belgium-Luxembourg 1,230.
Magnesite	2,242	1,516	All from United States.
Sodium and potassium compounds, n.e.s., caustic soda	3,133	9,634	United States 8,231; West Germany 1,403.
Stone, sand, and gravel:			
Dimension stone, crude and partly worked	689	710	All from Italy.
Dolomite	1,439	NA	
Sand, excluding metal bearing	2,243	3,892	All from United States.
Sulfur, elemental	947	NA	
Talc and steatite	277	NA	
Other: Oxides and hydroxides of magnesium, strontium, and barium	68	105	All from United States.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	220	131	All from Japan.
Coal, including briquets, all grades	20,625	23,331	All from United States.
Coke and semicoke	104,522	82,294	Do.

See footnotes at end of table.

Table 4.—Peru: Imports of mineral commodities [1]—Continued
(Metric tons unless otherwise specified)

Commodity	1970 [2]	1971 [3]	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 4,973	11,074	NA.
Refinery products:			
Gasoline---do---	166	279	NA.
Kerosine and jet fuel---do---	--	159	NA.
Residual fuel oil---do---	3,283	1,748	NA.
Lubricants---do---	246	211	NA.
Other---do---	420	1,857	NA.

r Revised. NA Not available.
[1] Because official Peruvian trade returns were not available at the time this table was compiled, imports of a number of mineral commodities are not included. The tabulated data were obtained from Peruvian customs records.
[2] Source: Unless otherwise noted, Ministerio de Energia y Minas, Dirección General de Mineria, Anuario de La Mineria del Peru, 1971. Lima, 1971, 148 pp.
[3] Source: Statistical Office of the United Nations. World Trade Annual, 1971. V's. I, II, and III, New York, 1973.
[4] Partial figure; United States and Canada listed as source countries but quantity not reported.

COMMODITY REVIEW

METALS

Copper.—It was announced in April that Minero Perú signed agreements with Southern Peru Copper Corp. and Cerro de Pasco Corp. permitting the companies to continue selling their mineral products for another year, remitting to Minero Perú 0.5% of the gross return.

Core drilling at Cerro Verde has determined the existence of 30 million tons of ore in an oxide ore body, and another 220 million tons in an adjacent sulfide ore body. Average grade is estimated at 1.1% copper. British Smelter Construction, Ltd., will develop the deposit for Minero Perú. Annual production of 29,000 tons of electrolytic copper is scheduled to start in 1975. Pilot plant testing was underway.

A Minero Perú contract with five Japanese firms called for a feasibility study on bringing the Michiquillay copper deposit (625 million tons at 0.72% copper) into production.

Mitsui Mining and Smelting Co., Ltd., began drilling on a porphyry copper body discovered near Apurimac. Present estimates indicate 50 to 100 million tons of 0.57% grade ore.

The Swedish firm Gränges AB held extensive discussions with Minero Perú concerning establishment of a "mixed company" to develop copper deposits at Chalcobamba and Ferrobamba, relinquished by Cerro de Pasco in 1969. Chalcobamba has been extensively drilled and contains an estimated 27.8 million tons of 2.1% ore.

In April the Government announced formation of a Special Mining Company for development of the Antamina copper deposit in Ancash. Shares in the company will be held 51% by Minero Perú and 49% by Geomin, a small Romanian governmental mining company. Proven reserves at Antamina are 2.4 million tons of ore containing 2.6% copper and 1.34% zinc.

In October Minero Perú contracted with Mitsui Mining and Smelting Co., Ltd. and Furukawa Mining Co. for construction of a 165,000-ton-per-year copper refinery at Ilo. The plant will cost $31 million, and is expected to go onstream in August 1975. Concentrates from Toquepala, and later from Cuajone as well, will be processed to blister copper at Southern Peru Copper Corp.'s smelter; the blister will in turn be fed to the new refinery.

Minero Perú has contracted with Cia. Minera de Sta. Rosalia for the smelting and refining of 300,000 tons of copper concentrate over the next 5 years.

Peruvian blister copper will be sent to Japan at the rate of 1,000 to 1,500 tons monthly for conversion to wirebar. The processing will be done by Mitsubishi Metal Corp., Nippon Mining Co., and Mitsui Mining and Smelting, who will ship the wirebar to India in fulfillment of the trade agreement mentioned above.

The Locumba Mining Co., privately owned, began producing copper concentrates from its deposit 50 miles north of Tacna. Current minimum production of 30

tons of 27% concentrates per day may be doubled in 1973. Another privately owned mine, the Madrigal, near Arequipa, began production of copper-lead-zinc ore in April, at a rate of 15,000 tons per month. Homestake Mining Co. is the major shareholder.

Gold.—A significant placer discovery was made in the gravels of the Inambari River, in the Department of Madre de Dios on the lower eastern slopes of the Andes. The Banco Minero intended filing a petition for a reserved zone to avoid disorderly exploitation. Possibly as a result of this discovery, a commission was appointed to recommend measures to increase Peruvian gold production.

Iron Ore.—About midyear, Marcona Mining brought into production its expanded beneficiation facility in the San Nicolas complex. The annual production rate will be 10.5 million tons, consisting of 4.2 million tons of sinter feed, 4.0 million tons of pellets, and 2.3 million tons of slurry. A third pelletizing plant, to be completed by January 1975, will make pellets from about 80% of the sinter feed.

The port of San Nicolas was dredged to accommodate 175,000-deadweight-ton carriers at the ore pier. In March, Marcona took delivery, from a Japanese shipyard, of the MV *San Juan Exporter,* which was converted to a slurry carrier and enlarged to 141,700 long tons.

Five Japanese steelmakers, headed by Nippon Steel Corp. signed a contract with Marcona for delivery of 24 million tons of iron ore pellets at the rate of 3.5 million tons per year, beginning in 1975.

In addition to their interest in copper in the Apurimac region, Japanese interests were evaluating the possibility of iron ore production of 10 million tons per year.

Iron and Steel.—To aid in planning the steel complex to be built at Nazca, Peruvian officials solicited technical assistance from several sources. A preliminary study was completed by Japanese technicians, a group from the U.S.S.R. was conducting its own study, and West Germany was planning to send a technical party for a market survey.

At Chimbote, Emprésa Siderúrgica del Perú (SIDERPERU) began replacing its blast furnace lining with a higher temperature refractory, which will permit a 20% increase in throughput. Present capacity is 290,000 tons annually. Transformer capacity for the two electric-arc furnaces was doubled, increasing steelmaking capacity from 70,000 to 130,000 tons per year. A third arc furnace was under construction, and a 150,000-ton ferrous and nonferrous foundry was being built; both are expected on line in 1973. Planned for operation in 1975 are a second blast furnace and a third basic oxygen furnace.

An item of high priority to the Peruvian Government was construction of a $10 million plant to make the large-diameter pipe needed to build the trans-Andean pipeline. The plant was to be operable by mid-1973.

Lead and Zinc.—A preliminary study for a lead refinery of 72,000 tons and a zinc refinery of 75,000 tons annual capacity was concluded by Minero Perú and the Japanese Consulting Institute. Assuming positive results from feasibility studies, Minero Perú hopes to have the refineries in operation by 1975.

Minero Perú also announced plans to build a plant to recover 157,000 tons of sulfuric acid annually from smelter gases of a zinc refinery, planned for construction in 1973 in the Lima area. Both units will come onstream in 1975.

NONMETALS

Cement.—Cementos Lima, S.A., increased the capacity of its Atacongo plant 50% by scrapping eight old kilns and replacing them with a single kiln of 800,000-ton annual capacity.

Fertilizer Materials.—The Bayovar phosphate and potash deposits, held as a concession by Midepsa Industries, Ltd., of Montreal, were turned over to Minero Perú, since Midepsa had not filed a plan of exploitation. Minero Perú plans to begin operations in a relatively high-grade area of the concession, and expects to produce 300,000 tons of phosphate, 50,000 tons of potash, and 500,000 tons of crude salt annually, beginning early in 1976. Proved reserves at Bayovar consist of 2.762 billion tons of ore containing 9% phosphorus pentoxide and 6.4 million tons of potash.

As part of the Talara petrochemicals complex, a plant to produce 500 tons of urea and 300 tons of ammonia per day will be built by the Toyo Engineering Corp. Japanese interests have loaned Petroleos del Perú (Petroperu) $44.2 million for the project.

MINERAL FUELS

Coal.—In 1970 a party of technicians from Poland conducted an investigation of coal seams in the Alto Chicama, Santa, and Oyon regions. In 1972 the Polish governmental company KOPEX began a feasibility study on exploiting the coal of the Oyon region, in the northeast corner of the Department of Lima. The study will include a geological survey of 80 square kilometers, and a sampling and analysis program. Some of the coal may be of coking grade.

Petroleum.—Construction of the 900 kilometers trans-Andean pipeline will begin in May 1974, and cost $282 million. The pipeline will be operating by about January 1976. Minimum operating capacity is estimated at 100,000 barrels of crude oil daily. Bechtel, Inc., was employed to make a feasibility study of the pipeline.

On April 4 the Council of Ministers issued Decree Law 19345, which required all companies operating under provisions of the basic Petroleum Law (Law 11780, 1952) to perform geologic and geophysical work and drilling on all concessions. This work was to be completed by September 30, 1972, as a ruling condition for holding the concessions. Since only 6 months was available for this activity, a number of concessions reverted to Petroperu. Mobil Oil Co. del Perú relinquished 283 square miles north of Pucallpa in Loreto (the so-called "Callaria parcels") early in the year, and Peruvian Gulf Oil Co. released concessions north of Puno and in Central Oriente, retaining, however, the Alianza group, which is located in unassigned Block 12. Other concessions were expected also to revert to public ownership. This law did not apply to contracts recently placed with companies exploring Peru's Upper Amazon Basin.

Supreme Decree 051–72–EF, published on April 7, authorized Banco de la Nacion to place at the disposal of the Ministry of Energy and Mines funds to cover payment for expropriating the assets of the International Petroleum Corp. (IPC). A check was issued, deposited to IPC's credit in the Banco de la Nacion, and immediately garnisheed by the Procurador General to apply against IPC's alleged debt to Peru. The expropriation of IPC was considered complete on May 23.

Decree Law 19754, effective October 17, waived customs duties and other normally applicable taxes on all refinery equipment until the end of 1975. An earlier decree law had similarly waived duties on oil-field exploration and drilling equipment.

Late in the year Petroperu contracted with Marubeni Corp. of Japan for construction of a 16,600-barrel-per-day catalytic cracker to replace obsolete equipment at the Talara refinery. It will cost $24.5 million, and is expected to go onstream in late 1974.

Early in the year, contracts for exploration and exploitation of various parcels of land in the Upper Amazon Basin were concluded with Amoco Peru Petroleum Co. and its partner, Cía. Petrolera Pecten del Perú, Arco Peru Corp. (Atlantic Richfield), Getty Oil, Inc. and partners, and Phillips Petroleum Co. of Peru. In September Sun Oil Co. signed an exploitation contract for a parcel of the oil lands. This contract also called for delivery by the company of 2.92 million barrels of Venezuelan heavy crude to Peruvian refineries over several years, with payment to be deferred according to a stated schedule. This arrangement is equivalent to a $7.25 million loan; it was indicated, however, that future contracts would require an $8 to $10 million cash loan to Peru as a basic consideration. Applications for exploration contracts were also filed by Signal Oil Co., Cía. Peruana de Petroleo, Ltda. (El Oriente), and Tenneco, Inc. Negotiations leading to formal applications by Superior Oil Co., the Cities Service/Cayman Oil group, Peruvian Gulf Oil Co., and a French-Spanish consortium continued. However, at the close of the year eight blocks remained unassigned, and Texas Petroleum Co. withdrew its previously filed application.

The Japan Petroleum Development Corp., a French group, and six U.S. companies, including Sun Oil, were reportedly interested in contracts with Petroperu for exploration in the eastern Peru Department of Madre de Dios.

Petroperu's second exploratory well, Capirona X–2, was drilled to 12,014 feet. Drilling stopped on February 8, at which time the flow was 1,500 barrels of low-sulfur oil per day. A third wildcat well, Pavayacu X–3, was spudded in on March 22. This well was thought to be on the main part of the oil structure, while wells X–1

and X–2 were on outlying structures. Oil was found by the drillers on May 23 at 9,400 feet; the well was continued to 11,325 feet, but the results were discouraging as to both quantity and grade.

A fourth exploratory well, Belen X–4, was started in June, near Parayaquillo, but was abandoned in August, having reached 9,493 feet without finding oil. At about the same time, a confirmatory well, Corrientes 5–XC, was being drilled near the site of well X–1. The 5–XC was abandoned in August at 10,115 feet, after finding only feet of oil sands.

It was reported in mid-June that Petroperu was discussing the sale of 22,000 barrels per day of crude from the Loreto area to the refinery at Manaus, Brazil. In mid-August the talks, while still going on, were scaled down to 10,000 barrels per day.

The drill ship *Glomar II* arrived off Tumbes at the end of March, and the first hole was spudded in for Tenneco-Union about mid-May. A trace of oil was reported 2 months later at the 9,600- to 10,000-foot depth, and shortly thereafter the hole cut a major oil sand. The flow of crude was estimated at 5,346 barrels per day, plus over 18 million cubic feet of gas. A second hole is to be started shortly nearby.

Occidental del Perú, Inc., had three geophysical crews in the field, and began drilling its first exploratory well, designated 41-X1, late in June, at a point close to the Ecuadorean border. At the end of October, Occidental announced a depth of 12,750 feet, and a flow of 2,650 barrels per day of 36.4° API low-sulfur crude.

During most of the year the other companies holding contracts had seismic and geologic crews in the field. El Oriente announced drilling plans in August, but no other similar plans were made public.

Production of crude oil increased 4.6% in 1972, due primarily to a 29% increase in production from offshore wells. Production in the older fields continued to decline. Coastal fields provided 54% of total crude oil (43% from the Continental Shelf, and 11% from the Eastern fields). Refinery output increased 2%; the expansion of the La Pampilla refinery in 1971 permitted a 33% increase in output there. Quantities of refined products are tabulated below in thousand 42-gallon barrels:

	Motor gasoline		Kerosine		Diesel		Residual fuel		Other	
	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972
Petroleos del Peru:										
Talara	6,559	6,558	3,715	3,864	5,210	4,687	5,236	4,870	1,052	907
La Pampilla	2,718	3,673	161	154	958	1,251	2,385	3,293	1,423	1,803
Iquitos	69	50	81	92	139	161	121	141	(1)	[2] 1
Refineria Conchan-Chevron, S.A	988	546	295	257	524	453	1,492	1,138	205	142
Cia. de Petroleo Ganso Azul, Ltda	73	70	62	61	139	128	96	86	30	28

[1] Less than 500 barrels.
[2] Processing gain.

Industria del Peru called for bids to construct seven plants, which are to form the nucleus of a petrochemical complex at Petroperu's La Pampilla refinery. Cost is estimated at $68 million, and the scheduled dates of completion will occur late 1975 and 1976.

The Mineral Industry of the Philippines

By Brinton C. Brown [1]

In 1972 the mining industry of the Philippines established another record high mineral production value of $329.6 million,[2] an increase of 5%. Disastrous floods in central Luzon during July and August were responsible for the sharp dip of the gross national product (GNP) growth rate to 3.5% compared with 6.5% in 1971 based on constant 1967 prices. Mineral production continued to make an increasing contribution to the overall economy of the country.

Ranking eighth in the world and largest in the Far East, copper production continued to be the Philippine mineral industry leader in terms of volume and value. Gold producers benefited from the continuing high international price of gold. Gold recovered by primary producers and as by-product from copper flotation ranked seventh in world production. Chromite production ranked sixth in the world, and the Philippines was the leading exporter of refractory-grade chromite to the United States.

Portland cement dominated nonmetallic mineral production despite operating at 48% capacity and was second to copper in output value. Creation by the Government of a Cement Industry Authority with the purpose of developing export markets may benefit the industry and utilize the large excess capacity.

Widespread civil disorder and other problems impelled President Marcos, by Proclamation No. 1081, to declare martial law on September 21. Government measures under martial law have had beneficial effects in general price stability and introduced a new environment for economic activity in the Philippines. By yearend, U.S. investors and traders were taking an active part in the expansion of mining and commercial projects. Presidential Decree No. 8 on October 2 and Presidential Decree No. 87 on December 21 established a new oil exploration law permitting foreign companies to enter into production sharing service contracts. (Details are given in petroleum section of commodity review.)

Presidential Decree No. 1-A, issued November 2, provided for an 11-member board of the newly created National Economic Development Authority (NEDA). The Wage Commission, the Oil Industry Commission, and the Price Control Council were placed under the NEDA.

Under martial law, strikes, picketing, and demonstrations were banned. Presidential Decree No. 21 established a new National Labor Relations Commission (NLRC) to provide for prompt mediation, arbitration, and conciliation of all labor disputes.

On October 27, Presidential Decree No. 34 completely revised the tariff and customs code of the Philippines. Among the significant changes were (1) the reduction of the number of tariff rates from 43 to 6; (2) introduction of a uniform revenue rate of 10% ad valorem; and (3) a change in the basis of valuation from c.i.f. to f.o.b. The revised code became effective November 26 with the exception of new rates of duty which will become effective January 1, 1973. Although the revised code was designed to protect local industry in some measure, there was a definite shift of emphasis to raising revenue.

Development and exploitation of mineral deposits was high on the Government priority list. Nevertheless, Presidential Proc-

[1] Mining engineer, Division of Nonmetallic Minerals—Mineral Supply.

[2] Where necessary, values have been converted from Philippine pesos (₱) to U.S. dollars at the rate of ₱6.72=US$1.00.

lamation No. 69 will phase out the percentage depletion allowance for mining companies so that mines will pay a larger share of income in the form of taxes. In the past, percentage depletion of 23% of the gross or 50% of the net, whichever was less, was an allowable tax deduction. When the decree is promulgated in 1973, percentage depletion will be reduced to 35% of the net and further reduced to 25% of the net for 1974. The incentive for new mines, exemption from all taxes except income tax for 5 years, has been removed.

Certain provisions of the Mining Act were amended by Presidential Decree No. 99-A to prevent claim jumping, overstaking of claims, and resulting litigation that slows development of promising mineral prospects. The decree ordered that whenever there is any conflict between claim owners over any mining claim, whether mineral or nonmineral, the locator of the claim who first registered his claim with the proper mining registrar, notwithstanding any defect in form or technicality, shall have the exclusive right to possess, exploit, explore, develop, and operate such mining claim.

In August the Philippine Supreme Court issued decisions on two long-pending cases. In the Quasha case the court ruled that special rights and privileges of U.S. citizens terminate on July 3, 1974, regarding land ownership and parity rights and that Americans never had the right to acquire private land, only the opportunity to acquire public lands under the Parity Amendment. The court also ruled that under the Anti-Dummy Law, companies in sectors reserved to Filipinos, such as public utilities, could not have foreign directors or top management personnel. Neither decision was final but U.S. citizens and companies faced the problem of Filipinizing their landholdings and rights in natural resource exploitation.

American and foreign mining companies were continuing efforts to increase Filipino ownership to a minimum of 60%, as required for corporations engaged in developing natural resources under constitutional provisions that take effect at the expiration of the Laurel-Langley Agreement on July 3, 1974. Atlas Consolidated Mining & Development Corp. by selling shares of stock to its Filipino staff and to the Philippine public, divested nearly 50% of its foreign ownership. Marcopper Mining Corp. had divested 29% by April and was selling additional stock to employees. Lepanto Consolidated Mining Co. achieved 69% Filipino ownership. Benguet Consolidated Inc.'s reorganizational plan to split into two companies was subject to approval by the Philippine Central Bank and the security and exchange commissions of both the Philippines and the United States.

A 320-man committee with nationwide representation was convened on the premise that the first Constitution of the Philippines had not adequately served the needs of the nation. Collectively known as the Constitutional Convention (Concon), this delegation had the responsibility of framing a new Constitution that would insure more appropriate conditions for attaining the ideals and aspirations of Philippine society including achievement of rapid economic development. Among the economic articles in the proposed Philippine Constitution adopted by the Concon on November 30, the following are significant to the minerals industry: (1) All lands of the public domain, waters, minerals, coal, petroleum, and other mineral resources of the Philippines belong to the state; and (2) the disposition, exploration, development, exploitation, or utilization of any of the natural resources of the Philippines shall be limited to citizens of the Philippines or to corporations or associations with at least 60% of the capital owned by such citizens. Existing valid and binding service contracts for financial, technical, management, or other forms of assistance were recognized.

Inflation continued to be a serious problem. Average consumer prices for the year were 10.2% higher than those in 1971. Under martial law the Government expected to curb the inflation rate.

Unemployment figures were unreliable, but unemployment was estimated to exceed 8%. Approximately 50,000 were employed by the minerals industry. Although the minimum wage established by the Minimum Wage Act as amended in 1970 was $1.19 (8 pesos) a day for nonagricultural industries including mining, skilled workers in the minerals industry received $1.79 to $2.38 (12 to 16 pesos) a day, and large equipment operators received $2.98 to $3.72 (20 to 25 pesos) a day. By the end

of 1973 the minimum wage was expected to reach 12 pesos a day.

Oil refinery operators seeking price increases for petroleum products to recover losses from increased crude oil and operating costs have experienced delays from the Oil Industry Commission (OIC). Finally on November 24, the Supreme Court issued a temporary restraining order to prevent implementation of a modest price increase granted by the OIC.

The Philippines may join the Intergovernmental Council of Copper Exporting Countries (CIPEC). The addition of the Philippines, which mines about 4% of the world's copper and exports about 14%, would give CIPEC members control of about 80% of all copper exported. Curtailment of copper concentrate imports by the Japanese and the imposition of additional smelter charges may impel Philippine copper producers to build two smelters.

The government-owned National Power Corp. (NPC) received assistance from the World Bank to construct a 150-megawatt thermal-electric generating unit on Bataan peninsula. With a total installed generating capacity of 500 megawatts (mainly hydroelectric), NPC sells bulk power to industrial users and local utilities including the privately owned Manila Electric Co. (Meralco). Together, NPC and Meralco generate about 90% of the electric power in the Philippines. This project will increase NPC's generating capacity in Luzon by about 30%. The Asian Development Bank extended additional assistance to NPC for installation of another 50-megawatt unit at the Agus V Maria Cristina hydroelectric power station in Agusan, Mindanao.

By yearend NPC was very interested in establishing a geothermal power generating plant at Tiwi, Albay. Philippine Geothermal Inc., a subsidiary of Union Oil Co. of California, explored the Tiwi steam potential and found it to be an excellent power source capable of development into a major producing area. The initial geothermal generating plant would cost $2.5 million for installation of two 10,000-kilowatt units. Power would service rural electric cooperative systems in Camarines Sur and the Bicol area.

PRODUCTION

Base metals accounted for 69.2% of Philippine mineral output value in 1972. Copper dominated with 61.4% followed by iron at 4.8%, chromite at 2.2%, zinc at 0.3%, and nickel, mercury, pyrite, and manganese the remaining 0.5%. Precious metals comprised 11.1% of the mineral production value with gold accounting for 10.2%, silver at 0.8%, and platinum and palladium the remainder. Portland cement dominated the nonmetallic mineral production accounting for 14% of the country's total mineral output value and was second to copper. Other nonmetallic minerals of major importance were sand and gravel at 2.1%, salt at 1.4%, fertilizer at 1.1% with gypsum and lime each less than one-half percent. Coal, the only mineral fuel produced, was valued at $238,000.

In addition to the value of indigenous mineral output, petroleum products derived from refining imported crude were a source of substantial value added in the mineral fuels category.

As evidence of the world significance of 1972 mineral output the Philippines ranked eighth in copper production, sixth in chromite output (actually first in refractory chromite), seventh in gold, 13th in mercury, and 20th in silver production.

Table 1.—Philippines: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Cadmium, mine output, metal content—kilograms	4,990	9,843	7,983
Chromium, chromite, gross weight:			
Metallurgical grade	99,933	88,790	81,370
Refractory grade	466,510	340,804	268,230
Total	566,443	429,594	349,600
Copper, mine output, metal content	160,296	197,573	217,977
Gold—troy ounces	602,715	637,048	606,730
Iron and steel:			
Iron ore and concentrate—thousand tons	1,870	2,331	2,205
Ferroalloys	r 1,225	1,484	1,819
Lead, mine output, metal content	14	e 20	--
Manganese ore and concentrate, gross weight	5,121	5,133	2,491
Mercury, mine output, metal content—76-pound flasks	4,648	5,020	3,341
Molybdenum, mine output, metal content	32	4	--
Nickel, mine output, metal content	103	222	384
Platinum-group metals:			
Palladium—troy ounces	878	1,756	4,810
Platinum—do	352	703	2,712
Silver, mine output, metal content—thousand troy ounces	1,702	1,940	1,848
Zinc, mine output, metal content	3,191	3,875	4,603
NONMETALS			
Asbestos	1,213	e 1,200	--
Cement, hydraulic—thousand tons	2,447	3,117	2,903
Clays:			
Bentonite	164	133	61
White	12,346	14,384	e 15,000
Rock	3,177	4,436	e 5,000
Other	240,515	289,768	e 300,000
Diatomite	51	e 50	--
Feldspar	20,236	39,358	46,061
Fertilizer materials:			
Crude, phosphatic:			
Guano	1,480	1,135	2,012
Phosphate rock	1,400	4,729	2,618
Manufactured:			
Nitrogenous [1]	60,000	48,000	54,000
Mixed and unspecified	58,929	55,864	56,975
Gypsum and anhydrite, crude [2]	17,458	42,796	84,945
Lime	161,892	222,580	282,661
Perlite	12,000	415	435
Pyrite and pyrrhotite (including cupreous):			
Gross weight	273,851	238,334	255,785
Sulfur content	127,012	110,944	118,787
Salt, marine	210,306	235,000	219,500
Sand and gravel:			
Sand, glass—thousand tons	684	498	412
Sand and gravel, n.e.s. [3]—thousand cubic meters	4,619	4,628	e 4,700
Stone:			
Coral, crushed—do	180	335	e 350
Dolomite	11,011	11,488	8,871
Limestone—thousand tons	3,567	3,948	4,015
Marble (dimension), unfinished	10,271	3,700	e 11,000
Tuff	87,997	59,206	49,387
Cobbles and boulders, n.e.s—thousand cubic meters	245	215	216
Sulfur, elemental	41	39	10
Talc	1,590	1,317	1,007
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades	42,401	40,024	38,900
Petroleum, refinery products:			
Gasoline—thousand 42-gallon barrels	15,601	15,771	16,004
Jet fuel—do	2,703	2,116	2,589
Kerosine—do	3,371	3,382	3,601
Distillate fuel oil—do	13,790	14,946	13,663
Residual fuel oil—do	23,517	24,528	21,562
Other—do	2,048	2,421	2,549
Refinery fuel and losses—do	3,784	3,949	4,153
Total—do	64,814	67,113	64,121

e Estimate. p Preliminary. r Revised.

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

[2] Including synthetic.

[3] Including unspecified earths.

TRADE

Although Japan continued to displace the United States as the Philippines No. 1 trading partner, the United States remained a close second and, much more significant, was the nation with which Philippine traders recorded the largest surplus in 1972, that is, exports $759.2 million, imports $625.2 million. Under the 1954 United States-Philippines Revised Trade Agreement, known as the Laurel-Langley Agreement, Philippine exports to the United States received a 40% margin of tariff preference until 1971 and a 20% margin from 1971 until July 3, 1974, when full U.S. duty rates would apply. Correspondingly, U.S. exports to the Philippines received a 10% preference until 1974. The U.S. share of total Philippine exports

Table 2.—Philippines: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal including alloys, all forms	453	1,080	Hong Kong 440; Singapore 287; Oman 130.
Chromite ore and concentrates	596,037	403,887	Japan 128,255; United States 114,871; United Kingdom 78,439.
Copper:			
Ore and concentrates	604,352	720,186	Japan 685,904.
Waste and scrap, including alloys	3,954	1,686	Japan 851; West Germany 320; Spain 187.
Matte	6	--	
Alloys unwrought	1,997	2,390	All to Japan.
Gold bullion, thousand troy ounces	653	327	Switzerland 193; United States 134.
Iron and steel:			
Iron ore and concentrates including waste pyrites	1,831,905	2,213,290	Japan 2,188,870.
Scrap	200	--	
Lead ore and concentrates	379	--	
Manganese ore and concentrates	5,197	8,877	Japan 3,700; Taiwan 3,550; Republic of Korea 1,500.
Mercury, 76-pound flasks	r 4,500	4,496	Japan 4,396.
Molybdenum concentrates	29	11	All to United States.
Nickel ore and concentrates	500	769	All to Japan.
Platinum and silver ores, value, thousands	$54	$2,406	NA.
Silver metal, thousand troy ounces	624	492	Japan 391; United Kingdom 98.
Zinc:			
Concentrates	7,694	9,630	Japan 6,120; United States 3,510.
Scrap	614	1,018	Japan 929.
Other metals:			
Gold, silver, and platinum-group metals, not differentiated, value, thousands	$23,884	$12,159	United Kingdom 6,919; United States 4,691.
Ores and concentrates containing more than one metal:			
Copper-gold-silver concentrates	157	7,115	All to United States.
Lead-copper concentrates containing gold and silver	164	2,610	All to Japan.
Ash, slag and other residues containing nonferrous metals	150	51	All to Taiwan.
NONMETALS			
Cement, hydraulic	122,968	635,903	South Vietnam 186,075; Singapore 149,145; Hong Kong 127,512.
Fertilizer materials manufactured	17,596	8,000	South Vietnam 5,000; Singapore 3,000.
Stone, sand and gravel:			
Sand	1,236	6,831	Japan 6,570.
Gravel and crushed stone	19	13	Hong Kong 9; Singapore 4.
Stone, dimension, not worked	7	49	Indonesia 23; Guam 16.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, thousand 42-gallon barrels	37	142	Brunei 99; Sabah 31.
Kerosine, do	47	151	Brunei 53; Hong Kong 40; Sabah 31.
Jet fuel, do	80	310	Singapore 233; Hong Kong 70.
Distillate fuel oil, do	r 3,576	3,944	Singapore 2,121; Hong Kong 1,224.
Residual fuel oil, do	r 1,837	343	Singapore 201; Japan 81; South Vietnam 47.
Other, do	r 2,575	2,873	Japan 2,021; Singapore 699.
Total, do	r 8,152	7,763	

r Revised. NA Not available.

dwindled from 72% in 1950 to 32.5% in 1972 compared with 32.7% for Japan in 1972. Despite a surplus in trade with the United States, the Philippines registered an overall trade deficit of $162.6 million in 1972, the largest since the prestabilization 1960's.

Promulgation of Executive Order No. 384 was a significant milestone in the quest for new markets. Under this order the Philippines was able to trade with all Communist and Socialist countries including People's Republic of China and the U.S.S.R.

Many copper and iron mines and beneficiation plants in the Philippines were developed and constructed with Japanese assistance. In return for the financial and technical aid, long-term contracts, for 10 to 20 years, were signed to enable the Japanese to receive repayment through the receipt of ores and mineral concentrates. At the same time Philippine mine operators were also assured a market for their production. Currency devaluation, environmental problems, and economic conditions in Japan forced Japanese ore buyers to reduce purchases of copper concentrate by about 20% in 1972. Some Philippine producers curtailed production, and others found European markets. Lepanto Consolidated, the only exporter of copper to the United States, also encountered environmental problems at the Tacoma, Wash., smelter and curtailed mine production and shipped to an European smelter.

Of the total Philippine mineral export value for 16 commodities copper accounted for about 74%, followed by gold 12%, iron 7%, chromite 3%, cement 1.6%, and silver 1%. Japan was the principal customer receiving about 72% of Philippine mineral exports including all the metallurgical chromite, nickel, manganese, platinum and palladium, molybdenum, unpolished marble, and the largest share of copper, iron ore, mercury, and silver. The United States imported smaller quantities of copper, iron ore, and silver but imported all the zinc and cadmium and the largest share of refractory chromite. The United Kingdom imported the largest quantity of gold followed by Japan and the United States.

Portland cement exports comprising mostly clinker became an increasingly important source of income. In 1972 Indonesia received 64% of the 239,000 tons of cement exported from the Philippines. South Vietnam, Brunei, New Caledonia, Singapore and other Far Eastern countries imported the remainder.

Table 3.—Philippines: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Alloys, unwrought	8,438	10,076	United States 5,982; Australia 2,435.
Scrap	95	27	All from United States.
Copper metal, including alloys, all forms	r 6,077	5,292	Japan 2,471; United States 2,027.
Iron and steel:			
Iron ore and concentrates	5	10	All from Japan.
Scrap	r 4,728	5,717	Australia 4,951; United States 563.
Pig iron, cast iron, powder and shot	12,435	18,888	Japan 10,228; Australia 7,869.
Ferroalloys	5,116	5,190	Japan 2,377; Taiwan 1,307.
Steel, primary forms	r 581,947	204,578	Japan 79,672; Australia 78,078; Belgium 20,357.
Semimanufactures:			
Bars, rods, angles, shapes, sections	59,804	51,525	Japan 36,083; Australia 5,300.
Universals, plates, sheets	156,508	143,930	Japan 133,938.
Hoop and strip	15,687	12,695	Japan 11,457.
Rails and accessories	3,584	5,243	Australia 3,143; Japan 1,246.
Wire	10,371	10,057	Japan 8,084.
Tube, pipes, fittings	39,309	29,927	Japan 23,249.
Castings and forgings	3,011	297	Japan 118; United States 109.
Lead metal, including alloys, all forms	r 5,981	7,141	Australia 5,873.
Manganese ore and concentrates	4,096	4,481	All from Ghana.
Nickel metal, including alloys, all forms	58	1,202	France 1,005; United States 134.
Silver and platinum metals, including alloys, troy ounces	r 340	96	All from United States.
Tin metal, including alloys, all forms	863	837	Malaysia 531; Japan 211.
Zinc metal, including alloys, all forms	17,789	15,353	Japan 5,179; Canada 4,671; Australia 4,534.
Other: Ore and concentrate of nonferrous base metals	r 421	3,385	United States 3,000; Australia 368.

See footnote at end of table.

Table 3.—Philippines: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS			
Abrasives:			
Grinding stones	r 400	634	Taiwan 208; Japan 115; United Kingdom 124.
Other	453	624	Australia 211; United States 154; Japan 166.
Asbestos:			
Crude, washed or ground	3,303	1,903	Canada 1,683.
Manufactures of asbestos	1,829	2,992	Japan 644; United States 520; Taiwan 313.
Cement	15,712	20,781	Japan 18,257; Taiwan 2,040; United States 325.
Clays and clay products:			
Crude clays	24,671	29,545	Japan 16,396; United States 10,368.
Products—value thousands	$2,132	$3,977	Japan $1,894; United States $704; United Kingdom $414.
Diamond, industrial—do	$215	$207	All from former French West Africa.
Feldspar and fluorspar	2,270	2,789	Italy 1,154; Republic of Korea 890; Thailand 360.
Fertilizer materials:			
Crude	155,216	123,371	United States 123,281.
Manufactured:			
Nitrogenous	122,656	238,775	Japan 186,420.
Phosphatic	2,361	12,253	Japan 8,013; Republic of Korea 3,000.
Potassic	65,933	52,435	United States 35,950; Israel 10,500.
Mixed	r 649	16	West Germany 5.
Gypsum	11,434	16,845	Australia 14,148; West Germany 2,395.
Magnesite	1,785	928	Austria 439; United Kingdom 384.
Pigments, iron oxides processed	251	341	Japan 157; West Germany 125; United States 45.
Salt	2,025	27,163	India 17,685; Australia 6,103.
Stone, sand and gravel:			
Dimension worked	49	20	Italy 12.
Dolomite	r 3,738	3,977	Japan 2,872; United States 648.
Sand	3,907	7,049	Japan 4,726; South Vietnam 2,000.
Gravel	231	212	France 172; Belgium 40.
Sulfur	5,767	19,225	Iran 18,535.
Talc	4,035	3,669	Japan 2,980; United States 419.
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke and briquets	17,024	14,809	Japan 13,310.
Petroleum:			
Crude—thousand 42-gallon barrels	r 66,671	66,217	Iran 15,977; Kuwait 14,014; Indonesia 13,936.
Refinery products:			
Gasoline:			
Aviation—do	r 118	107	Bahrain 56; Iran 17; Thailand 15.
Motor—do	82	(1)	NA.
Kerosine and jet fuel—do	45	90	Malaysia 58; Singapore 32.
Residual fuel oil—do	--	38	All from United States.
Distillate fuel oil—do	29	151	All from Malaysia.
Lubricants—do	r 982	821	United States 359; Japan 189; Netherlands Antilles 180.
Other—do	r 187	240	Taiwan 71; Sarawak 44.
Total—do	r 1,443	1,447	

r Revised. NA Not available.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Cadmium.—Benguet Exploration, Inc., produced 8 tons of cadmium as byproduct of zinc and copper concentrates. Ore mined at Camp 6, Tuba, Mountain Province, contains 0.01% cadmium.

Chromite.—Ranking sixth in the world, Philippine chromite production totaled 349,600 tons in 1972, a decrease of 19%. Refractory chromite production decreased 21% and metallurgical chromite production declined 8%.

Exports declined 2% in quantity but increased slightly in total value. Shipments of refractory chromite decreased 4% in quantity; however, the average unit value increased $0.37 a ton to $20.08 so the total value was slightly lower than in the preceding year. Metallurgical chromite shipments increased 9% in quantity and value

despite a unit value decrease of 2 cents a ton to $30.97.

Refractory chromite was mined at the Coto Mine in Masinloc, Zambales, owned by Consolidated Mines, Inc. Ore reserves were reported to be 7.4 million tons. Acoje Mining Co., Inc., was the country's only producer of metallurgical-grade chromite at its mine in Lucapon near Santa Cruz, Zambales. Ore reserves were 1.6 million tons averaging 28% Cr_2O_3. Ore was milled to produce a concentrate exceeding 48% Cr_2O_3.

Copper.—The Philippines continued to rank eighth as a world producer of copper, and the country's output reached another alltime record high of 218,000 tons of copper metal. Shipments comprising 793,059 tons of concentrate and 23,414 tons of direct shipping ore were exported to smelters, mostly in Japan, with some shipments to the United States and Europe.

Widespread occurrence of copper in the islands had been proven by exploration drilling. Ore reserves reported exceed 1.5 billion tons averaging 0.5% copper.

Atlas Consolidated broke production records at its new Biga pit at Toledo, Cebu, where 28,987,352 tons of waste was stripped and 11,351,934 tons of 0.42% copper ore was mined in 1972. Also, during the year at the underground block caving mine, nine blocks were in production which were being drawn down at an average rate of 10 inches a day. Atlas Consolidated, Asia's largest copper producer, has milling capacity of 65,000 tons a day. The company produced 304,272 tons of concentrates containing 85,610 tons of copper metal of which 27% was from underground operations. Gold, silver, magnetite, and pyrite were also recovered. New equipment installed at the Biga pit included: a P & H 2100 BL electric shovel with a 17-cubic-yard bucket; eight WABCO Haulpak trucks with a capacity of 120 tons; and a belt conveyor 3,600 feet long for waste removal at the rate of 3,400 tons an hour. The company plans to install the Marconaflo system for tailings removal. Using a specially designed nozzle to accomplish reslurrying, tailings will be pumped in a slurry pipeline to a deep fall area in the ocean, a distance of 16 miles. Ore reserves were increased to 721 million tons with 0.47% copper as follows: 258 million tons averaging 0.44% copper from open pits with a waste-to-ore ratio of 2.56 to 1, and 463 million tons averaging 0.5% copper from underground reserves.

Table 4.—Philippines: Production and exports of chromite

Producer, grade, and country of destination	1971		1972	
	Metric tons	Value US dollars	Metric tons	Value US dollars
Production:				
Refractory: Consolidated Mines, Inc.	340,804	--	268,230	--
Metallurgical: Acoje Mining Co., Inc.	88,790	--	81,370	--
Total	429,594	--	349,600	--
Exports:[1]				
Refractory:				
Argentina	4,500	$98,484	--	--
Australia	14,296	304,871	6,883	$140,417
Brazil	9,423	184,244	3,012	62,219
Canada	6,890	137,541	19,779	377,770
Chile	6,103	122,726	3,194	60,113
Italy	19,033	394,239	20,916	439,361
Japan	34,307	692,314	47,927	1,081,567
Netherlands	5,118	105,200	11,641	195,223
Peru	--	--	1,798	34,228
Scotland	--	--	1,985	33,336
Spain	630	12,854	--	--
Taiwan	295	6,300	500	9,937
United Kingdom	72,587	1,349,838	31,649	563,670
United States	115,329	2,257,154	135,099	2,727,319
Venezuela	4,935	110,032	5,975	116,135
Yugoslavia	4,650	99,213	--	--
Total	298,096	5,875,010	290,358	5,841,295
Metallurgical: Japan	63,238	1,959,697	68,873	2,132,893
Grand total	361,334	7,834,707	359,231	7,974,188

[1] Figures for 1971 differ from those shown on table 2 because of source.

Table 5.—Philippines: Copper production by major producers
(Dry metric tons)

Company	1971			1972		
	Concentrate	Direct shipping ore	Copper content	Concentrate	Direct shipping ore	Copper content
Acoje Mining Co., Inc	--	6,244	594	2,800	4,113	1,307
Atlas Consolidated Mining & Development Corp	233,973	--	73,962	304,272	--	85,610
Benguet Consolidated, Inc.[1]	4,830	--	1,695	9,572	--	2,575
	--	--	[2]138			
Benguet Exploration, Inc	1,016	--	155	1,340	--	232
Black Mountain, Inc. (Kennon)	9,730	--	2,259	10,493	--	2,594
Consolidated Mines, Inc	15,153	--	2,876	13,313	--	2,751
Inco Mining Corp. (Masara) [3]	6,055	--	1,165	--	--	--
Itogon-Suyoc Mines, Inc	NA	--	188	NA	--	61
Lepanto Consolidated Mining Co	90,912	--	29,171	89,783	--	25,903
Marcopper Mining Corp	160,553	--	39,403	167,903	--	44,350
Marinduque Mining and Industrial Corp.						
Bagacay	49,847	27,603	7,519	31,071	19,301	6,302
Sipalay	84,491	--	19,058	102,843	--	25,173
Philex Mining Corp	85,817	--	18,969	57,818	--	20,744
Surigao Consolidated Mining Co., Inc.[4]	1,388	--	263	--	--	--
Philippine Iron Mines Inc	--	--	--	1,851	--	375
Other and unaccounted for	NA	--	158	--	--	--
Total	743,765	33,847	197,573	793,059	23,414	217,977

NA Not available.
[1] Started producing concentrates January 1971.
[2] From 342 dry metric tons of cement copper.
[3] Did not operate in 1972.
[4] Started producing concentrates February 1971 and ceased in October 1971.

Marcopper Mining Corp., the country's second largest copper producer, operated an open pit mine near Santa Cruz, Marinduque. Marcopper produced 44,350 tons of copper metal of which 89,828,500 pounds were recovered as concentrate and 7,946,000 pounds were recovered from leaching operations. Gold and silver were also recovered. The concentrator treated 7,648,000 tons of ore at a grade of 0.70% total copper, recovering 83.9% of the contained copper. Although the mill has a design capacity of 15,000 tons a day the average throughput was 20,900 tons a calendar day. Because of reduced smelter intake in Japan and Marcopper's increased production the company obtained a 2-year contract to sell some concentrates to Germany. Ore reserves were 118 million tons with an average grade of 0.59% copper using a cutoff grade of 0.4% copper.

Despite a 13% decrease in output Lepanto Consolidated was the third largest copper producer from its underground mine at Mankayan, Mountain Province. Lepanto milled 1,197,045 tons of ore averaging 2.51% copper and produced 89,783 tons of concentrate averaging 31.8% copper with a total metal content of 25,904 tons. The company's average selling price was $0.493 a pound compared with $0.51 a pound in 1971. The drop in production was a management decision because the Tacoma, Wash. smelter could not take its normal consignment of concentrate. Two shipments were made to Europe. Exploration work increased ore reserves to 9.3 million tons averaging 2.85% copper.

Marinduque Mining and Industrial Corp.'s (MMIC) mine at Sipalay, Negros Occidental, nearly tied Lepanto for third with copper output from the open pit mine at 25,173 tons of copper metal. Despite accelerated stripping at the Cansibit pit that increased mine production, feed to the expanded mill was short of the new rated capacity of 14,500 tons a day. Ore reserves at Sipalay were 58 million tons averaging 0.8% copper based on 0.5% copper cutoff. MMIC also produced 6,302 tons of copper metal from its open pit mine at Bagacay, Samar. This came from 19,301 tons of direct shipping ore averaging 10.7% copper and 31,071 tons of concentrates. Byproduct pyrite concentrate was produced. Ore reserves were 1.4 million tons averaging 2.58% copper and 185,000 tons of direct shipping ore at 10.7% copper.

Philex Mining Corp. produced concentrates containing 20,744 tons of copper metal at the Banget and Santo Tomas II

mills operating on ore mined by block caving at the Santo Tomas ore body in Pacdal, Tuba, Mountain Province. Philex also recovered gold, silver, and magnetite concentrates. Ore reserves were 85 million tons averaging 0.5% copper. In September 1972 the company started operating the Santo Niño open pit mine 21 kilometers north of Baguio City owned by Baguio Gold Mining Co. Under operating management of Philex on an equal share basis, the company will mill 4,000 tons a day from an open pit mine when in full production. Gold and silver were also recovered. Ore reserves were 48 million tons with an average copper content of 0.4%.

Consolidated Mines produced concentrates containing 2,751 tons of copper metal from its Isao-Pili ore body at Mogpog, Marinduque. Mill feed averaging 1.14% copper was treated in the concentrator, which had the capacity increased during the year to 1,500 tons a day. The company plans to erect another concentrator with a daily capacity of 8,000 tons to beneficiate ore from the Ino-Capayang-Bintakay ore body nearby; completion was scheduled for late 1974. Ore reserves at Isao-Pili were 3.7 million tons averaging 0.85% copper and the Ino-Capayang-Bintakay ore reserves were 70 million tons with an average copper content of 0.625%.

Black Mountain Inc. under the management of Frontino, Inc., operated the Kennon mine at Tuba, Mountain Province, owned by Benguet Exploration, Inc. Ore mined by block caving was treated in a mill with a daily capacity of 3,400 tons and 2,594 tons of copper metal in concentrate was produced. Ore reserves were 26 million tons averaging 0.47% copper.

Benquet Consolidated produced concentrates containing 2,575 tons of copper metal at a new 200-ton-a-day mill in Itogan, Mountain Province. Mill feed delivered from the Antamok mine averaged 2.8% copper. Ore reserves were 600,000 tons at 2.6% copper. Benguet ceased leaching operations on Balabac Island, Palawan, and shipped partially leached sulfides as pyrite ore to Japan.

On January 16, 1972, Acoje Mining inaugurated its new 500-ton-a-day mill at Barlo, Mabini, Pangasinan Province. Concentrates containing 1,307 tons of copper metal were produced. Ore reserves were 2 million tons averaging 2.0% copper.

Philippine Iron Mines, Inc., (PIM) recovered copper concentrate from a flotation circuit treating scavenger tailings in its iron ore concentrator at Larap, Jose Pangañiban, Camarines Norte Province. PIM expanded the flotation circuit capacity 80% during the year to produce concentrates containing 375 tons of copper metal.

Benguet Exploration recovered concentrates containing 232 tons of copper metal from its 120-ton-a-day mill at Camp 6, Tuba, Mountain Province. Ore reserves were 100,000 tons averaging 0.69% copper. Itogon-Suyoc Mines, Inc., produced copper concentrate from ore mined in Suyoc, Mankayan, Mountain Province. Inco Mining ceased mining at the Masara mine in Mabini, Davao, Mindanao, owned by Samar Mining Co., Inc. Samar reports ore reserves of 32 million tons averaging 0.47% copper in the Tarago and Kurayao areas at Masara.

White Eagle Overseas Oil Co. operated the 200-ton-a-day Guripan mill owned by Surigao Consolidated Mining Co., Inc. (Suricon). Mill feed came from Suricon's Lipawan and Guripan underground mines in Dumingag and Mahayag, Zamboanga del Sur. White Eagle was forced to halt mining operations because an unreasonable landowner closed the Mahayag road. Ore reserves comprised 1.6 million tons averaging 1.58% copper.

Western Minolco Corp., a relatively new company, acquired the Boneng property near Atok, Benguet Province, from Itogon-Suyoc Mines, Inc., in August 1971. The company was constructing a concentrator with a daily capacity of 10,000 tons with completion scheduled for December 1973. The open pit mines will include the Lobo area nearby. Ore reserves exceed 51 million tons averaging 0.47% copper and 0.02 ounce of gold a ton. The Kalinga-Apayao copper deposit controlled by Philippine Overseas Drilling and Oil Development Corp. adjoins the Boneng property. Philipp Brothers Oceanic Inc. will purchase Western Minolco's copper output. After revaluation of the yen Nippon Mining Co., Ltd., of Japan postponed two copper projects. Nippon may terminate its joint venture with Batong-Buhay Gold Mines, Inc., to build a 6,000-ton-a-day mill on the Kalinga-Apayao copper project where ore reserves are reported to be 69

million tons. Nippon may also cancel its joint venture with Dizon Copper-Silver Mines Inc. to build a 10,000-ton-a-day mill at Botolan, Zambales. Ore reserves were 75 million tons averaging 0.50% copper.

Many exploration projects have been initiated by major mining companies and numerous prospectors. Abra Mining and Industrial Corp. was drilling to prove 40 million tons on its Capapo copper project in Abra. Astro Mineral and Oil Corp. acquired rights to explore copper prospects in Masbate and northern Luzon. Demmag (Philippines), Inc. was exploring copper deposits in Inayawan, Negros Occidental. Fil-Am Resources, Inc., started drilling a copper prospect in Nueva Vizcaya. Imperial Resources, Inc., was planning to drill a copper prospect on Marinduque Island. Inco Mining Corp. was drilling a copper deposit in the Kalinga-Apayao area. Jabpract Mining and Industrial Corp. was working on a copper prospect in Patnongon, Antique, and another in Gabaldon, Nueva Ecija. Jel Mining and Development Corp. was drilling copper deposits in Toledo, Cebu and San Miguel, Surigao del Sur. Leyte Base Metal Co., Inc., was exploring a copper prospect in Leyte del Norte. Montevista Minerals, Inc. was exploring copper deposits in Camarines Norte and Davao. Olasahar Mining Corp. was exploring copper prospects in Leyte, Kalinga-Apayao, Pangasinan, Nueva Vizcaya, and Cagayan. Omico Mining and Industrial Corp. was operating a 100-ton-a-day mill owned by Macawiwili Gold Mining and Development Co. near Itogen in Mountain Province. PIM was completing plans to erect a 6,000-ton-a-day concentrator for its copper-molybdenum deposit at Larap with reserves reported at 19 million tons containing a copper equivalent of 0.42%. Republic Resources and Development Corp. was exploring copper prospects at Maypay near Toledo, Cebu; Roxas, Zamboanga del Norte; Lawaan Wright, Samar; and Maria Aurora, Quezon. Sabena Mining Corp. was drilling the Tagpura copper deposit in Davao and blocked out 9 million tons of ore averaging 0.65% copper. South-Eastern Sierra Madre Resources, Inc., was exploring a copper prospect in Milbuk, Cotabato. White Eagle Overseas Oil Co. drilled in the old Rapu-Rapu copper mine on Rapu-Rapu Island owned by Hixbar Mining Co. White Eagle was continuing exploration of the Labo property in Camarines Norte. Benguet Consolidated drilled the Tawi-Tawi project east of Baguio City and measured 55 million tons of ore averaging 0.5% copper. Lepanto Consolidated drilled copper deposits in Bohol, Southern Leyte, and Cebu. Hercules Minerals and Oils, Inc., drilled the Bully Bueno deposit in Benguet Province and blocked out 2.6 million tons of ore averaging 0.85% copper. Apex Exploration and Mining Co. Inc. was drilling a copper prospect in Zamboanga del Norte. Mindanao Nickel Co. was developing copper claims at Hinobaan, Negros Occidental, south of Sipalay.

The Presidential Advisory Committee on the copper industry has recommended building two smelters rather than one. Lepanto Consolidated was establishing the Philippine Copper Smelting Corp. to build a $100 million smelter at Poro Point, San Fernando, La Union Province. The pyrometallurgical process was selected because of its suitability to the types of concentrates produced by Lepanto and other mining companies in northern Luzon. The chief difficulty in the process design is the high arsenic content of the Lepanto concentrates that will comprise 44% of the smelter feed. Planned capacity is 80,000 tons a year of refined copper from the processing of 250,000 to 300,000 tons of concentrates. Construction was scheduled to start early in 1975 and completion expected by mid-1976. Atlas Consolidated has undertaken a feasibility study of a 40,000-ton-a-year refined copper smelter using the Mitsubishi-Ishikawajima continuous pyrometallurgical process or the Arbiter-Anaconda hydrometallurgical process. The $20 million smelter would be located on Cebu Island.

Gold.—Dramatic increases in world gold prices stimulated interest in reopening some old gold mines, and exploration activity at many gold prospects. Ranking seventh in world gold production, Philippine gold output from five primary mines and as byproduct from copper concentrates was 606,730 ounces, a decrease of 4.8%. The average unit value was $55.23 an ounce.

Benguet Consolidated, the country's largest primary gold producer recovered 215,514 ounces of gold from ore mined at the Acupan and Antamok mines south of Baguio in Benguet Province. Benguet Consolidated elected to refuse the Philippine gold subsidy program and sell its gold production on the free market.

Lepanto Consolidated operated a primary gold mill treating an average of 268 tons a day and recovered byproduct gold in concentrates from the copper flotation. Combined gold production was 121,119 ounces at the mill in Mankayan, Mountain Province. The company received an average selling price of $62.96 an ounce compared with $40.49 in 1971. Lepanto also operated the Agusan mine and mill in Agusan Province owned by Manila Mining Co. During the year, 68,189 tons of ore were milled, and gold production reached 17,047 ounces. Itogon-Suyoc Mines, Benguet Exploration, and Atok-Big Wedge Mining Co. were also primary gold producers operating properties in Mountain Province.

Byproduct gold production from copper operations increased in 1972. Philex Mining recovered 98,251 ounces of gold from the Santo Tomas property and 1,131 ounces of gold from the Santo Niño mine owned by Baguio Gold Mining Co., both in Mountain Province. Atlas Consolidated produced 58,150 ounces of gold in copper concentrate at Toledo, Cebu. Marcopper Mining recovered 41,465 ounces of gold in Marinduque. Smaller quantities of byproduct gold were recovered by MMIC at Sipalay and Bagacay, by Black Mountain at Kennon, Consolidated Mines at Mogpog, and Acoje Mining at Barlo.

Abra Mining and Industrial Corp. was installing a 100-ton-a-day mill on its Patok property near Bangued in Abra Province. Completion was scheduled for early 1973. Ore reserves were reported to be 1 million tons containing 1 ounce of gold a ton. Golden River Mining Corp. was prospecting the Paracale district in Camarines Norte.

Iron Ore.—Iron ore and pellet shipments reached another alltime record high of 2,303,611 tons in 1972, an increase of 6%.

PIM delivered pellet feed to the Pellet Corp. of the Philippines (owned by Kawasaki Steel Ltd. of Japan) from its open pit and underground mines at Larap, Jose Pangañiban in Camarines Norte Province. Recurring high sulfur in the crude ore fed to the concentrator imposed difficulties on the company's ability to meet sulfur specifications which also contributed to a reduction of crude ore output. Ore reserves at Larap were 45 million tons averaging 25.7% magnetic iron. In July, Zambales Base Metals, Inc., ceased mining iron ore at its Sibuguey mines in Zamboanga del Sur.

FILMAG (Philippines) Inc., the largest producer of magnetite concentrate, processed beach sands along the coast of Ilocos Sur at Tagudin, Santa Cruz, and Santa Lucia. Inco Mining was expanding its Tolsa plant capacity in April 1972 to 495,000 tons a year in 1973. Although the beach sands at Tolsa, Leyte, average 20.8% magnetite sand, other areas nearby have a higher grade and were blended with the feed to the magnetic separators. Exploration drilling increased reserves to 24 million tons. Long Beach Mining Corp. produced magnetite concentrate from beach sands at Morong, Bataan. Anglo-Philippine Oil and Mineral Corp. built a magnetic separation plant with an annual capacity of 126,500 tons of concentrate to recover magnetite from beach sands at Damortis, La Union.

Atlas Consolidated produced byproduct magnetite concentrate averaging 65% iron from copper flotation tailings at Toledo, Cebu. Philex Mining recovered a magnetite concentrate from copper flotation tailings averaging 64% iron at Santo Tomas II, Mountain Province.

Although some iron concentrates were shipped to local cement plants most of the concentrates and pellets were exported to Japan. Long Beach Mining shipped to the United States and Philex Mining made a small shipment to Australia.

Iron and Steel.—The Philippine steel industry comprises several small electric arc furnaces for melting scrap into billets, one hot-rolling mill, three cold-rolling mills, five steel pipe and tube manufacturers, and many small iron and steel foundries. The financially troubled Iligan Integrated Steel Mills Inc. (IISMI) plant at Iligan, Lanao, idle since August 1971, restarted operations in November 1972. Following the proclamation of martial law the cold strip mill was in production with plant supervision under government control. Although the capacity of the cold-roll mill is 35,000 tons a month, production was scheduled at 25,000 tons a month. The company plans to have the hot-strip mill in operation by February 1973. However, the Government has encountered difficulty in obtaining feedstock. Elizalde Iron and Steel Corp. (Elisco) and Elizalde Steel

Table 6.—Philippines: Production and exports of iron ore by country of destination
(Dry metric tons)

	1971			1972			
		Exports			Exports		
	Production	Quantity	Value US dollars	Production	Quantity	Value US dollars	Country of destination
Anglo-Philippine Oil & Mineral Corp.[1]	81,083	--	--	120,190	83,200	429,917	Japan.
Atlas Consolidated Mining & Development Corp.	79,346	72,890	548,612	104,766	106,810	892,609	Do.
FILMAG (Philippines)	732,848	714,096	5,017,631	579,995	572,408	3,921,491	Do.
Inco Mining Corp.	347,490	354,980	[2]2,342,607	460,834	510,420	3,408,305	Do.
Long Beach Mining Corp.	248,593	196,237	1,220,265	127,614	209,763	1,285,315	United States.
Philex Mining Corp.	67,460	39,830	308,424	88,146	78,759	611,520	Japan.
					3,891	218,215	Australia.
Philippine Iron Mines, Inc	688,090	688,307	9,008,103	710,639	709,705	5,886,720	Japan.
Zambales Base Metals, Inc.[3]	86,273	100,549	850,245	12,697	28,655	257,233	Do.
Total	2,331,183	2,166,889	19,295,887	2,204,881	2,303,611	16,911,325	

[1] Anglo-Philippine Oil & Mineral Corp. started operation in February 1971.
[2] Inco Mining Corp. exported concentrates to the United States in 1971.
[3] Zambales Base Metals ceased operation in July 1972.

Rolling Mills, Inc. (Elirol) had to rehabilitate mills after the July floods. Elizalde mills were also put under control of the Presidential Steel Committee.

With the extremely tight world market for steel, the proposal for a blast furnace begins to look increasingly attractive to the Philippines.

Marsteel Corp. of Manila and Armco Steel Corp. planned to build a moly-cop grinding ball plant with an annual capacity of 25,000 tons. Production was scheduled for 1973 using existing Marsteel ball-forming equipment but new heat treating facilities designed by Armco. Moly-cop balls are widely used for grinding media in processing metallic ores and in cement manufacturing.

Manganese.—Output of manganese ore decreased 51% to 2,491 tons averaging 52% manganese. R. B. Industrial Development Co. mined pyrolusite at Cabadbaran, Agusan del Norte Province, and G. T. Lluch Mining Co. produced manganese at Gabu, Titay, in Zamboanga del Sur Province.

Mercury.—Mercury production decreased 33% in quantity to 3,341 flasks. Palawan Quicksilver Mines, Inc., operated five rotary kilns with a daily capacity of 450 tons at Tagburos, Puerto Princesa, Palawan. Ore averaging less than 2 pounds of mercury a ton was treated in the new beneficiation plant by tables, jigs, and flotation. Feed to the kilns totaled 116,300 tons averaging 2.45 pounds of mercury a ton. Ore reserves were 1.3 million tons averaging 2.66 pounds of mercury a ton.

Molybdenum.—MMIC shutdown the molybdenum flotation plant at its copper mill in Sipalay, Negros Occidental, because the diminishing molybdenite content in the mill feed rendered continued recovery uneconomical. MMIC, the country's sole producer of byproduct molybdenum, shipped molybdenum concentrates containing 22,551 pounds of molybdenite.

Nickel.—Acoje Mining operated a 400-ton-a-day mill in Santa Cruz, Zambales, and produced nickel-cobalt concentrates containing 384 tons of nickel metal. Ore reserves in Acoje's dunite deposits were 900,000 tons averaging 0.7% nickel plus platinum and palladium values.

Nickeliferous laterite resources in the Philippines exceed 3 billion tons. Several companies were actively drilling ore deposits and conducting metallurgical tests.

MMIC was constructing a $244.6 million nickel refinery complex on Nonoc Island, Surigao del Norte, that will have the capacity to process 3.5 million tons of lateritic nickel ore a year, which will yield 68.4 million pounds of pure nickel, mixed sulfide concentrates containing 6.6 million pounds of nickel, and 3.3 million pounds of cobalt. This will be the first commercial plant to use the Sherritt Gordon process. Completion was scheduled for late summer in 1974. Ore reserves exceed 110 million tons averaging 1.2% nickel and 38% iron.

A. Soriano y Cia. continued exploration and metallurgical testing of its lateritic nickel deposits on Mindanao and Palawan. Ore reserves were revised as follows: Pujada Peninsula, Davao, 115.3 million tons averaging 1.29% nickel; Berong, Palawan, 80.2 million tons averaging 1.42% nickel; and Long Point, Palawan, 88.7 million tons averaging 1.37% nickel. Atlas Consolidated has an option to develop these properties. Atlas would use the Freeport ammonia leaching process to produce nickel carbonate. This would be followed by electrowinning to produce cathode nickel. The company was considering the Berong and the adjacent Long Point deposits on the west-central coast of Palawan and estimated the cost of the plant to produce 36 million pounds of nickel a year would be $130 million.

Universal Oil Products Co. sold its 40% interest in the Rio Tuba Nickel Mining Corp. to Pacific Metals Co., Ltd. of Japan. The company reports a 73-million-ton ore body at Rio Tuba, Palawan averaging 1.64% nickel of which part of the deposit contains 29 million tons averaging 2.17% nickel. The company was planning a plant with an annual capacity to produce 50 million pounds of nickel. Other proposed nickel projects include: Global Mining Co.'s (subsidiary of Global Marine of New York) development of Benguet Consolidated's laterite deposit at Santa Cruz, Zambales, with reserves of 83.2 million tons averaging 1.44% nickel; Mindanao Nickel Co.'s deposit in the Surigao Mineral Reservation in Mindanao with reserves estimated to be 30 million tons averaging 1.8% nickel; and a joint venture by Nippon Mining Co. of Japan and Lecar & Sons, Inc., at Brooke's Point, Palawan. Exploration on lateritic deposits was conducted by Buka Minerals NL of Australia on Palawan; Integrated Development Service Corp. in Zambales; Marsman and Co. on Minikani Island, Samar; and Trident Mining and Industrial Corp. in Sulat, Samar, and in Palawan.

New Frontier Mines, Inc., reported finding an ore deposit with 9.5 million tons of reserves averaging 2.5% nickel in Palawan.

Platinum and Palladium.—Acoje Mining produced nickel-cobalt concentrates containing 2,712 ounces of platinum and 4,810 ounces of palladium at its 400-ton-a-day mill in Santa Cruz, Zambales. Concentrates were shipped to Japan.

Silver.—The Philippines ranked 20th in world silver production. Output in 1972 was 1,847,589 ounces, a decrease of 5% below production in the preceding year. Lepanto Consolidated was again the leading producer recovering 439,990 ounces of silver from both its gold and copper mills in Mountain Province. Benguet Consolidated recovered 327,495 ounces of silver in Benguet Province. Altas Consolidated recovered 269,493 ounces from its copper mill in Cebu, and Marcopper produced 203,795 ounces in copper concentrates in Marinduque. Philex recovered 98,251 ounces from Santo Tomas ore and 8,540 ounces from the Santo Niño in Mountain Province. Smaller quantities of silver were produced by Benguet Exploration, Itogon-Suyoc, Black Mountain at Kennon, and Atok-Big Wedge in Mountain Province; MMIC at Sipalay, Negros Occidental, and Bagacay, Samar; Consolidated Mines at Mogpog, Marinduque; and Acoje at Barlo, Pangasinan. Lepanto recovered 9,914 ounces of silver by milling 68,189 tons of ore from the Agusan mine owned by Manila Mining Corp. near Del Pilar, Agusan, on Mindanao Island.

Zinc.—Benguet Exploration, produced concentrates containing 4,603 tons of zinc metal from its 120-ton-a-day mill at Camp 6, Tuba in Mountain Province. This was an increase of 19% above 1971 production. Ore reserves were 100,000 tons averaging 10.47% zinc plus additional gold, silver, copper, and cadmium values. Zambales Base Metals, Inc., was constructing a 1,000-ton-a-day flotation mill in Bulano, Zamboanga del Sur, to treat zinc-copper-lead ore. Completion of the company's Ayala project was scheduled for August 1973. Ore reserves were 4.9 million tons averaging 5.23% zinc (plus lead) and 0.308% copper. The company leased claims of Hofilenia Mines Co., Ltd., in the Ayala district with ore reserves reported to be 3 million tons assaying 4.2% zinc, 1.38% lead, and 0.38% copper.

NONMETALS

Asbestos.—No production was reported in 1972. La Suerte Resources and Industries, Inc., was actively developing an asbestos prospect in Zambales negotiating to ship asbestos to Japan.

Barite.—Increased interest in oil well drilling spurred Falcon Rare Metals and Industrial Minerals, Inc., to negotiate with property owners to operate a barite deposit in Batangas.

Cement.—Portland cement production was 2,903,404 tons in 1972, a decrease of 7%. With an annual production capacity of 6 million tons of cement in the country, capacity utilization was only 48%. Nevertheless, cement led all nonmetallic minerals in total value and was second to copper in mineral production value.

Only 16 of the country's 19 plants reported production during the year. The Development Bank of the Philippines foreclosed on two cement plants and proposed to sell the equipment to Indonesian manufacturers. Floro Cement Corp.'s new plant at Lugait, Misamis Oriental, with an annual capacity of 460,000 tons was closed. Fortune Cement Corp.'s plant with a capacity of 384,000 tons a year at Taysan, Batangas, also did not operate during the year.

The following plants operated in 1972 with production capacity (based on 300 day's operation) in thousand tons shown in parentheses: Apo Cement Co. (102) at Naga City, Cebu; Bacnotan Consolidated Industries, Inc., (256) at Bacnotan, La Union, and (128) at Davao City, Mindanao; Filipinas Cement Corp. (563) at Teresa, Rizal; Hi-Cement Corp. (384) at Norzagaray, Bulacan; Iligan Cement Corp. (384) at Iligan, Lanao; Island Cement Corp. (767) at Antipolo, Rizal; Luzon Cement Corp. (153) at San Ildefonso, Bulacan; Mindanao Portland Cement Corp. (153) at Iligan, Lanao; Northern Cement Corp. (640) at Sison, Pangasinan; Pacific Cement Co., Inc. (179) at Surigao, Surigao del Norte; Philippine Portland Cement Co. (102) at Buenavista on Guimaras Island, Iloilo; Republic Cement Corp. (640) at Norzagaray, Bulacan; Rizal Cement Co., Inc., (358) at Binangonan, Rizal; and Universal Cement Co., Inc., (384) at Danao City, Cebu.

Continental Cement Corp. started operating a new plant with an annual capacity of 443,000 tons at Norzagaray, Bulacan and produced 47,000 tons of cement in 1972.

In 1972 Prime White Cement Corp. was the first company to produce white cement in the Philippines. The annual capacity of the new plant at Asturias, Cebu, was 30,000 tons, more than adequate to meet the present demand for white cement.

Portland cement and clinker exports continued to expand to a total of 239,184 tons for 1972. Northern Cement, Republic Cement, Filipinas Cement, and Iligan Cement were granted incentives under R.A. 6135, the Export Incentives Law. Island Cement, Bacnotan Consolidated, and Hi-Cement made applications for incentives under the Export-Incentives Act. Northern Cement was selling $3 million worth of cement to China with the first shipment of 10,000 tons made in June 1972. Bacnotan Consolidated was the leading exporter of cement and clinker in 1972 valued at $1.4 million. Most of the exports were clinker.

The Price Control Council authorized an increase in the manufacturers price to $0.71 (₱4.75) a bag of cement effective March 10, 1972.

Clays.—Eight major producers and many small operators produced red, white, and other clays in most of the large provinces for tile, bricks, ceramics, pottery, and industrial uses. Total bentonite output was 61 tons and was produced in Camarines Sur. Falcon Rare Metals and Industrial Minerals, Inc., was negotiating with property owners to operate a bentonite deposit in Mindoro. Lepanto Consolidated tested bentonite from its deposit in northern Leyte and found it suitable for pelletizing iron concentrates at PIM, for foundry uses, and for drilling mud.

Feldspar.—Output of feldspar was 46,061 tons, an increase of 17%. Most of the feldspar production came from Porac, Pampanga, with smaller quantities from Ilocos Norte in the Burgos-Pagudpud area, Bulacan, Nueva Ecija, Rizal, and Iloilo Provinces.

Fertilizer Materials.—Atlas Consolidated produced 130,600 tons of byproduct pyrite in flotation concentrates in 1972 averaging 46.5% sulfur that was sold to local fertilizer plants. Atlas Fertilizer Corp. operated a 240-ton-a-day sulfuric acid plant and a 480-ton-a-day ammonium sulfate plant at Sañgi Beach near the copper mine in Toledo, Cebu. The plant produced a complete line of mixed fertilizers and byproduct gypsum and pyrite cinder.

MMIC produced 90,606 tons of pyrite concentrate averaging 46.5% sulfur as byproduct from copper flotation at Bagacay,

Samar. MMIC pyrite production was sold to Esso Standard Fertilizer and Chemical Co. that operated a 390,000-ton-a-year fertilizer plant adjacent to its Bataan refinery.

Gem Stones.—A black gem mineral called tektite reported to be a variety of billitonite and Philippine jade were exported in small quantities.

Gypsum.—Crude gypsum was mined in Surigao del Norte and Bulacan Provinces. Byproduct gypsum was produced from phosphoric acid and superhosphate fertilizer operations by Esso Standard Fertilizer at Bataan and Altas Fertilizer at Sañgi Beach, Cebu. Combined output of gypsum was 84,945 tons, nearly double the 1971 production.

Lime.—Lime production was 282,661 tons, an increase of 17%. Largest production of lime came from the following provinces, in descending order: Lanao del Norte, Benguet, Surigao del Norte, Rizal, Quezon, Bulacan, Pangasinan, Bohol, and Pampanga. Acoje Mining was erecting a lime kiln at Barlo, Pangasinan, to furnish calcium oxide to neutralize the highly acid copper ore feed to the mill.

Perlite.—Perlite output increased 5% to 435 tons in 1972. Trinity Lodge Mining Corp. mined perlite near Legaspi, Albay, and processed the material in a plant in San Pedro, Laguna.

Quartz.—Most of the quartz was produced as silica sand for glassmaking. Production was 411,644 tons, a decrease of 17%. More than 62% of the output came from Rizal and Palawan Provinces. Smaller quantities were produced in Pampanga, Benguet, Bulacan, Surigao del Norte, and Quezon Provinces.

Salt.—Despite destructive typhoons and devastating flood conditions, salt recovered from seawater evaporation decreased only 7% to 219,500 tons. Prices continued to rise because increased demand exceeded the supply. Numerous small independent and marginal operators produce 79% of the crude and table-grade salt from solar evaporation on a combined area of 4,000 hectares. The remaining 21% of the salt output was industrial grade produced by the Salt Industry of the Philippines from 575 hectares using an evaporation crystallizer for 96% to 98% purity salt; Pacific Farms, Inc., produced a washed solar salt with 92% to 94% purity from 480 hectares. Although salt was recovered in 26 provinces, most of the salt was produced in the following provinces: Bulacan, Pangasinan, Occidental Mindoro, Cavite, Rizal, and Batangas.

Sand and Gravel.—Sand and gravel output decreased 5% because of curtailed construction activities. Although sand and gravel production was widespread, the largest production came from the following provinces: Rizal, Bulacan, Davao del Norte, Iloilo, Bohol, and Leyte.

Stone.—Stone production was widespread in larger provinces, mostly at small-scale operations. The largest quarries were in limestone deposits, and the output was used in manufacturing portland cement and lime. Smaller quantities of limestone were used for agricultural purposes. Most of the crushed stone was produced in the following provinces listed in descending order: Rizal, Bulacan, Pangasinan, Batangas, Cebu, La Union, Lanao del Norte, Davao, Negros Occidental, and Surigao del Norte.

Commercial-grade marble deposits of different varieties and colors occur in Bulacan and Rizal Provinces on Luzon; Aklan and Antique Provinces on Panay; Davao del Norte on Mindanao; and Romblon, Bohol, Mindoro, and Samar Islands. Most of the marble was quarried in the following provinces: Romblon, Bulacan, Davao del Norte, Tarlac, and Bohol. Marblecraft, Inc., produced finished marble quarried in Mindoro and Bulacan. Century Marble Co. processed finished marble at Tanay, Rizal.

Other Nonmetals.—Phosphate rock output was 2,618 tons, a decrease of 45%. Most of the production came from Iloilo, Bohol, Negros Oriental, and Cebu Provinces. Sulfur production in Cagayan Province dropped 74% to 10 tons. Talc produced in mostly Zambales with lesser quantities from Occidental Mindoro and Rizal decreased 24% to 1,007 tons.

MINERAL FUELS

Coal.—Coal production continued to decline. The country's total output, mostly from Cebu, was 38,900 tons, a decrease of 3%. A small quantity was mined in Albay Province.

Petroleum.—Since 1896 some 275 wells have been drilled in the Philippines, but no commercially exploitable oil has been found. Following proclamation of martial law, Presidential Decree No. 8 on October 2

offered incentives to foreign companies to engage in oil exploration, which the Congress failed to pass. In place of the former concession system that left undefined the rights of the foreign participants in the event of a discovery, the Government now offers explorers service contracts to explore and produce crude petroleum. The new constitution also provides for such contracts in the natural resource field. The Oil Exploration Act was revised by Presidential Decree No. 87 on December 21 which contained the following provisions: (1) Under a service contract a company would receive 40% of net proceeds of crude sales (gross proceeds minus operating costs) tax free and the Government gets 60%; (2) contract areas were extended to 750,000 hectares maximum for onshore exploration and 1.5 million hectares offshore; (3) the exploration period was lengthened to 10 years with provisions for additional 40 years production rights for oil discovered in commercial quantities; and (4) operating costs were limited to 70% of the gross proceeds. On December 31 Caltex (Philippines) Inc., in a joint venture with Astro Mineral and Oil Corp. and Jabpract Mining and Industrial Corp., signed the first service contract under the new law and agreed to spend $8 million in the next 5 years for exploration of 1.2 million hectares offshore western Palawan-Sulu Sea area. At least one well must be started before the end of 1973.

A total of 13 wells were drilled in 1972 with combined total footage of 69,888 feet. Five of the holes were carryovers from the preceding year. American Asiatic Oil Corp. (AAOC), in a joint venture with Pioneer Natural Resources Exploration Co., Inc., contracted with the Chinese Petroleum Corp. of Taiwan (CPC) to drill on concessions held on Bantayan, Daan Bantayan, Jibitnil, and Tanguingui Islands off Cebu. Five wells were drilled totaling 15,342 feet. Four of the holes were dry and abandoned. The fifth was down 2,507 feet at yearend. South Seas Oil and Mineral Exploration Development Co., Inc., in a joint venture with San Jose Oil Co., Inc., Buendia Natural Resources Corp., and Acoje Oil Exploration and Drilling Co., Inc., drilled two wells on San Jose's concession at Koronadal in Southern Cotabato. The holes, Roxas-2 (8,425 feet) and Roxas-3 (7,780 feet), were unsuccessful and drilling ceased in September. Republic Resources and Development Corp. (Redeco) and Philippine Oil Development Co., Inc., (Podco) contracted with Cletom International Exploration Corp. to drill two wells in Alegria, Cebu. One hole was suspended at a depth of 1,389 feet and the other at 4,114 feet. Philippine Overseas Drilling and Oil Development Corp. (Philodrill) drilled its Topac Well No. 1 (15,178 feet deep) at Tabuk, Kalinga-Apayao. South-Eastern Sierra Madre Resources, Inc., (Sesmar) drilled the Kalian well at Gen. Santos, Cotabato, 8,018 feet deep. Triton Philippines Oil and Gas Co. in a joint venture with Podco and Pioneer started an offshore well, Sulu Sea A-1, on Philippine Exploration Concession No. 382 near the Turtle Islands on December 22. Podco was drilling a well, Lucena-1, on Panay Island at Lucena, Iloilo and was 900 feet deep by December 29. Oriental Petroleum and Minerals Corp. contracted with Westrans Industries, Inc., for exploration of Oriental's 1.3 million hectares offshore concession near Palawan.

All crude petroleum was imported. Imports increased 3.5% in 1972 and totaled 9,180,831 tons, mostly from the following countries with quantities shown in million tons: Saudi Arabia (3.56), Iran (1.76), Kuwait (1.34), Sarawak (0.7), and Iraq (0.65). An additional 146,622 tons of refined petroleum products were imported.

Exports of refinery products dropped sharply to 397,179 tons, a decrease of 64%. About 60% went to Singapore and the remainder to Hong Kong, Japan, Guam, South Vietnam, Sabah (North Borneo), Trust Territory of the Pacific Islands, and Taiwan. Gas oil, bunker fuel, petroleum pitch and coke, fuel oils, and diesel oil were the principal petroleum products exported.

Details of production from four refineries in the Philippines having a combined total crude distillation capacity of 237,000 barrels a day are shown in table 1.

The oil refining and distribution industry, a major area of U.S. investment, registered deeper losses in 1972 as a result of the squeeze between frozen prices and sharply increased costs. The Oil Industry Commission (OIC) issued an order September 18 raising prices 9% effective in November. The increase, about half of that requested by the companies, would not permit recovery of losses incurred dur-

ing the year. However, the Supreme Court delayed the increase until January 1973.

Filoil Refinery Corp. received OIC approval to expand the daily capacity of its refinery in Rosario, Cavite, from 22,000 to 100,000 barrels. However, the expansion was postponed until 1975. Gulf Oil Corp., majority stockholder, planned to divest its shares in Filoil, and the Philippine Government was interested in the Filipinization of the company.

Caltex submitted an application to OIC to increase its Bataan refinery capacity from 72,000 to 150,000 barrels a day. Caltex received OIC approval for erecting a grease plant in Pandacan near Manila. At present only Mobil Oil (Philippines) Inc., manufactures greases and lubricants in the Philippines. Shell (Philippines) Inc., also submitted an application to OIC for a grease plant. Bataan Refinery Corp., owned by Mobil and Esso, increased capacity from 50,700 to 108,000 barrels a day in 1972. Refinery production was interrupted by a labor strike in August.

The Mineral Industry of Poland

By Bernadette Michalski [1]

The mineral industry supported by both indigenous and imported raw materials was a major contributor to the Polish economy providing an estimated 20% of the gross national income. Total industrial growth in 1972 was estimated at 9%. Expanded mineral output was largely responsible for this increase as the minerals industry, which includes processing through semimanufacturing, contributed about 35% of the value of industrial production.

The industry contributed significantly to the nation's mineral consumption requirements and also provided an avenue for foreign currency earnings through exports of coal, zinc, copper, steel, and sulfur. In addition to exports of minerals and mineral products, Poland has developed an export market for mineral-related technology with sales of mining and manufacturing equipment as well as complete industrial units.

PRODUCTION

The Polish statistical office reported significant increases in the output of most mineral and metal commodities produced in the nation. Largest gains were realized in the capital intensive industries of coal, steel, and copper where heavy investment in mine development and mechanization along with construction and expansion of metal processing facilities have sustained a strong and constant growth pattern. Coal production valued at $15 billion [2] and offering employment to 350,000 people is the base of the industrial economy.[3] Coal output satisfies domestic requirements and supports a heavy and growing export market.

Steel production based on domestic fuel and imported ores increased on an average of 0.8 million tons annually during 1970–72. The rapid climb in steel output will continue with completion of two additional iron and steel mills within the decade. Copper historically has been mined in Poland but the development activity in the Lubin-Sieroszewice copper deposit resulted in a 70% increase in the copper mined during 1970–72.

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[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

[2] Where necessary, values have been converted from Polish zloty (Zl) to U.S. dollars at the official exchange rate of Zl3.376=US$1.00.

[3] Rocznik Statystycny, 1972 (Statistical Annual for 1972). Central Statistical Office, Warsaw, 1972, 722 pp.

Table 1.—Poland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Aluminum metal, primary		98,800	100,000	102,000
Cadmium metal, primary [e]		450	500	550
Copper:				
Mine output, metal content [e]		72,000	[r] 90,000	122,500
Metal:				
Smelter		[r] 72,200	92,700	[e] 130,000
Refined, including secondary		72,200	92,700	131,000
Iron and steel:				
Iron ore and concentrate, gross weight	thousand tons	2,554	2,078	1,656
Pig iron	do.	[r] 6,847	7,043	7,291
Ferroalloys:				
Blast furnace	do.	137	143	132
Electric furnace	do.	119	133	175
Steel, crude	do.	11,795	12,738	13,471
Steel semimanufactures:				
Rolled, excluding pipe	do.	8,136	8,722	9,216
Pipe	do.	723	847	933
Lead:				
Mine output, metal content		57,200	62,800	[e] 65,000
Metal, refined, including secondary		54,500	60,200	65,300
Nickel, mine output, metal content [e]		2,000	1,800	1,500
Silver, mine output, metal content [e]	thousand troy ounces	180	200	210
Zinc:				
Mine output, metal content		186,800	193,600	195,000
Metal, refined, including secondary		209,000	220,000	228,000
NONMETALS				
Barite [e]		50,000	55,000	50,000
Cement, hydraulic	thousand tons	12,180	13,082	13,986
Clays, bentonite		50,000	[e] 50,000	[e] 50,000
Feldspar [e]		30,000	30,000	30,000
Fertilizer materials:				
Crude phosphatic, phosphate rock [e]		[r] 30,000	(2)	--
Manufactured:				
Nitrogenous:				
Gross weight	thousand tons	3,142	3,217	NA
Nitrogen content [3]	do.	1,030	1,081	1,147
Phosphatic:				
Gross weight	do.	[r] 2,872	3,016	NA
P_2O_5 content [3]	do.	599	706	763
Gypsum and anhydrite:				
Crude [e]	do.	850	850	850
Calcined	do.	265	271	[e] 275
Lime (quicklime and hydrated lime)	do.	[r] 3,586	3,819	4,097
Magnesite, crude [e]		50,000	50,000	50,000
Salt:				
Rock	thousand tons	1,225	1,222	1,209
Other	do.	1,679	1,740	1,801
Sulfur:				
Elemental:				
Frasch process	do.	1,800	2,200	2,600
Other native	do.	883	513	335
Total	do.	2,683	2,713	2,935
Sulfuric acid	do.	1,901	2,252	2,565
MINERAL FUELS AND RELATED MATERIALS				
Coal:				
Bituminous	do.	140,101	145,493	151,698
Lignite and brown	do.	32,766	34,517	38,200
Total	do.	172,867	180,010	189,898
Coke:				
Coke oven	do.	15,208	15,504	15,878
Gashouse	do.	1,336	1,329	1,322
Total	do.	16,544	16,833	17,200
Fuel briquets, all grades	do.	1,832	1,945	NA
Gas:				
Manufactured:				
Town gas	million cubic feet	28,615	29,149	NA
Coke oven gas	do.	207,331	210,368	NA
Natural, marketed	do.	183,014	190,098	205,636
Natural gas liquids, natural gasoline	thousand 42-gallon barrels	226	NA	NA
Peat		24,700	15,200	NA

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum:				
Crude:				
As reported	thousand tons	424	395	347
Converted	thousand 42-gallon barrels	3,146	2,931	2,574
Refinery products:				
Gasoline	do	13,804	15,827	18,071
Kerosine (presumably including jet fuel)	do	1,155	550	e 660
Distillate fuel oil	do	16,703	19,568	22,574
Residual fuel oil	do	13,320	15,058	e 19,770
Lubricating oil	do	2,121	2,380	e 2,855
Grease	do	113	101	e 120
Paraffin	do	126	126	e 150
Bitumen	do	3,325	e 3,500	e 4,200
Total [4]	do	50,667	57,110	e 68,400

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to the commodities listed, antimony, cobalt, germanium, gold, a variety of crude nonmetallic construction materials, and carbon black are also produced in Poland, but information is inadequate to make reliable estimates of output levels. Poland may also produce alumina in small quantities, but details on such an operation, if it exists, are not available.

[2] Revised to none.

[3] Including content of multi-ingredient fertilizers.

[4] Total of listed commodities only, excluding products not reported individually in official sources as well as refinery fuel and losses.

TRADE

Polish exports totaled $4,533 million and imports totaled $4,903 million in 1972. Mineral and metal commodities constituted an estimated 30% of all exports or $1,360 million and 32% of all imports or $1,555 million.

Exports of fuel and power, principally coal, were reported at $615 million as compared with $543 million in 1971. Imports of fuel and power, principally liquid fuels, were reported at $298 million as compared with $260 million in 1971.

Table 2.—Poland: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Cadmium metal, all forms	222	225	All to U.S.S.R.
Chromium trioxide	501	718	Finland 167; Italy 148; Spain 139.
Copper:			
Ore and concentrate	--	56,556	Bulgaria 35,226; West Germany 10,811.
Metal, unwrought and wire	18,012	29,087	United Kingdom 12,494; West Germany 8,055; Czechoslovakia 5,070.
Iron and steel:			
Iron ore and concentrate	2,000	2,000	NA.
Scrap	228,007	180,468	West Germany 41,622; Switzerland 40,482; Italy 37,480; Austria 35,212.
Pig iron	[1] 378,857	[2] 90,459	Japan 42,569; Netherlands 38,463; West Germany 6,374.
Ferroalloys	1,439	[3] 1,002	Mainly to West Germany.
Steel ingots	3,014	4,088	All to Hungary.
Semimanufactures, thousand tons	1,618	[1] 1,473	United States 174; U.S.S.R. 143; Romania 129.
Lead:			
Ore and concentrate	14,138	10,304	Romania 7,098; Czechoslovakia 3,206.
Metal, including alloys, unwrought	--	118	All to U.S.S.R.
Zinc:			
Oxide	1,926	--	
Metal, including alloys, unwrought and semimanufactures	106,306	91,179	U.S.S.R. 42,267; United Kingdom 9,215; Czechoslovakia 8,164; Hungary 7,678.

See footnotes at end of table.

Table 2.—Poland: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Other:			
Nonferrous ores and concentrates, n.e.s	17	--	
Metal, nonferrous, n.e.s.:			
Scrap	21,131	--	
Semimanufactures, including alloys	939	9,685	U.S.S.R. 3,983; West Germany 1,789; Italy 1,273; United Kingdom 1,135.
NONMETALS			
Cement	56,682	145,558	West Germany 22,364; Czechoslovakia 5,523.
Clays and clay products:			
Crude:			
Bentonite	905	--	
Refractory	63,846	29,229	Hungary 15,448; Italy 6,724; Austria 4,208.
Products:			
Fire clay manufactures	14,507	--	
Silica manufactures	2,557	--	
Fertilizer materials, manufactured, nitrogenous—thousand tons	454	848	East Germany 311; India 127; France 79.
Gypsum and plasters:			
Gypsum—do	556	572	Sweden 213; Denmark 146; Norway 133.
Plasters—do	31	33	Finland 16; Hungary 4; West Germany 3.
Lime	142,811	131,499	Czechoslovakia 86,388; Hungary 24,210; Netherlands 16,455.
Magnesite manufactures	551	--	
Salt:			
Rock salt—thousand tons	156	159	Czechoslovakia 47; Hungary 26; Finland 22; Sweden 21.
Brine—do	--	51	France 23; Czechoslovakia 11.
Stone:			
Dolomite	--	22,431	West Germany 17,441; Denmark 4,990.
Granite	9,240	--	
Marble	786	--	
Pavement stones	26,328	--	
Sulfur:			
Elemental—thousand tons	[4] 1,775	2,064	France 246; United Kingdom 246; U.S.S.R. 198; India 184.
Sulfuric acid	126,123	197,373	Portugal 97,911; West Germany 45,821; East Germany 21,437.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous—thousand tons	28,816	30,301	U.S.S.R. 8,388; Italy 3,286; Czechoslovakia 2,565; Finland 2,365.
Lignite and lignite briquets—do	3,972	3,561	All to West Germany.
Coke—do	2,284	2,398	U.S.S.R. 795; East Germany 719; Hungary 279; Romania 208.
Gas, manufactured coke oven—million cubic feet	277	301	All to East Germany.
Natural gas, liquid	1,910	--	
Petroleum refinery products—thousand tons	1,314	1,069	U.S.S.R. 403; West Germany 262; Austria 200.

NA Not available.
[1] Includes iron and steel castings.
[2] Includes blast furnace ferroalloys.
[3] Includes electric furnace ferroalloys only.
[4] Source: Sulfur (London). No. 92, January–February 1971, p. 14.

Table 3.—Poland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Alum'num:			
Bauxite and concentrate	118,081	122,168	Hungary 103,463.
Oxide and hydroxide	213,012	224,983	Hungary 122,083; United States 51,065; France 24,731.
Metal, including alloys, all forms	687	21,375	U.S.S.R. 7,765; Yugoslavia 4,096; Hungary 3,472.
Bismuth metal, including alloys, unwrought	64	--	
Chromium, ore and concentrate	141,493	152,536	U.S.S.R. 105,345; Albania 44,395.
Copper metal, including alloys, unwrought and wire	21,900	34,629	United Kingdom 21,769; U.S.S.R. 3,646; Belgium-Luxembourg 3,320.
Iron and steel:			
Ore and concentrate--thousand tons	11,843	12,430	U.S.S.R. 10,312; Sweden 675.
Scrap--do	203	262	Czechoslovakia 226; Bulgaria 13; East Germany 12.
Pig iron--do	[1] 1,512	[2] 1,552	Mainly from U.S.S.R.
Iron powder--do	6	--	
Ferroalloys--do	20	[3] 9	U.S.S.R. 5; Austria 1.
Semimanufactures--do	1,467	[1] 1,328	U.S.S.R. 616; East Germany 139; Czechoslovakia 132.
Lead metal, including alloys, unwrought	14,178	18,590	United Kingdom 7,840; U.S.S.R. 4,003; Yugoslavia 2,892.
Magnesium metal, including alloys, all forms	701	1,001	All from U.S.S.R.
Manganese:			
Ore and concentrate	389,388	401,120	U.S.S.R. 359,431; United Kingdom 15,982.
Oxides	4,621	--	
Metal, all forms	--	1,069	U.S.S.R. 669; Italy 200; Czechoslovakia 79.
Mercury--76-pound flasks	685	934	Netherlands 534; United States 191; United Kingdom 73.
Molybdenum, ore and concentrate	282	489	Canada 388; France 100.
Tin metal, including alloy, all forms long tons	3,481	4,878	United Kingdom 2,952; Netherlands 1,071.
Titanium oxide	12,397	--	
Tungsten, ore and concentrate	3,351	--	
Zinc, ore and concentrate	124,034	109,820	United States 27,234; West Germany 16,080; Ireland 14,658.
Other:			
Nonferrous ores and concentrates	6,303	--	
Nonferrous semimanufactures, n.e.s	23,879	2,805	U.S.S.R. 869; Italy 200; West Germany 143.
NONMETALS			
Asbestos	64,385	67,252	U.S.S.R. 43,158; United Kingdom 7,558; Canada 6,586.
Barite	25,376	14,045	Belgium-Luxembourg 9,984; East Germany 1,998.
Cement	311,456	614,176	U.S.S.R. 383,068; Romania 52,184; Austria 32,779.
Clays and clay products:			
Crude:			
Bentonite	7,425	--	
Fuller's earth	11,547	11,348	Yugoslavia 5,047; Czechoslovakia 4,401; Romania 1,900.
Kaolin (china clay)	113,503	127,633	Czechoslovakia 58,805; United Kingdom 21,384; U.S.S.R. 20,504.
Refractory clays and burnt slate	20,799	14,071	U.S.S.R. 12,491; West Germany 1,560.
Products:			
Fire clay manufactures	1,453	--	
Silica manufactures	12,960	--	
Cryolite	2,041	--	
Diatomite	2,024	1,765	United States 1,248; Belgium-Luxembourg 268.
Feldspar	13,415	--	
Fertilizer materials:			
Crude, phosphatic, apatite concentrate thousand tons	662	953	All from U S.S.R.
Manufactured:			
Phosphatic--do	[r] 1,386	1,567	Morocco 974; Tunisia 507.
Potassic--do	2,215	2,191	U.S.S.R. 1,205; East Germany 922.
Fluorspar	23,130	29,985	East Germany 20,398; People's Republic of China 7,507.
Graphite, natural	11,620	11,818	Austria 6,919; U.S.S.R. 3,816.
Magnesite:			
Crude	206,163	160,551	North Korea 71,107; Czechoslovakia 67,645; Yugoslavia 17,793.
Bricks	17,213	--	

See footnotes at end of table.

Table 3.—Poland: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Mica	1,508	1,658	All from India.
Pyrite	39,441	--	
Stone:			
Dimension, marble	4,064	--	
Quartzite	--	10,353	All from U.S.S.R.
Other	--	14,696	Norway 10,176; Finland 4,006.
Talc	21,116	19,868	North Korea 10,470; Czechoslovakia 4,185; Norway 1,785.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous coal, thousand tons	1,130	1,302	U.S.S.R. 847; East Germany 337.
Lignite and lignite briquets, do	310	6	All from East Germany.
Gas, hydrocarbon:			
Natural, million cubic feet	35,399	52,548	All from U.S.S.R.
Manufactured, do	143	167	All from East Germany.
Petroleum:			
Crude, thousand tons	7,011	7,894	All from U.S.S.R.
Refinery products, do	2,417	2,267	U.S.S.R. 1,304; Romania 235; West Germany 201; Hungary 138.

r Revised.
1 Includes iron and steel castings.
2 Includes blast furnace ferroalloys.
3 Includes electric furnace ferroalloys only.

COMMODITY REVIEW

METALS

Aluminum.—A total of 231,000 tons of bauxite was imported during 1972, sustaining the capacity operation of Poland's two aluminum reduction plants—the Skawina and the Konin. A 40,000-ton-per year-capacity rolling mill at Konin was commissioned during the year. Additional investments in the aluminum industry are not scheduled in the current 5-year plan ending in 1975. However, an alumina plant is slated for construction in 1977–78 at Nowiny. The plant is to produce alumina from domestic raw materials by a method developed and patented by Dr. Jerzy Grzymek. Raw materials will include limestone from the Kielce deposit and fly ash from the Turów powerplant. The proposed capacity of the Nowiny plant is 100,000 tons of alumina and 377,000 tons of cement annually.

Copper.—Ore output exceeded 11 million tons as a result of continuing development work in the Lubin-Sieroszewice deposit. Two mines are in operation at the deposit—the Lubin mine and the Polkowice mine. Ore from these mines is processed at the 80,000-ton-per year-capacity electrolytic copper refinery at Glogów and at the 60,000-ton-per-year capacity plant at Legnitca. Nearly half of 1972 copper production was exported. Cathode copper, wire bars, pipes, and rods were exported to East and West Germany, the United Kingdom, Austria, and Sweden. By 1975, copper metal production is planned at 200,000 tons with half of the output slated for the international market.

Initial development work on the Lubin-Sieroszewice deposit was partially financed by Czechoslovakia. Future development work on this 10-million-ton copper metal deposit and the construction of processing facilities are open to foreign capital investment.

Iron Ore.—Domestic production of siderite continued to drop sharply. The decline was precipitated in 1969 when a program was launched closing submarginal mining operations. By yearend only 8 mines were in operation as compared with 17 mines in operation in 1968.

Poland historically has been dependent upon iron ore imports to sustain its steel industry. The principal source of supply has been and continues to be the U.S.S.R.; however, projections revealing a rapid growth in steel production by 1980 will double iron ore requirements. Imports from Sweden, Brazil, and Chile will play a significant role in fulfilling these requirements.

Iron ore imports from Sweden totaled

1.3 million tons in 1972. An agreement was signed between Poland and Sweden increasing Polish imports of Swedish iron ore to 3.0 to 4.5 million tons annually for the 1976–80 period. Iron ore of 62% to 64% iron content will be delivered from Kiruna, Sweden.

Poland through the foreign trade company Kopex has entered into agreement with the Pacific Steel Co. (Chile) for cooperation in development of iron ore deposits at Boqueron Chanar, Chile. Mining operations are scheduled to begin in 1973 with output projected at 3 million tons annually by 1975.

Iron and Steel.—Expansion and modernization activities continued at the nation's major iron and steel plants and resulted in a record output of pig iron, crude steel, and steel semimanufactures. Comparing 1972 with 1970, pig iron production increased by more than 400,000 tons while the number of blast furnaces in operation dropped to 22 from 24; consumption of coke per ton of pig iron declined to 660 kilograms from a level of 703 kilograms.

Steel capacity expansion is based on replacement of small open-hearth furnaces with large capacity basic oxygen furnaces (BOF). By yearend 85 open-hearth furnaces were in operation yielding 8.4 million tons of crude steel or 62% of total steel output. In 1970, 90 furnaces were in operation yielding 8.7 million tons of steel or 74% of Poland's total steel output.

During the year an agreement was signed with the Soviet Union for construction of a 4.25-million-ton-per year- capacity iron and steel plant at Zaglebie Dobrowski. The completion date is scheduled for 1976 at which time 2 blast furnaces each of 3,200-cubic-meter capacity and 2 basic oxygen furnaces each of 350-ton capacity should be in operation.

The Bierut Steelworks at Czestochowa opened a ship plate rolling mill of 250,000-ton-per year initial capacity. By the close of the current 5-year plan (1975) the plant capacity is scheduled at 700,000 tons of ship plate annually.

Lead and Zinc.—Ore extraction from lead-zinc mining operations was reported at 3,988,000 tons with another 888,000 tons of zinc bearing materials treated from waste. Domestic production is supplemented by imports of zinc concentrate which totaled 161,000 tons in 1972. Zinc metal output was reported at 228,000 tons in 1972. Of this total 47% or 107,000 tons was produced at the Szopienice and the Boleslaw electrolytic zinc plants, 37% or 84,000 tons was produced at the Silesia Gob retort plant and 16% or 34,000 tons was produced by the Imperial smelting furnace at the Miasteczko Slaskie plant. Zinc metal exports were reported at 96,700 tons in 1972, earning an estimated $40 million in foreign exchange. While zinc production fulfills domestic needs and earns foreign exchange on world markets, domestic production of lead covers only 80% of Poland's requirements.

NONMETALS

Cement.—The Kujawy cement plant in Bydgoszcz Province with four rotating furnaces came into production. This plant raised the number of Polish cement plants to a total of 23 with a combined total of 96 furnaces. By 1975 at least 4 additional cement plants are scheduled for operation raising cement output to 18 million tons annually.

Fertilizer Materials.—Expanded fertilizer output is attributable to the mid-year commissioning of the Brzeznie nitrogen combine. Plant capacity is reported to be 1,500 tons per day of ammonia, 1,800 tons per day of nitric acid, and 2,400 tons per day of ammonium nitrate. Domestic production of nitrogenous fertilizer meets consumption requirements and provides nearly 1 million tons of nitrogenous fertilizer for export. Consumption requirements for potassic and phosphatic fertilizers are largely dependent upon imported fertilizer and fertilizer materials. Imports of phosphate and apatite totaled 2.9 million tons while potassic fertilizer imports were reported at 2.5 million tons in 1972. Agricultural programs of the current 5-year plan call for increased usage of fertilizers. Consumption of fertilizer per hectare of sown area in kilograms is reported as follows:

Fertilizer type	1969–70	1970–71	1971–72
Nitrogenous (N content)	53	55	62
Phosphatic (P_2O_5 content)	40	42	49
Potassic (K_2O equivalent)	69	75	86
Lime (CaO)	119	133	162
Total	281	305	359

Sulfur.—The bulk of Polish sulfur output is obtained by a modified Frasch

process from the Jeziorko and Grzybów mines, each of which yielded well over 1 million tons of sulfur in 1972. Ore extraction from the Machów pit was reported at 2.9 million tons. About 85% of the total sulfur production or 2.5 million tons was exported. Expanded port facilities at Szczezin and Gdansk made it possible for 72% of the sulfur exports or 1.8 million tons to be shipped by sea. Pincipal markets in 1972 were Western Europe (735,000 tons), Asia and Africa (340,000 tons), and the Mediterranean countries (270,000 tons).

MINERAL FUELS

Coal.—Bituminous coal output in 1972 increased 4.3% over that of 1971 largely as a result of improved productivity. Output per underground worker per shift was 3,335 kilograms as compared with 3,184 kilograms in 1971. Solid fuels account for more than two-thirds of Poland's energy requirements and bituminous coal and coke exports earned an estimated $654 million in foreign exchange in 1972.

Helium.—Natural gas deposits near Wroclaw contain 0.4% helium. Poland has engaged an engineering affiliate of Burmah Oil Co. Ltd. (United Kingdom) to design a helium recovery system. Helium production will be initiated in 1974 and by the following year estimated production will reach 4 million cubic meters per day. By 1975, output will not ony be sufficient to meet domestic helium requirements but provide sufficient amounts to supply Western Europe—a market currently supplied by helium imports from the United States.

Natural Gas.—The bulk of Poland's natural gas output is obtained from the Rzeszów Region in Southeast Poland. New discoveries in Southwest Poland near Zielona Góra, Poznan, and Wroclaw have been a vital factor in augmenting production in 1971 and 1972. Polish planners anticipate annual production at 300 billion cubic feet by close of the current 5-year plan (1975).

Petroleum.—Refinery throughput for 1972 was approximately 187,000 barrels per day. About 97% of the throughput was derived from imported crude obtained from the U.S.S.R. via the Friendship pipeline. Product output from Poland's six refineries is supplemented by petroleum product imports of 48,000 barrels per day.

Poland's major refinery, the Plock combine, operated above its rated 180,000-barrel-per day level, reaching peak throughput of 198,000 barrels per day in the summer. Plock's rated capacity will be expanded to 280,000 barrels per day by 1975. Five other refineries were in operation during the year. The largest of which is a 12,000 barrel per day refinery at Ciechowice.

Construction of a 120,000-barrel-per day refinery at Gdansk was started in June 1972. Completion of the first stage of construction at 60,000 barrels per day is scheduled for 1975 at which time expanded port facilities should be available to accommodate tanker traffic. Design of the Gdansk refinery was contracted to Società Nazionale Metanodotti Progetti, Italy.

At the close of the year construction activity began at Blachownia Slaska in Southern Poland on another 120,000-barrel-per day refinery. The refinery distillation units, each of 60,000-barrel-per day capacity, should be in operation by 1976.

The Mineral Industry of Portugal

By Norman A. Matthews [1]

The Portuguese mineral and metal industries, in a depressed state during 1970 and 1971 along with the overall European economy, began to recover in 1972 as demand increased. Portugal's gross national product (GNP) increased approximately 6% over that of 1971, and manufacturing increased about 8%. Agricultural production declined in 1972, leading to higher food prices (10% to 12%) and a continuation of the high rate of inflation which has persisted at 7% to 8% over the last 3 years.

Tonnage and monetary values of production and exports of minerals decreased. For tungsten minerals, the most significant commodity in international trade, production was up modestly irrespective of the closing of several small mines. However, intensified development efforts continued and investments are being made in mechanized equipment to improve profitability and increase production substantially.

Under the Government-planned 5-year program to expand heavy industry and reduce imports, the following projects, were reported in various stages of study or implementation:

1. A construction schedule was announced for part 1 of the expansion of steelmaking facilities at Siderúrgia Nacional in Seixal.

2. A mini-steel mill of 300,000 tons annual capacity is planned at Oporto. At yearend selection of the prime contractor had been narrowed to either a British or a West German consortium.

3. Government officials were evaluating proposals for the design of an oil refinery and petrochemical complex on the Sines Peninsula, 60 miles south of Lisbon.

4. Port development at Oporto was deemed necessary to permit ocean shipment of iron ore from the Moncorvo area in the northeast. Parallel policy decisions involve questions as to whether ore movement to the coast is to be by the Duoro River waterway or by double tracking the existing railroad. This project is under study.

5. Planning is underway on a project to enlarge port facilities at Viana de Castelo, 33 miles north of Oporto, to permit entry of larger vessels and enlargement of shipbuilding ways to accommodate vessels in the 10,000 to 25,000-ton range.

PRODUCTION

Production of metals and minerals in Portugal was slightly higher than in 1971, with major gains in petroleum products and rolled steel products. Production of copper in concentrates increased substantially over the depressed level in 1971 but production of refined copper declined. Production of zinc, and tin concentrates declined whereas production of refined tin increased. Anthracite coal production continued at the rate which has prevailed for several years, whereas hematite ore production continued the downward trend. Production of most nonmetallic minerals increased moderately compared with that of 1971; cement production increased 14%.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Portugal: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Antimony, mine output, metal content	--	--	14
Arsenic, white	190	186	261
Beryl concentrate, gross weight	14	15	17
Columbite-tantalite concentrate, gross weight	4	11	12
Copper:			
Mine output, metal content:			
In cupreous pyrite	3,311	3,328	5,528
In other ore and concentrate	357	586	528
In precipitate	54	43	30
Total	3,722	3,957	6,086
Metal, refined primary	4,006	4,500	3,800
Gold:			
Mine output, metal content, troy ounces	11,992	13,696	16,718
Metal, do	13,085	NA	NA
Iron and steel:			
Iron ore and concentrate, gross weight:			
Hematite and magnetite, thousand tons	72	51	1
Manganiferous, do	54	48	42
Total, do	126	99	43
Pig iron, do	308	355	355
Ferroalloys:			
Ferromanganese	1,170	6,727	7,664
Ferrosilicon	5,932		
Ferrotungsten	307	273	336
Total	7,409	7,000	8,000
Steel, crude, thousand tons	r 385	412	425
Steel semimanufactures, do	r 342	353	NA
Lead:			
Mine output, metal content	1,558	1,383	1,157
Metal, refined	572	1,200	1,200
Manganese ore and concentrate, gross weight	5,526	4,734	5,348
Molybdenum ore and concentrate, metal content	--	3	2
Silver:			
Mine output, metal content, troy ounces	279,808	262,510	230,263
Metal, including secondary, do	260,035	NA	NA
Tin:			
Mine output, metal content, long tons	428	546	520
Metal, do	386	476	596
Titanium, ilmenite concentrate, gross weight	238	890	752
Tungsten, mine output metal content	1,475	1,344	1,403
Uranium oxide (U_3O_8) e	95	95	95
Zinc, mine output metal content	1,606	2,046	1,788
NONMETALS			
Asbestos	202	127	8
Barite	1,080	1,150	825
Cement, hydraulic, thousand tons	2,347	2,458	2,795
Clays:			
Kaolin	53,023	44,950	44,636
Other	64,900	60,920	72,917
Diatomite	3,195	4,671	1,651
Feldspar	30,809	18,771	18,011
Fertilizer materials, manufactured:			
Nitrogenous, gross weight, thousand tons	r 571	559	504
Phosphatic, gross weight, do	r 435	275	261
Mixed and unspecified, do	r 207	175	241
Total, do	r 1,213	1,009	1,006
Gypsum and anhydrite, do	115	178	135
Kyanite and related materials: Andalusite	190	181	103
Lime (quicklime and hydrated lime), thousand tons	211	205	320
Lithium minerals, lepidolite	NA	750	1,200
Mica, all grades	1,935	810	1,656
Pyrite and pyrrhotite (including cupreous):			
Gross weight, thousand tons	476	559	553
Sulfur content, do	213	249	243
Salt:			
Rock, do	194	235	286
Marine, do	207	161	212

See footnotes at end of table.

Table 1.—Portugal: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
NONMETALS—Continued				
Sand and gravel:				
Gravel	thousand tons	94	96	314
Sand	do	1,401	2,560	2,647
Stone:				
Calcareous:				
Dolomite	do	8	23	34
Limestone, marl and calcite	do	4,974	6,283	6,939
Marble	do	233	229	236
Other:				
Basalt	do	23	62	54
Diorite	do	43	54	51
Gabbro	do	19	19	22
Granite	do	2,101	1,654	2,756
Grawacke	do	29	2	30
Ophite	do	23	39	40
Porphyry	do	11	100	91
Quartz	do	144	158	170
Quartzite	do	283	116	115
Sandstone	do	1	1	NA
Schist	do	82	69	177
Serpentine	do	165	300	445
Slate	thousand tons	32	44	45
Syenite	do	3	3	4
Sulfur, elemental, including sublimed		3,148	2,824	e 3,000
Talc		1,807	1,275	1,204
MINERAL FUELS AND RELATED MATERIALS				
Coal, anthracite	thousand tons	271	253	252
Fuel briquets, all grades	do	33	35	34
Gas, manufactured	million cubic feet	11,830	13,702	NA
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	4,420	4,556	6,711
Jet fuel	do	1,464	1,668	2,096
Kerosine	do	1,550	1,268	1,251
Distillate fuel oil	do	5,573	6,251	6,801
Residual fuel oil	do	8,258	9,757	12,614
Lubricants	do	84	553	840
Other	do	2,744	3,525	1,718
Refinery fuel and losses	do	3,377	1,959	1,070
Total	do	27,470	29,537	33,101

e Estimate. p Preliminary. r Revised. NA Not available.

TRADE

A trade agreement between Portugal and the European Community (EC) was ratified by the Portuguese Parliament in December 1972. This agreement will gradually reduce the tariff barriers and reportedly will tend to reduce the trade deficit which has persisted for several years. The most significant reductions in tariffs will occur by stages ending principally in 1977 and 1985.

The Portuguese trade deficit has increased substantially during the last 2 years from $633 million in 1970 to about $671 million in 1972.[2] The value of exports and imports in 1972 increased 16%. Textiles and machinery showed the highest growth among exports. Iron and steel, coke, and petroleum products continued among the largest import commodities in value. The imbalance between imports and exports will not improve significantly until part 1 of the steel plant expansion at Seixal is completed in 1974 and the petroleum refinery on the Sines Peninsula is in production, perhaps in 1976.

Exports to the United States totaled about $139 million, or 11% of total exports, and involved primarily agricultural products, and electronic components produced in satellite plants established by U.S. companies. Imports from the United States were valued at $195 million, principally aircraft and parts, steel products, and coal.

[2] Where necessary, values have been converted from Portuguese escudos (Esc) to U.S. dollars at the rate of Esc27.25=US$1.00.

Table 2.—Portugal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms	141	82	Angola 48.
Arsenic trioxide, pentoxide and acids	140	--	
Beryl ore and concentrate	14	--	
Copper:			
Metal, including alloys, all forms	1,571	714	United States 222; Sweden 208; Italy 100.
Gold metal, troy ounces	56	--	
Iron and steel:			
Ore and concentrate, including roasted pyrite:			
Roasted pyrite	9,174	5,475	All to West Germany.
Other	1	26	United Kingdom 25; Angola 1.
Metal:			
Scrap	5,989	5,457	Greece 2,750; Netherlands 424.
Pig iron, ferroalloys, and similar materials	6,907	5,633	West Germany 3,170; Brazil 543; Turkey 434.
Steel, primary forms	9,519	--	
Semimanufactures:			
Bars, rods, angles, shapes, sections	7,038	9,924	Angola 4,599; Thailand 3,400; Mozambique 593.
Universals, plates, sheets	6,156	9,348	Angola 2,070; Spain 1,870; West Germany 1,757.
Rails and accessories	56	211	Mozambique 186.
Wire	3,232	1,711	Mozambique 526.
Tubes, pipes, fittings	12,040	10,163	Angola 3,795; Mozambique 2,066; Spain 1,061; Iraq 860.
Castings and forgings, rough	3,041	2,792	Angola 695; Switzerland 497; United Kingdom 417; Mozambique 340.
Lead:			
Ore and concentrate	2,631	2,205	All to France.
Oxides	73	103	Angola 41; Mozambique 31; Republic of South Africa 20.
Metal, including alloys, all forms	323	479	Angola 262.
Magnesium metal, including alloys	10	3	All to Angola.
Manganese ore and concentrate	3,000	1,004	All to France.
Nickel metal, including alloys, all forms	49	48	Ship stores 29; United Kingdom 14.
Platinum-group metals and silver:			
Platinum metal, including alloys, troy ounces	6,510	3,768	France 1,658; West Germany 1,318; United Kingdom 788.
Waste and sweepings [1], do	r 47,661	733,674	Belgium-Luxembourg 688,121; United Kingdom 37,459.
Silver, worked and partly worked, do	317	943	United States 528; Angola 289.
Tin metal, including alloys, all forms, long tons	r 125	88	Angola 35; Netherlands 11; West Germany 11
Tungsten ore and concentrate	1,857	1,473	United Kingdom 777; Netherlands 389; West Germany 118.
Zinc:			
Ore and concentrate	3,622	3,876	West Germany 2,700; France 1,175.
Oxide	114	129	Angola 69; Mozambique 59.
Metal, including alloys, all forms	445	111	Belgium-Luxembourg 31; Italy 31; Angola 17.
Other:			
Ore and concentrate, molybdenum, titanium, vanadium and zirconium	12	11	United States 10.
Ash and residues containing nonferrous metals	763	1,013	Belgium-Luxembourg 508; Netherlands 205; United Kingdom 141.
NONMETALS			
Asbestos	180	(2)	NA.
Cement	61,966	52,281	Guinea 22,912; Cape Verde 18,782; Angola 5,185.
Chalk	72	88	Angola 61; Mozambique 20.
Clay and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Kaolin	1,325	1,260	Netherlands 600; Belgium-Luxembourg 550; Angola 104.
Other	2,044	593	Spain 431; Angola 114.
Products:			
Refractory (including nonclay brick)	4,639	2,448	Italy 855; Angola 796; Gibraltar 327.
Nonrefractory	17,673	23,604	Gibraltar 7,286; Mozambique 5,149; Angola 2,604.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Diamond:			
Gem not set or strung thousand carats	1,412	1,559	United Kingdom 1,529; Belgium-Luxembourg 29.
Industrial do	655	865	All to United Kingdom.
Diatomite and other infusorial earths	120	174	Angola 70; Netherlands 70; Mozambique 25.
Feldspar, leucite, naphthaline, etc	9,779	10,407	Italy 4,452; United Kingdom 3,725; France 1,880.
Fertilizer materials, natural and manufactured:			
Nitrogenous	71,765	70,385	West Germany 35,820; Mozambique 9,682; Angola 7,711.
Phosphatic	96,259	108,640	Nigeria 28,375; United Kingdom 19,186; Brazil 18,280; France 12,148.
Potassic	1,814	1,853	Angola 977; São Tomé and Principe 536; Mozambique 296.
Other, including mixed	34,309	23,730	Cyprus 8,102; Angola 7,079; Mozambique 5,702.
Gypsum and plasters	238	244	Mozambique 106; Angola 100; Cape Verde 16.
Lime	1,859	1,600	Mozambique 612; Angola 333; Guinea 222.
Mica, crude, including splittings and waste	352	290	France 130; United Kingdom 100; West Germany 50.
Pigments, mineral:			
Natural crude	68	51	Angola 24; Guinea 20.
Iron oxides, processed	80	100	Mozambique 55; Angola 24; Cape Verde 12.
Pyrite (gross weight)	228,499	186,738	Belgium-Luxembourg 140,773; Denmark 45,965.
Salt	4,981	254	Finland 186; Angola 16; Guinea 16.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	115,826	104,923	Italy 40,791; West Germany 23,810; Belgium-Luxembourg 13,293.
Slate	5,635	6,408	West Germany 1,998; Belgium-Luxembourg 1,931; Denmark 820.
Granite and other	78,100	23,090	Denmark 6,408; United Kingdom 4,854; Italy 4,831.
Worked:			
Slate	4,723	4,364	Belgium-Luxembourg 1,125; West Germany 857; Netherlands 734.
Paving and flagstone	101,318	96,480	West Germany 46,089; Denmark 19,287; Switzerland 13,364.
Marble and other	19,634	33,011	West Germany 9,327; Denmark 7,117; United States 4,681.
Gravel and crushed rock	3,789	6,975	Gibraltar 4,652; Mozambique 1,606; Guinea 252.
Quartz and quartzite	114,245	128,475	Italy 52,911; Norway 46,736; Switzerland 17,640.
Sand, not metal bearing	22,918	39,106	Gibraltar 25,230; Italy 11,490; Morocco 2,200.
Sodium compounds	2,095	1,164	Mozambique 614; Angola 262; Republic of South Africa 100.
Sulfur, elemental, all forms	260	807	Angola 425; France 200; Mozambique 122.
Talc, and steatite	72	97	Angola 92; Mozambique 3.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	186	66	Cape Verde 52.
Coal and coke, including briquets	626	143	Cape Verde 61; Angola 50; Guinea 31.
Petroleum refinery products:			
Bunker deliveries:			
Distillate fuel oil thousand 42-gallon barrels	41	151	Foreign flag vessels and aircraft.
Residual fuel oil do	r 405	449	
Gasoline do	34	56	
Jet fuel do	525	655	
Lubricants do	9	52	
Gasoline (including natural) do	r 370	60	Guinea 48; Sao Tome and Principe 7.
Kerosine and jet fuel do	r 1,026	595	United Kingdom 441; Denmark 128.
Distillate fuel oil do	654	631	Netherlands 394; United Kingdom 110; Guinea 67.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products—Continued			
Residual fuel oil thousand 42-gallon barrels	1,494	1,142	Italy 481; Switzerland 292; Netherlands 145.
Lubricants ---do---	146	395	Belgium-Luxembourg 104; Netherlands 83; Republic of South Africa 57.
Liquefied petroleum gas ---do---	13	12	Guinea 6; Cape Verde 4.
Other ---do---	r 6	6	United Kingdom 4.
Total ---do---	r 4,723	4,204	

r Revised. NA Not available.
[1] Including silver.
[2] Less than ½ unit.

Table 3.—Portugal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	1,916	3,802	Japan 1,197; France 1,114; West Germany 924.
Metal, including alloys:			
Scrap	59	187	France 54; Canada 10.
Unwrought	1,619	1,578	United Kingdom 452; Sweden 247; Switzerland 239.
Semimanufactures	11,658	17,257	Canada 4,911; Belgium-Luxembourg 2,323; West Germany 2,206.
Chromium:			
Chromite	187	--	
Oxide and hydroxide	119	150	West Germany 81; United Kingdom 30; Netherlands 18.
Copper metal, including alloys:			
Scrap	873	554	NA.
Unwrought:			
Blister	1,949	1,547	Zambia 1,200; Angola 299; France 48.
Refined, unalloyed	r 6,590	6,552	Canada 3,176; Belgium-Luxembourg 2,068; United Kingdom 741.
Master alloys	86	78	United Kingdom 62.
Semimanufactures	8,297	8,946	United Kingdom 3,742; France 1,611; Italy 1,458.
Gold metal, unworked and partly worked thousand troy ounces	963	918	Belgium-Luxembourg 889; United States 19.
Iron and steel:			
Ore and concentrate, including roasted pyrite	r 194,696	340,172	Angola 254,859; Morocco 33,780; Brazil 25,400.
Metal:			
Scrap	9,553	10,278	Morocco 3,081; United Kingdom 1,978.
Pig iron, ferroalloys, and similar materials	11,730	23,392	Spain 15,575; Canada 3,131; West Germany 1,883.
Steel, primary forms	115,507	150,679	Japan 49,664; United States 35,138; France 18,057.
Semimanufactures:			
Bars, rods, angles, shapes, sections	62,749	92,433	West Germany 20,844; Belgium-Luxembourg 20,233; France 12,777.
Universals, plates, and sheets	201,094	180,748	West Germany 52,008; Japan 41,053; United Kingdom 23,295.
Hoop and strip	26,317	24,936	Belgium-Luxembourg 11,766; Japan 3,363; United Kingdom 3,038.
Rails and accessories	4,772	42,924	West Germany 24,076; Belgium-Luxembourg 17,118; Austria 948.
Wire	13,930	14,896	United Kingdom 3,166; Belgium-Luxembourg 2,983; France 2,422.
Tubes, pipes, and fittings	16,100	17,545	West Germany 7,428; Spain 1,912; United Kingdom 1,596; Japan 1,539.
Castings and forgings, rough	1,170	625	United Kingdom 299; West Germany 149.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Lead:			
Oxides	11	48	United Kingdom 47.
Metal, including alloys:			
Scrap	79	162	Gibraltar 95; Guinea 24; United Kingdom 23.
Unwrought and semimanufactures	9,530	12,117	Mexico 6,105; United Kingdom 3,664; Peru 2,200.
Magnesium metal, including alloys, all forms	3	5	West Germany 2; France 1; Netherlands 1; Switzerland 1.
Manganese:			
Ore and concentrate	985	213	Netherlands 129; Japan 65; West Germany 19.
Oxides	80	221	Netherlands 62; Japan 50; United Kingdom 42; West Germany 40.
Mercury—76-pound flasks	908	957	Netherlands 377; Spain 261; Czechoslovakia 203.
Molybdenum metal, including alloys, all forms—kilograms	600	290	West Germany 200; United States 30.
Nickel metal, including alloys, all forms	382	537	West Germany 191; United Kingdom 187; Finland 43.
Platinum-group metals and silver, including alloys:			
Platinum group—troy ounces	4,970	477,440	France 307,806; United Kingdom 168,655.
Silver—thousand troy ounces	886	1,253	United Kingdom 920; West Germany 252.
Tin:			
Oxides—long tons	42	9	West Germany 4; Austria 3.
Metal, including alloys, all forms do	181	95	Belgium-Luxembourg 31; Thailand 30; United Kingdom 11.
Titanium:			
Rutile concentrate	432	257	Australia 232; Austria 20; United Kingdom 5.
Oxides	4,142	4,107	Finland 1,245; West Germany 1,217; United Kingdom 1,164.
Zinc:			
Oxides	264	195	West Germany 69; Sweden 50; Netherlands 19; Denmark 18.
Metal, including alloys:			
Scrap	118	95	Netherlands 50; Spain 30; United Kingdom 11.
Unwrought	10,403	9,334	Spain 2,992; Canada 2,288; Belgium-Luxembourg 1,302.
Semimanufactures	751	863	West Germany 625; Belgium-Luxembourg 114.
Other ores and concentrates:			
Of titanium (except rutile), vanadium and zirconium	699	505	Australia 402; Netherlands 62; United Kingdom 41.
Unspecified nonferrous	34	16	United Kingdom 11; Australia 5.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum	654	403	Italy 201; Netherlands 114; United Kingdom 45.
Dust and powder of precious and semiprecious stones (includes diamond) kilograms	27	68	United Kingdom 61; Belgium-Luxembourg 3; Sweden 2.
Grinding and polishing wheels and stones	332	390	United Kingdom 123; Spain 71; West Germany 63.
Asbestos	6,509	5,780	Canada 2,846; Republic of South Africa 1,386; Mozambique 439.
Barite and witherite	241	362	West Germany 334; United Kingdom 19.
Cement	8,911	100,835	Norway 41,855; Sweden 33,102; United Kingdom 14,841.
Chalk	4,024	4,296	France 2,649; Belgium-Luxembourg 802; Sweden 267.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	4,632	5,014	West Germany 1,992; United States 1,095; Italy 625.
Kaolin	4,505	3,658	United Kingdom 3,241; United States 267.
Other	4,965	3,039	Spain 1,173; United Kingdom 824; West Germany 326.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Clays and clay products—Continued			
Products:			
Refractory (including nonclay bricks)	4,981	19,195	France 8,697; West Germany 4,658; Austria 1,657.
Nonrefractory	2,156	2,613	Spain 1,827; Italy 447; United Kingdom 307.
Crylite and chiolite	70	63	Denmark 61; United Kingdom 2.
Diamond, except powder and dust:			
Gem, not set or strung—carats	3,825	1,915	Belgium-Luxembourg 1,760; Netherlands 155.
Unspecified—thousand carats	2,546	2,279	All from Angola.
Diatomite and other infusorial earths	3,249	1,784	Spain 803; West Germany 333; Denmark 201.
Feldspar, leucite, nepheline, etc	1,468	2,662	United Kingdom 952; Mexico 793; Spain 616.
Fertilizer materials:			
Crude:			
Nitrogenous	--	1,565	Chile 1,500; West Germany 45; Belgium-Luxembourg 20.
Phosphatic	248,864	285,960	Morocco 264,036; Israel 11,420; Senegal 9,905.
Manufactured:			
Nitrogenous	4,600	3,901	France 1,752; Netherlands 1,100; Belgium-Luxembourg 679.
Phosphatic	13,334	11,419	Belgium-Luxembourg 8,780; France 2,170; Netherlands 200.
Potassic	35,129	39,588	Spain 39,532.
Other, including mixed	43,209	34,129	United Kingdom 11,637; West Germany 9,773; Belgium-Luxembourg 6,139.
Graphite, natural	163	179	West Germany 51; Norway 46; United Kingdom 44.
Gypsum and plasters	22,550	25,303	Morocco 25,007; Spain 265.
Magnesite	646	338	Netherlands 205; Austria 100; Spain 10.
Mica, crude and worked	203	230	Norway 121; United Kingdom 93.
Pigments, mineral:			
Natural crude	32	67	Austria 40; France 15.
Iron oxides processed	1,465	1,681	Spain 683; West Germany 599; France 161.
Salt and brine	3,087	27,015	Cape Verde 22,230; Italy 3,150; Angola 1,499.
Stone, sand and gravel:			
Dimension stone, crude and worked	633	79	United Kingdom 72; West Germany 7.
Dolomite, chiefly refractory grade	3,806	4,760	Italy 3,311; Spain 609; Norway 458; United Kingdom 277.
Flint and crushed rock	787	152	Spain 45; France 33; Belgium-Luxembourg 23; West Germany 22.
Quartz and quartzite	234	149	Switzerland 60; Belgium-Luxembourg 38; France 20.
Sand, excluding metal bearing	5,256	6,985	Netherlands 3,580; Belgium-Luxembourg 3,023; Spain 289.
Sulfur:			
Elemental, all forms	24,066	25,751	France 24,666; West Germany 906; Belgium-Luxembourg 175.
Sulfur dioxide	561	241	West Germany 134; France 63; Netherlands 27.
Sulfuric acid	47	54	West Germany 20; Italy 16; Netherlands 14.
Talc, steatite, soapstone, pyrophyllite	3,378	2,905	France 1,259; Norway 532; Italy 349.
Other nonmetals, crude, n.e.s	11,793	9,940	Cape Verde 7,994; Spain 1,021; Republic of South Africa 421.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,012	330	Belgium-Luxembourg 159; Netherlands 69; United States 56.
Carbon black	7,306	7,843	Spain 4,346; West Germany 941; United Kingdom 879.
Coal, all grades, including briquets thousand tons	481	156	Poland 113; United Kingdom 22; United States 11.
Coke and semicoke—do	258	311	France 88; United States 70; West Germany 55.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	27,148	25,535	Iraq 14,170; Saudi Arabia 6,711; Bahrain 4,349.

Table 3.—Portugal: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum—Continued			
Refinery products:			
Gasoline thousand 42-gallon barrels	r 397	362	Italy 213; Netherlands Antilles 90.
Kerosine and jet fuel ---do---	r 413	285	Netherlands 111; Italy 72.
Distillate fuel oil ---do---	r 2,059	2,140	Iran 419; Mozambique 357; Netherlands 334; Spain 250.
Residual fuel oil ---do---	1,226	2,137	Mozambique 538; Netherlands 447; Italy 271; Iran 236.
Lubricants ---do---	r 491	422	United Kingdom 210; Netherlands 69; France 68.
Liquefied petroleum gas ---do---	2,458	2,620	France 912; United Kingdom 588; Spain 586; Netherlands 344.
Other ---do---	r 371	260	Netherlands Antilles 84; Spain 82; West Germany 22.
Total ---do---	r 7,415	8,226	
Mineral tar and other coal–, petroleum–, or gas–derived crude chemicals	13,517	12,917	Netherlands 4,615; United Kingdom 4,382; Spain 2,733.

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Production of zinc concentrates and associated silver from the Terramonte mine increased 58% over that of 1971, but production of lead concentrates declined. Copper concentrate production increased overall, including a record production of cuperiferous pyrite. Tin and tungsten values from the Beralt Tin and Wolfram, Ltd., operations declined. The Murcas mine, purchased by Minas-Metalúrgia, began production of tungsten concentrates from an open pit. The Gerez molybdenite mine reopened, but only minor shipments were recorded in 1972. Intensified exploration for pyrite continued in the Alentejo district, but decisions have not been announced on major facility installations.

Iron and Steel.—Production of manganiferous iron ore continued at a modest rate, but the downward trend in hematite ore production of the last 2 years continued. As a result, total iron ore production was about 60% of that of 1968 and less than half that needed to support the domestic steel industry. Iron and steel production continued at capacity, but imports exceeded production in 1972 as in 1971. Phase 1 of the expansion program of the National Steel Mill at Seixal (projected for 1974) will increase capacity to 850,000 tons per year (about the total demand in 1971), and a mini-steel mill at Oporto of 300,000 tons capacity will come into production in 1975, if the currently announced plans are completed on schedule. Self-sufficiency in iron ore is projected with the development of the Moncorvo deposit in the northeast, but this project involves complex considerations with respect to transportation facilities to the coast to permit competitive exportation of approximately one half of the projected production of 2 million tons per year. The phosphorus contained in the ore is also high, and although beneficiation reduces the phosphorus level substantially, the product is inferior to ores being shipped from newly discovered deposits in Africa and South America.

NONMETALS

As a part of its 5-year industrial expansion plan, Portugal is striving to become self-sufficient in fertilizer production and by greater utilization to increase the yield of agricultural products. Mixed (nitrogen, potassium, and phosphorus-NKP) fertilizer and raw materials plants now coming into production or under construction will provide over a 100% increase in capacity of NKP fertilizer and perhaps an exportable surplus.

Ornamental stone production continued at an annual rate of 132,000 tons during 1972. Of this quantity, 41% consisted of

as-quarried blocks of marble shipped to Italy for sawing and finishing.

Two large cement plants of 650,000 tons annual capacity being constructed by Cia. Industrial do Cimento do Sul in southern Portugal will cope with increasing demand associated with the several major industrial construction projects. The latest announced major project is a 220-mile toll road system estimated to cost $347 million. The system will be privately financed and operated. The first segments are to be completed in the south by 1975 with the balance finished by 1981.

MINERAL FUELS

Anthracite coal production continued in the moderate decline that has been taking place during the last 3 years. Enlarged coke plant facilities went into production at Siderúrgia Nacional during 1972. Although the existing petroleum refinery at Oporto was enlarged during 1972, Portugal will not become self-sufficient in petroleum products until the new refinery (Petrusol-Sociedade Portuguesa de Refinação de Petroleus) on the Sines Peninsula, 60 miles south of Lisbon, is completed with a capacity of 6 million tons per year. It is expected that the contractors will be named and the schedule for completion of this project announced during 1973. The refinery and associated pier structures, petrochemical plants, and infrastructure are estimated at a total cost of $1.2 billion.

In December the Government issued regulations for establishing commercial nuclear powerplant facilities. The Portuguese Electric Company negotiated for site selection assistance for the first complex, to be in operation in 1980. The Portuguese system for approving nuclear facilities parallels U.S. practice involving (1) a preliminary license, (2) approval for construction, and (3) approval for power production.

The Mineral Industry of Romania

By Joseph B. Huvos [1]

In 1972 Romania's most important mineral products were crude oil, bauxite, aluminum, iron ore, iron and steel, manganese ore, cement, barite, pyrites, salt, and petrochemicals. Of these, only crude oil with an annual output equal to about 0.5% of the world's total production had importance by world standards.

During 1972 the Romanian Government continued a vigorous program of investment in economic development, with total investments in all sectors of the economy reaching 83.8 billion lei,[2] an increase of 8 billion lei over the 1971 level (corresponding to a plan fulfillment of 96.1%). Of this, industry as a whole received 48.2 billion lei, an increase of 15.1% over that of 1971. Major investments in the mineral industries were in the metallurgy area with additional capacities being constructed at the iron and steel combines of Galati, Hunedoara, and Reşita, the metallurgical plant of Iaşi, and the aluminum smelter at Slatina. In the chemical field, facilities receiving part of the 1972 investments included the sulfuric acid plant at Valea Călugărească and petrochemical plants at Făgăras and Ploieşti, while in the field of construction materials a new cement production line was added at the Cîmpulung Muscel combine. In the area of electric power, two new thermal generating units of 200 megawatts each at Rovinari and two central heating units of 200 megawatts at Brazi were commissioned.[3]

Romania's supply-demand balance for the more important minerals did not change much in 1972. In 1971 by world trade standards only the export of about 5.4 million tons of petroleum products and 62,100 tons of nonferrous metals and alloys, mostly aluminum, were significant.

Of Romania's total commodity trade, 25% was with the U.S.S.R.; trade with Communist countries including the U.S.S.R. amounted to 55.3% of total trade.

PRODUCTION

In 1972 Romania's industrial production was valued at 373.7 billion lei. This was an increase of 11.8% over 1971 production figures and corresponds to a 101.4% plan fulfillment.

During 1972, the main growth figures in the minerals and related industries were as follows:

Industry sectors	*% of growth*
Building materials industry	9.6
Chemical industry	16.1
Electric and thermal energy	10.7
Ferrous metallurgy, including mining	13.4
Fuels	3.5
Nonferrous metallurgy, including mining	3.5

Significant increases were registered in the production of fertilizers, electric power, aluminum and its alloys, crude steel, cement, coal, and natural gas.

[1] Foreign mineral specialist, Division of Fossil Fuels.

[2] Values have not been converted from Romanian currency units (Lei) to U.S. dollars, because of the wide variation between the official exchange rate (Lei 4.97=US$1.00) and those actually used for some transactions.

[3] Scînteia (Bucuresti) Communicat . . . la Indeplinirea Planului . . . (Release on Plan Fulfillment). V. 53, No. 9420, Feb. 14, 1973, p. 1.

Table 1.—Romania: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Aluminum:				
Bauxite		304,300	[e] 305,000	[e] 305,000
Alumina [e]		210,000	210,000	210,000
Ingot (including alloys)		[r] 101,667	111,222	122,000
Bismuth, mine output [e]		80	80	80
Cadmium, smelter output [e]		80	80	80
Copper:				
Mine output, metal content, recoverable [e]		13,000	14,200	35,000
Smelter [e]		10,000	11,000	35,000
Gold, mine output [e]	troy ounces	60,000	60,000	60,000
Iron and steel:				
Iron ore	thousand tons	3,206	3,467	[e] 3,500
Pig iron and blast furnace ferroalloys	do.	4,210	4,382	[e] 4,800
Electric furnace ferroalloys	do.	1	--	--
Crude steel	do.	6,517	6,803	7,401
Semimanufactures:				
Castings and forgings, finished	do.	524	[e] 550	NA
Pipes and tubes	do.	767	825	NA
Rolled products	do.	4,504	4,763	NA
Lead:				
Mine output, metal content, recoverable [e]		38,000	38,000	38,000
Smelter [e]		36,000	36,000	36,000
Manganese ore:				
Gross weight [e]		127,000	127,000	130,000
Manganese content [e]		28,000	28,000	30,000
Silver, mine output, metal content [e]	thousand troy ounces	800	1,000	1,000
Zinc:				
Mine output, metal content, recoverable [e]		39,800	39,800	40,000
Smelter [e]		39,800	39,800	40,000
NONMETALS				
Barite [e]		116,500	116,000	116,000
Cement, hydraulic	thousand tons	8,127	8,523	9,212
Clays:				
Bentonite [e]		120,000	120,000	120,000
Kaolin [e]		50,000	50,000	50,000
Fertilizer materials, manufactured:				
Nitrogenous, nitrogen content		646,917	826,836	[e] 926,000
Phosphatic, phosphorus pentoxide content		244,176	244,664	[e] 274,000
Fluorspar [e]		15,000	15,000	15,000
Graphite		6,019	[e] 6,000	[e] 6,000
Lime	thousand tons	2,011	2,251	[e] 2,300
Pyrites:				
Gross weight	do.	807	[e] 840	[e] 840
Sulfur content [e]	do.	346	360	360
Salt	do.	2,862	2,948	[e] 2,950
Sulfuric acid (monohydrate)	do.	994	1,047	NA
Talc		56,728	[e] 57,000	[e] 57,000
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		72,474	74,634	[e] 75,000
Coal:				
Run-of-mine:				
Anthracite and bituminous	thousand tons	8,087	8,505	NA
Brown	do.	704	654	NA
Lignite	do.	14,044	13,792	NA
Total	do.	22,835	22,951	25,271
Washed (produced from above):				
For coke and semicoke production	do.	1,306	1,329	NA
Lignite	do.	13,461	13,187	NA
Other (unspecified)	do.	5,764	6,085	NA
Total	do.	20,531	20,601	NA
Coke, metallurgical	do.	1,070	[e] 1,070	[e] 1,070
Gas:				
Manufactured	million cubic feet	18,434	18,953	NA
Natural, gross production:				
Associated	do.	178,691	189,074	[e] 194,000
Nonassociated	do.	705,266	754,494	[e] 760,000
Total	do.	883,957	943,568	954,000

See footnotes at end of the table

Table 1.—Romania: Production of selected mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum:				
Crude:				
As reported	thousand tons	13,377	13,793	14,128
Converted [e]	thousand 42-gallon barrels	102,067	102,799	105,296
Refinery products:				
Gasoline	do	[r] 23,682	25,645	NA
Kerosine	do	[r] 7,509	7,866	NA
Distillate fuel oil	do	[r] 37,667	39,366	NA
Residual fuel oil	do	[r] 28,296	29,111	NA
Lubricants	do	4,242	4,200	NA
Asphalt	do	3,254	3,424	NA
Petroleum coke	do	407	671	NA
Liquefied petroleum gas	do	2,401	2,587	NA
Total	do	[r] 107,458	112,870	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, antimony, asbestos, feldspar, gypsum, and mica, as well as a variety of crude construction materials are produced, but information is inadequate to make reliable estimates of output levels.

TRADE

In 1971, reference year for this chapter's trade tables, Romania's exports and imports of all goods was 12.6 billion lei, each. In 1972, exports increased 13.5% to 14.3 billion lei. In 1971, trade by major mineral and related commodity groups was as follows:

	Million lei	*% of total*
Exports:		
Building materials	335.4	2.7
Chemicals, fertilizers and rubber	1,031.7	8.2
Fuels (except petroleum products) minerals and metals	2,552.7	20.3
Petroleum products	857.3	6.8
Imports:		
Building materials	155.3	1.2
Chemicals, fertilizers and rubber	679.7	5.4
Fuels (except petroleum products) minerals and metals	3,813.7	30.2
Petroleum products	--	--

Romania did not publish detailed trade figures showing commodities by country of origin or destination; only total value of all goods traded was reported. In 1971, on the basis of this total value, Romania's principal trading partners were as follows:

Country	*% of total trade*
U.S.S.R.	25.0
West Germany	8.5
East Germany	6.7
Czechoslovakia	6.4
Italy	5.4
France	5.2

Trade with Communist countries was 13.9 billion lei or 55.3% of Romania's total trade.

Table 2.—Romania: Exports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
METALS			
Aluminum and alloys:			
Scrap	2,307	NA	
Unwrought and semimanufactures	24,095	NA	
Copper and alloys, unwrought and semimanufactures	3,086	NA	
Iron and steel:			
Pig iron and ferroalloys	5,373	NA	
Steel:			
Primary forms	[3] 181,900	NA	
Semimanufactures:			
Bars, rods, angles, shapes, sections	[3] 106,378	[4] 1,096,000	U.S.S.R. 319,500.[5]
Plates and sheets	[3] 385,592		
Hoop and strip	[3] 11,037		
Wire	[3] 5,297	NA	
Pipes, tubes and fittings	[3] 237,552	[6] 241,800	U.S.S.R. 131,600.[5]
Castings and forgings	[3] 5,943	NA	
Total	751,799	NA	

See footnotes at end of table.

Table 2.—Romania: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal destinations, 1971
METALS—Continued			
Lead:			
Oxides	388	NA	
Metal and alloys, unwrought and semimanufactures	2,852	NA	
Manganese ore	[2] 28,900	49,200	NA.
Silver:			
Waste and sweepings—value, thousands	$2,085	NA	
Metal, crude and worked—do	$2,567	NA	
Zinc, metal and alloys, unwrought and semimanufactures	2,709	NA	
Other, nonferrous scrap, n.e.s	16	NA	
NONMETALS			
Barite	42,900	[5] 42,500	All to U.S.S.R.
Cement, hydraulic—thousand tons	[2] 1,200	932	NA.
Clays and products:			
Crude, bleaching	1,441	NA	
Products, nonrefractory	24,836	NA	
Fertilizer materials, manufactured:			
Nitrogenous	179,319	NA	
Phosphatic	1,484	NA	
Mixed	15,916	NA	
Pyrite, unroasted	40,816	NA	
Salt	[2] 603,700	633,600	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	50,447	[5] 38,500	All to U.S.S.R.
Soda ash	94,819	[5] 99,400	Do.
Stone, sand and gravel:			
Dimension stone, worked	21,700	NA	
Other	10,480	NA	
Talc	1,248	NA	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	15,535	[7] 46,500	NA.
Carbon black	[2] 34,800	36,300	U.S.S.R. 2,009.[5]
Gas, natural and manufactured—million cubic feet	[2] 7,066	7,063	NA.
Peat and briquets	3,642	NA	
Petroleum:			
Crude—thousand 42-gallon barrels	13	NA	
Refinery products:			
Gasoline—do	[2] 5,956	5,304	NA.
Kerosine—do	[2] 702	253	NA.
Distillate fuel oil—do	[2] 19,010	19,548	NA.
Residual fuel oil—do	[2] 10,201	10,260	NA.
Lubricants—do	2,444	2,508	NA.
Mineral jelly and wax—do	150	128	NA.
Nonlubricating oil, n.e.s—do	2	NA	
Petroleum coke—do	371	606	NA.
Total—do	38,836	38,607	NA.
Crude chemicals from coal, gas and oil distillation	11,889	NA	

NA Not available.

[1] Compiled from 1970 edition of Supplement to the World Trade Annual. V. 1 (Eastern Europe), Walker and Company, New York 1972 (prepared by the Statistical Office of the United Nations) and official trade returns of Poland and the U.S.S.R. unless otherwise noted. These data represent imports from Romania as reported by selected trading partner countries.

[2] Source: Official Romanian export statistics unless otherwise noted.

[3] Source: United Nations Economic Commission for Europe. World Trade in Steel 1970. United Nations, New York 1971.

[4] Officially reported Romanian export of "rolled steel;" corresponding figure for 1970 is 1,278,100 tons; shapes included may not correspond to those entered in this table for 1970, and figure may include some primary forms.

[5] Source: Official import statistics of the U.S.S.R.

[6] Officially reported Romanian export of pipes (apparently excluding fittings).

[7] Includes petroleum refinery asphalt.

Table 3.—Romania: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971 [3]
METALS			
Aluminum:			
Bauxite	158,863	[4] 174,033	All from Yugoslavia.[4]
Alumina	21,517	NA	
Metal including alloys, unwrought and semimanufactures	12,002	[3] 3,125	All from U.S.S.R.
Copper metal including alloys, unwrought and semimanufactures	18,028	[3] 6,290	Do.

See footnotes at end of table.

Table 3.—Romania: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970 [1]	1971 [2]	Principal sources, 1971 [3]
METALS—Continued			
Iron and steel:			
Iron ore—thousand tons	[2] 6,268	6,939	U.S.S.R. 4,300.
Pig iron, sponge iron, powder and shot—do	500	[3] 525	All from U.S.S.R.
Ferroalloys—do	[2] 102	121	U.S.S.R. 80.
Steel:			
Primary forms—do	263	NA	
Semimanufactures:			
Bars, rods, angles, shapes, sections—do	[5] 195		
Plates and sheets—do	[5] 477	[6] 1,544	U.S.S.R. 687.
Hoop and strip—do	[5] 50		
Rails and accessories—do	[5] 65		
Wire—do	[5] 15	NA	
Pipes, tubes and fittings—do	[5] 82	[7] 93	NA.
Total—do	[5] 884	NA	
Lead oxides	1,124	NA	
Manganese oxides	731	NA	
Mercury—76-pound flasks	638	NA	
Nickel metal including alloys, unwrought and semimanufactures	247	NA	
Platinum-group metals, unwrought and semimanufactures value, thousands	$490	NA	
Silver metal, unwrought and semimanufactures—do	$189	NA	
Tin metal including alloys, unwrought and semimanufactures long tons	904	NA	
Titanium oxides	2,954	NA	
Tungsten metal, all forms	5	NA	
Zinc:			
Powder (blue dust)	1,181	NA	
Oxides	535	NA	
Metal including alloys, all forms	1,288	NA	
NONMETALS			
Asbestos	19,287	[3] 20,200	All from U.S.S.R.
Barite and witherite	256	NA	
Borates, crude natural	--	NA	
Chalk	656	NA	
Clays and products:			
Crude clays, n.e.s	19,586	NA	
Products:			
Refractory	27,552	[3] 12,800	All from U.S.S.R.
Nonrefractory	174	NA	
Cryolite	535	[3] 487	All from U.S.S.R.
Diamond:			
Gem—value, thousands	$71	NA	
Industrial—do	$158	NA	
Feldspar and fluorspar	694	NA	
Fertilizer materials:			
Nitrogenous, nitrogen content	[2] 700	--	
Phosphatic, apatite concentrate, P_2O_5 content	[2] 317,000	340,600	Mainly from U.S.S.R.
Potassic, K_2O equivalent	[2] 29,900	34,200	NA.
Graphite	--	NA	
Magnesite	3,284	NA	
Mica, worked	19	NA	
Pigments, mineral, iron oxide	663	NA	
Stone, quartz and quartzite	435	NA	
Sulfur, elemental (including colloidal)	11,355	[3] 7,380	All from U.S.S.R.
Sulfuric acid	40,189	[3] 32,700	Do.
Talc	--	NA	
Other crude nonmetals	875	NA	
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	307	NA	
Coal—thousand tons	[2] 728	758	U.S.S.R. 406.
Coke—do	[2] 1,822	2,435	U.S.S.R. 1,080.
Petroleum refinery products:			
Lubricants—do	5	NA	
Other—do	81	NA	
Unspecified, possibly including crude oil—do	15	NA	
Crude chemicals from coal, gas, or oil distillation	[r] 27,218	17,521	All from U.S.S.R.

[r] Revised. NA Not available.

[1] Compiled from Supplement to the World Trade Annual 1970. V. 1 (East Europe), Walker and Company, New York 1972 (prepared by Statistical Office of the United Nations) unless otherwise noted these data represent exports to Romania as reported by selected trading partner countries.

[2] Source: Official trade returns of Romania unless otherwise noted.

[3] Source: Official export statistics of the U.S.S.R. unless otherwise noted.

[4] Source: Official export statistics of Yugoslavia.

[5] Source: United Nations Economic Commission for Europe. World Trade in Steel 1970. United Nations, New York 1971.

[6] Officially reported Romanian import of "rolled steel;" figure does not correspond exactly to 1970 data presented insofar as range of products is concerned; may include some primary forms. Corresponding 1970 figure is 1,361,000 tons.

[7] Officially reported Romanian imports of "pipe including tanks"; apparently excludes pipefittings.

COMMODITY REVIEW

METALS

Aluminum.—Construction of the 250,000-ton-per-year alumina plant in Tulcea was nearing completion at yearend, with shakedown runs scheduled for the beginning of 1973.[4]

Primary aluminum and aluminum alloy production in 1972 was 122,000 tons, 9.7% more than in 1971. Expansion of Romania's only aluminum smelter in Slatina continued according to plans[5] and will reach a production capacity of 200,000 tons per year by 1975 according to the current 1971–75 5-year plan.

It can be assumed that in 1972 imports of bauxite were continued from Yugoslavia in order to satisfy the steadily increasing demand.

Copper.—Production of copper ore was at the 3.0 to 3.5-million-tons-per-year level resulting in a smelter production of about 35,000 tons in 1972. The current 1971–75-year plan provides for a major expansion of copper production leading to an output of about 50,000 tons by 1975.

Romania has several mining areas which have been known since Roman times and which are generally of the complex-sulfide-ore type, with the copper, often associated with gold, silver, and other nonferrous base metals. The most important of these areas are the Baia Mare region, including Baia Sprie, and Cavnic; the areas of Roşia Montana, Moldova Nouă, Borşa, Bălan, and Leşul Ursului.

In 1972, Romania was a net importer of copper. A contract was signed with Chile for importing a total of 20,000 tons over the next 4 years, the first 5,000 tons to be delivered during 1972.[6]

An agreement was reached between the Peruvian State mining agency and Romania to study the feasibility of developing the Antamina copper deposit in Peru. Upon completion of the study, the cost of which will be shared equally, a joint venture, with 51% Peruvian and 49% Romanian participation, will be formed. An initial investment of $35 to $40 million is anticipated.[7]

A joint committee was set up by Romania and Zambia for economic and technical know-how for developing Zambian copper deposits.[8]

Iron and Steel.—Rapid development of Romania's iron and steel industry continued according to plans. Steel production increased to 7.4 million tons, 8.8% over that of 1971. Of the total, 529,000 tons were alloys, which corresponds to an increase in alloy output of 19.1% over that of 1971.

The steel production plan of 7,340,000 tons was exceeded by 0.83%. Much of the iron ore used had to be imported; sources of iron ore supply were as follow in thousand tons:

	1970	1971
Romania (domestic)	3,206	3,467
U.S.S.R.	3,832	4,300
India	1,544	1,380
Algeria	741	1,139
Yugoslavia	151	120
Total	9,474	10,406

Algeria which will supply 1.2 million tons of iron ore in 1973 reportedly will boost shipments to 1.5 million tons per year by 1975.

Romania has ordered a complete continuous welded tube plant valued at $4.7 million from West Germany's Mannesmann-Meer Company.[9]

Lead and Zinc.—Lead and zinc are associated in Romania generally with copper in complex sulfide ores. Efforts directed at increasing copper production will increase lead and zinc production in the major mining areas.

Tin.—Romania became a member of the Fourth International Tin Agreement.[10]

NONMETALS

Cement.—Cement production in 1972 increased 8.1% over that of 1971 but fell about 388,000 tons short of the 9.6-million-ton goal set in the production plan for the year. The Fieni cement plant was being expanded and modernized by the addition of a new production line which will double its unspecified 1972 capacity in 1973.[11]

[4] Scînteia (Bucuresti). V. 52, No. 9436, Mar. 2, 1973, p. 1.
[5] Scînteia (Bucuresti). V. 51, No. 9226, June 29, 1972, p. 1.
[6] Mining Magazine (London). Chile/Romanian Trade. V. 126, No. 6, June 1972, p. 469.
[7] Mining Journal (London). Peru-Romanian Copper Project. V. 278, No. 7132, Apr. 28, 1972.
[8] Metal Bulletin. Zambia-Romania Pact. No. 5689, Apr. 7, 1972, p. 19.
[9] Metal Bulletin (London). Romanian Mill Order No. 5749, Nov. 10, 1972, p. 34.
[10] Viata Economica (Bucharest). Anton Pascale and Cornel Vasiliade. No. 48, Dec. 1, 1972, p. 15.
[11] Scînteia (Bucuresti). (Concerning the economy.) V. 52, No. 9400, Jan. 21, 1973, p. 3.

Fertilizer Materials.—In 1972, production of fertilizer materials, in terms of total active substance (nitrogen, phosphorus pentoxide, and potassium oxide) fell short of the plan target of 1,463,700 tons by 18%, but exceeded the 1971 production by 12%.

Rapid growth of the fertilizer industry is to continue according to the 1971–75 5-year plan; 1975 production will reach 2,600,000 to 2,760,000 tons of total active substance, of which about 2.4 million tons will be nitrogen if programed goals are met. At present, fertilizer consumption equivalent is 26 kilograms of nitrogen and 13 kilograms of phosphorus pentoxide per hectare. Nitrogen consumption is slated to be raised to 80 to 100 kilograms per hectare in 1975, the end of the current 5-year plan period.

Investments in the fertilizer industry were in excess of $400 million for the 1964-70 period. Facilitated by Romania's ample hydrocarbon resources, this has resulted in a spectacular increase in nitrogen production, with Romania becoming the third-ranking producer in East Europe after the US.S.R. and Poland.

In 1972, there were six nitrogen fertilizer producing plants. Făgăraş near the Transylvanian gasfield area is the oldest plant and was recently rebuilt to a capacity of 82,000 tons of nitrogen, as ammonia, per year. The ammonia is used to produce nitrate. Victoria, a small plant in the same area, produces less than 20,000 tons of nitrogen, per year, also as ammonium nitrate. At Piatra Neamt a 160,000-ton-per-year nitrogen plant with gas piped in, which went onstream in 1963, produces ammonium nitrate and urea. The plant was engineered by GIAP and the Romanian State Designing Company (IPRAN). The Craiova plant, using natural gas from the olt-Argeş region, has a 160,000-ton-per-year ammonium nitrate and urea production unit utilizing GIAP technology. A more recent unit constructed by Humphrey and Glasgow Ltd. has 246,000-ton-per-year ammonia capacity and uses Imperial Chemical Industries (ICI) technology. At Turnu Magurele on the Danube a unit similar to that of Craiova was built by Uhde and IPRAN, and it is now being expanded to more than 500,000 tons of ammonia per year for ammonium nitrate and urea.

There are also two 400,000-per-year nitrogen-phosphate-potassium (NPK) complex fertilizer plants, each with a diammonium phosphate capacity. The Tirgu Mureş plant in the Transylvanian gasfield has a capacity of 150,000 tons of nitrogen and was engineered by the Società Generale per l'Industria Mineraria e Chimica Anonima Montecatini and Uhde.

The trend in the current 5-year plan is to produce a greater percentage of products high in nitrogn such as urea[12] as shown in the following tabulation:

Commodity	% of production	
	1970	1975
Ammonium nitrate	62	34
Urea	27	40
Calcium ammonium nitrate	3	1
Ammonium sulfate	1	1
Complex fertilizers	7	24

Further planned additions to existing fertilizer plants include the following: Slobozia near Bucharest has a new 925-ton-per-day ammonia plant using the ICI process and will have ammonium nitrate and urea units downstream designed by Kaltenbach, Stamicarbon and Grande Paroisse, and Coppée-Rust as the main contractors; Turnu-Magurele will have in 1973–74 a 925-ton-per-day ammonia plant designed by Kellogg N.V. and a NPK plant using the Norsk-Hydro process and engineered by Wellmann-Power Gas Co. of London. Tirgu Mures will have an ammonia plant engineered by Kellogg and a 900-ton-per-day urea plant using the Stamicarbon process and engineered by Coppée-Rust and IPRAN; Piatra-Neamt will have in 1972 a 900-ton-per-day ammonia plant with Ammonia Casale and Copée-Rust as contractors; Arad will have a third 1,000-ton-per-day ammonia plant by Kellogg in 1975–76, and a Wellmann-Power gas 891,000-ton-per-year NPK facility downstream; Craiova will have in 1974 a third NPK plant.

Romania continued to import raw materials for its phosphatic fertilizer industry, with the U.S.S.R. providing the bulk, and the remainder coming from the United States (200,000 tons), Morocco (31,000 tons), and Algeria (10,000 tons) in 1972.

Sulfur.—Preliminary surveys by GEOMIN, the Romanian State Geological Survey and

[12] Nitrogen. No. 78, July–August 1972, pp. 31–44.

Mining Company, have found a sulfur deposit in the Calimiani Mountains of Transylvania, which is estimated to be among the largest in Europe.[13]

An order for a 200,000-ton-per-year sulfuric acid plant for an unspecified location was awarded by the Romanian State trading organization Romchim to Lurgi Chemie und Hüttentechnik G.m.b.H. of Frankfurt, West Germany. Pyrite flotation concentrate will be used in the plant.[14]

IPRAN will do the detailed engineering for a 300,000-ton-per-year sulfuric acid plant at Abu Zaabal in Egypt using the Chemiebau-Zieren process with some sections of the plant supplied by the Compagnie Power-Gas of Paris. The elemental sulfur-based plant is due onstream in 1974.[15]

MINERAL FUELS

Romanian energy resources were varied (lignite, coking coal, crude oil, natural gas, and some bituminous schists) but mostly limited in amounts. Electric power production, with 43.4 billion kilowatt hours increased 10% over that of 1971 and exceeded slightly the 1972 plan target of 43.3 billion kilowatt hours. The 220 kilovolt Arad-Nadrag and Arad-Timişoara powerlines were commissioned, insuring a direct power link with Hungary.

Hydropower projects in the news included the Prut River project at Stanca-Costeşti; construction will start in 1973, will cost 62 million transferable rubles, and will take 5 years to complete.[16]

Construction of the Bulgarian-Romanian hydropower project on the Danube at Cigara-Belene will start in 1975 and will take 7 years. The project will elevate the water level of the Danube for 300 kilometers.

Coal.—In 1972, total run-of-mine coal production in Romania increased 10.1% but fell short of the 27.4-million-ton plan target by 7.7%. Apparently the new electric power generating units, which were scheduled to start production thereby increasing lignite consumption, did not go onstream as scheduled.

A new briqueting plant to use 440,000 tons per year of lignite from the Baratul mines was readied at Cămpeni-Covasna.[17]

Natural Gas.—Romanian gross natural gas production, including natural gas liquids increased in 1972 by 1.1%. This corresponds to a plan fulfillment of 100.4%. Development work was pursued energetically, with production plans up to 25.5 to 26.8 billion cubic meters by 1975.

Petroleum.—In 1972, Romanian petroleum production exceeded 1971 output by 2.4%, corresponding to a plan fulfillment of 100.9%. According to the current 1971–75 5-year plan, only slight increases can be expected in the future. The reason for this is that in spite of an aggressive exploration program no significant new deposits have been found. Exploration was extended to the Black Sea area. The Offshore Co., Houston, Texas supplied design and licensing of a jacking system plus technical assistance during construction for an offshore rig to be built in a Romanian shipyard using Romanian drilling equipment. Drilling capacity is 25,000 feet in 300 feet of water. About $3.2 million financing is by an Export-Import Bank loan and the Manufacturers Hannover Trust (London).[18]

In 1972, there were about 7,000 producing wells and about 250 test rigs in Romania.

Romania will explore for oil for the Iraq National Oil Co., east of Baghdad in the Djebel Hamarine region, under a recent $35 million technical and economic agreement between the two countries.[19]

There are at present about 300 Romanian experts working in oilfields in developing countries. Refinery expansions planned include a crude processing and hydrorefining plant in Borzeşti; a 2,250-barrel-per-day hydrotreater in Bucharest; a new refinery and gasoline plant in Buzău, designed by Lurgi Gesellschaft für Mineralöltechnik G.m.b.H, a subsidiary of the Metallgesellschaft A.G., and a vacuum distillation and visbreaking plant at Piteşti, with Eurotechnica as contractor.[20]

Petrochemicals will be allocated one-half of all investment funds in the chemical industry during the current 5-year plan, and the chemical industry itself is the fastest growing branch of the whole economy. The

[13] Sulphur. No. 99, March–April 1972, p. 13.
[14] Chemical Age. V. 104, No. 2748, Mar. 17, 1972, p. 24.
[15] European Chemical News (London). V. 22, No. 539, June 30, 1972, p. 14.
[16] Bulletinul Official (Bucharest) No. 124, Nov. 10, 1972, Decree No. 392 of Oct. 11, 1972.
[17] Scînteia (Bucuresti). V. 52, No. 9319, Oct. 10, 1972, p. 1.
[18] Ocean Oil Weekly Report. V. 6, No. 5, Sept. 19, 1972, p. 3.
[19] Oil and Gas Journal. V. 70, No. 8, Feb. 21, 1972, p. 34.
[20] Oil and Gas Journal. V. 70, No. 14, Apr. 3, 1972, p. 86.

industry is based at three major centers: Ploieşti, Piteşti, and Borzeşti, which produce mainly petrochemical feedstock.

At Piteşti, a 200,000-ton-ethylene-per-year plant is being added to the existing 100,000-ton-per-year unit and is due onstream in 1973. At Constanta there are plans to build a 400,000-ton-per-year cracking unit, utilizing higher olefin fractions. Sixteen % of investments in the chemical industry are destined by 1975 to plastics facilities, including polyvinyl chloride, polystyrene for high-density polyethylene and polypropylene, and also epoxy and polyesther resins. Styrene and butadiene rubber, carbon black, and also isoprene monomer and polymer facilities are planned. Synthetic fiber production should meet 80% of indigenous demand in 1975.

The Mineral Industry of Sierra Leone

By Henry E. Stipp [1]

The mineral industry of Sierra Leone in 1972 continued to play a large role in the economy of the small West African country. Mineral exports in 1971 accounted for about 74% of total exports and about 17% of the gross national product (GNP) estimated at $456 million.[2] Diamond exports were the largest source of foreign exchange, valued for export at about $59.9 million.

Resumption of rutile mining at Gambatoke, Bonthe District, was anticipated as the result of an agreement signed by the Government and Sierra Rutile Ltd., a consortium of Nord Resources Corp. and Armco Steel Corp. of the United States. The agreement was ratified by Parliament in November.

A 968.9 (revised figure) carat diamond was found at Yengema by National Diamond Mining Co. (Sierra Leone) Ltd. The diamond, named the Star of Sierra Leone, was sold to a U.S. jeweler at yearend, reportedly for about $1.5 million.

In April the Government increased the price of gasoline by 3 cents per gallon and the price of fuel oil by 4 cents per gallon. The increase in prices was necessary to enable the Sierra Leone Petroleum Refinery Co. to operate profitably. In May a new oil refining company was incorporated in Sierra Leone. An act to ratify the agreement between the Government and a number of oil firms on ownership and operation of the refinery was passed by Parliament. Fifty percent of the company operating the oil refinery is now owned by the Sierra Leone Government and 50% by a consortium of firms that includes British Petroleum (WA) Ltd., Shell Co. of S.L. Ltd., Texaco Africa Ltd., Mobil Oil (S.L.) Ltd., and Agip (S.L.) Ltd.

An exclusive prospecting license was granted by the Government to Spencer Engineering and Exploration Co. Ltd. to prospect for chromium, nickel, copper, cobalt, and associated minerals in Bonthe, Bo, Kenema, and Pujehun Districts. In July the Government announced that the drive to curtail illicit diamond mining resulted in the removal of 1,500 persons from the diamondiferous areas.

Conferences on trade between the Governments of Sierra Leone and Nigeria were being conducted at yearend. Sierra Leone was bargaining to buy crude oil from the Nigerian Government. In return Sierra Leone would supply iron ore and petroleum products to Nigeria.

The Government and Sierra Leone Development Co. Ltd. (DELCO) began negotiations in May for acquisition by the Government of a 51% equity interest in the company. At yearend negotiations were still in progress. DELCO has been mining iron ore at Marampa since 1930.

PRODUCTION

Production of mineral commodities in 1972 was valued at an estimated $87.7 million (not including petroleum refinery products) compared with an estimated $82.5 million in 1971. Although the output of diamond decreased about 5% from 1971, the value increased about 2% because of the higher price for diamond on the world market.

Quantity figures for the production of mineral commodities are shown in table 1.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from Leones (Le) to U.S. dollars at the rate of Le1 = US$1.20.

Table 1.—Sierra Leone: Production of mineral commodities

Commodity [1]		1970	1971	1972 [p]
Aluminum, bauxite, gross weight	thousand metric tons	440	590	694
Cement, hydraulic	do	[e] 30	--	--
Diamond:				
Gem [e]	thousand carats	723	716	609
Industrial [e]	do	1,232	1,219	1,038
Total	do	1,955	1,935	1,647
Iron ore, gross weight	thousand metric tons	2,295	2,548	2,321
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	322	337	405
Jet fuel	do	122	223	137
Kerosine	do	123	49	140
Distillate fuel oil	do	525	517	503
Residual fuel oil	do	803	883	804
Other	do	38	182	13
Refinery fuel and losses	do	82		192
Total	do	2,015	2,191	2,194
Titanium minerals, rutile	metric tons	44,083	11,932	--

[e] Estimate. [p] Preliminary.

[1] In addition to the commodities listed, a variety of crude construction materials (clays, sand, gravel, and stone) is produced, but production data are not reported and available general information is inadequate for the formation of reliable estimates of output levels. The previous edition of this chapter indicated that commercial salt production began in 1970, but it has subsequently been determined that this activity is simply a refining of crude marine salt produced in France and imported by Sierra Leone; therefore, salt is not listed among the items produced in Sierra Leone. Some 8,000 to 10,000 tons of salt is refined annually by this operation.

TRADE

Data on the trade of mineral commodities by Sierra Leone are shown in tables 2 and 3.

Table 2.—Sierra Leone: Exports of selected mineral commodities

Commodity		1970	1971
Aluminum, bauxite	thousand metric tons	[r] 392	561
Diamond:			
Uncut and unworked	thousand carats	1,946	1,924
Cut and polished	do	9	9
Iron and steel:			
Ore and concentrates	thousand metric tons	2,427	2,610
Scrap	metric tons	17	--
Other, nonferrous metal scrap	do	3,031	13,056
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	1	22
Kerosine and jet fuel oil	do	88	134
Diesel fuel oil	do	863	1,139
Rutile	metric tons	[r] 29,230	16,378

[r] Revised.

Table 3.—Sierra Leone: Imports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal and alloys, all forms	177	161
Copper metal and alloys, all forms	12	36
Iron and steel semimanufactures	23,600	14,415
Lead metal and alloys, all forms	29	50
Nickel metal and alloys, all forms	--	376
Platinum-group metals and silver:		
Ores, waste and sweepings—troy ounces	47,367	--
Silver metal unworked or partly worked—do	1,533	1,466
Tin metal and alloys, all forms—long tons	7	(1)
Zinc metal and alloys, all forms	(1)	4
NONMETALS		
Abrasives, natural, n.e.s., dust and powder of precious and semiprecious stones including diamond	625	--
Cement	63,612	60,721
Clay products:		
Refractory (including nonclay bricks)	21	92
Nonrefractory	363	136
Fertilizer materials, crude and manufactured	11	34
Gypsum and plasters	1	3
Lime	446	288
Salt	11,923	30,048
Sodium compounds, n.e.s., caustic soda	141	214
Stone, sand and gravel	109	425
Other crude nonmetallic minerals	97	56
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	1,347	35
Coal, coke and briquets	--	10
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	1,002	2,194
Refinery products:		
Gasoline—do	69	63
Kerosine and jet fuel oil—do	1	10
Distillate fuel oil—do	602	520
Liquefied petroleum gas—do	5	5
Lubricants—do	42	25
Mineral jelly and wax—do	2	2
Other—do	21	20
Total—do	742	645

[1] Less than ½ unit.

COMMODITY REVIEW

METALS

Bauxite.—A Swiss company started prospecting for bauxite in the Port Loko District. The project was expected to take 5 years to complete.[3] Reportedly Sierra Leone Ore and Metal Co. (SLOM) at Mokanji had a good year in 1972. Employment in June totaled 1,203 persons including 24 supervisory and executive personnel. SLOM was granted a license to prospect for bauxite, rutile, and associated minerals at Maforki, Bure, Yoni, Koya and Marampa-Masimera Chiefdoms in northwestern Sierra Leone.

Iron Ore.—Reportedly the Government of Sierra Leone received an offer from an organization interested in exploiting the Sankara iron ore deposit located in the Sula Mountains in north-central Sierra Leone. The Government did not approve the offer because of problems involved in establishing a market for the ore. However, Nigeria is contemplating erecting an iron and steel complex, which will require a regular supply of iron ore that could be supplied by Sierra Leone.

An Argentine company was reported to be interested in mining iron ore in the Tonkolili area of Sierra Leone.[4] The Government was prepared to give the company every encouragement because development activity would aid the Tonkolili District.

Titanium Minerals (Rutile).—Sierra Rutile Ltd. was prospecting for rutile in Banta,

[3] Barclays International Review (London). Ghana. November 1972, p. 21.

[4] Sierra Leone Trade Journal (Freetown). South America is Anxious to Trade with Sierra Leone. V. 12, No. 2, April–June 1972, p. 52.

Banta Mokelle, and Imperri Chiefdoms, a 520-square-mile area in southwestern Sierra Leone.[5] The company employed about 405 persons including 25 supervisors and executives.

An exclusive prospecting license was granted to a German group, Bayer-Preussag, in 1970. The area covered by the license consisted of 2,700 square miles in Bonthe and Moyamba Districts. The company was prospecting for rutile in Moyamba District in 1972 with 58 persons including seven supervisors and executives.

NONMETALS

Diamond.—Although the world diamond market recovered from the depressed sales and value levels of 1971, production in Sierra Leone decreased moderately. Illicit diamond mining and smuggling continued to hamper company operations. An intensive drive to remove unauthorized persons from the diamondiferous areas was undertaken by the Government in June. More than 1,500 persons who did not have valid permits were arrested. Heavy rains flooded mine workings in July, causing a slowdown in alluvial diamond mining. Employment totaled 20,794 persons in July compared with 24,087 in June and 14,882 in July 1971. The number of diamond mining licenses issued through November 1972 totaled 1,144 compared with 1,346 in 1971. Purchases of rough and uncut stones by the Government Diamond Office in 1972 totaled 800,523 carats valued at $25.6 million, a decrease from the 1,031,090 carats valued at $30.2 million in 1971.

Salt.—Osman Thomas Brothers and Sons Ltd., a domestic firm, planned to recover salt from seawater by solar evaporation.[6] The plant will be located at Suen in the Ribi Chiefdom. About 100 people were employed by the company to clear the area at Suen where the plant will be built. Production of salt is expected to be large enough to supply local consumption and a small quantity for export to nearby countries.

The Salt Manufacturing Co. located near Freetown was expected to export salt to Liberia and other neighboring countries.[7] Three new machines were installed in the plant to increase quantity and quality of the salt manufactured. In 1971 the company sold 8,000 tons of salt locally.

MINERAL FUELS

Petroleum.—Four oil companies have been conducting seismic surveys offshore from Sierra Leone. Reportedly they have completed the first phase of their work and were analyzing data obtained in their studies.

The oil refinery located at Kissy and commitments relating to it were inherited by the present government. One of the points in the original establishment of the oil refinery was the willingness of the Government to pay a subsidy of about $360,000 to make up for losses incurred by the Sierra Leone Refinery Co. After the Government acquired a 50% interest in the company, it was considered in the public interest to insure that the refinery was operating on a profitable basis. After examining all aspects of supply and demand for crude oil and petroleum products, increases in the prices of most refined products were approved by the Government in April.

[5] Sierra Leone Trade Journal (Freetown). News in Brief. V. 12, No. 3, July–September 1972, p. 78.

[6] Sierra Leone Trade Journal (Freetown). More Salt to be Manufactured Locally. V. 12, No. 2, April–June 1972, p. 48.

[7] Sierra Leone Trade Journal (Freetown). Salt Manufacturing Company—Republic of Sierra Leone. V. 12, No. 3, July–September 1972, p. 79.

The Mineral Industry of the Republic of South Africa

By James H. Jolly [1] and Roderick G. Murchison [2]

The Republic of South Africa's mineral industry achieved a record high in mineral output value in 1972. The value of total mineral production, including gold and diamond sales, increased $479 million [3] over that of 1971, to an estimated $2.5 billion. Steady increases in the price of gold, firmer world metal markets particularly in the second half of the year, strong demand for diamond and revival of the dormant platinum market were the main factors in setting the new high in mineral sales.

Increased earnings from gold sales and an improved trade balance dramatically improved the Republic of South Africa's balance of payments position from a deficit of $1,143 million in 1971 to a deficit of only $243 million in 1972. The gross national product (GNP) increased 11.8% to $21.8 billion at current prices but the overall domestic economy was disappointing as real production rose by only 3.1%. Inflation was 7.4%, one of the highest rates in the nation's history, raising operating costs and adversely affecting earnings. The continued shortage of skilled and semiskilled labor was a major constraining factor on economic growth leading to increased emphasis on raising productivity through training, in particular the training of African industrial and mine workers.

The mining industry experienced inflationary costs because of wage increases, lower productivity of workers, and rising prices for stores and equipment. Mineral exports were subjected to higher rail freight rates and harbor and shipping costs.

The Government continued or planned major programs to increase the Republic of South Africa's ability to export larger quantities of mineral products and to develop domestic industry. Projects in the program included the development of Sishen Saldanha–Bay for iron ore exports by the South African Iron and Steel Industrial Corp. Ltd. (ISCOR), the continued development of harbor facilities at Richards Bay, major expansion in steel producing facilities, further work toward establishment of a uranium enrichment plant, and expansion and improvement of electrical supply and rail services.

In the metals sector, the country's first aluminum smelter completed its first full year of operation. Trial milling operations started at the Prieska copper and zinc mine. A major copper-lead-zinc-silver discovery in northwestern Cape Province was announced by Phelps Dodge Corp. Gold production declined but output value increased dramatically as gold prices on the free market rose substantially. Lower grade gold ores were mined as a result of higher prices leading to longer life of many mines. Subsidies paid to state assisted gold mines decreased considerably during the year. ISCOR continued its major expansion program. Ferroalloy production capacity was increased as two 48 MVA electric ferroalloy furnaces were commissioned. Two additional electric furnaces were scheduled for completion in 1973. Platinum producers planned expansion programs in response to firm or potential contracts from automobile and catalytic converter manufacturers.

In the nonmetals sector, demand for chrysotile asbestos increased whereas demand for crocidolite asbestos fell markedly because of health hazard difficulties. Cement, for years in under supply in

[1] Physical scientist, Division of Nonferrous Metals, Assistant Directorate–Mineral Supply.
[2] Regional minerals officer, U.S. Consulate General, Johannesburg, Republic of South Africa.
[3] Where necessary values have been converted from South African Rand (R) to U.S. dollars at a rate of R1=US$1.293 (average of monthly averages as given in volumes 25 and 26 of International Financial Statistics). The rate for 1970–71 was R1=US$1.40.

South Africa, reached a position of oversupply with commissioning of new facilities in 1972. Production and value of diamond increased as demand and prices rose during the year. The Central Selling Organization's diamond sales exceeded the 1969 record high by 43%. The chemical and fertilizer industry continued expansion. Vermiculite production and sales increased.

In the fuels sector, coal mining operations were under expansion to supply increasing domestic and export demands. Although a price increase was allowed by the Government in February, the increase did little to alleviate the effects of rapidly rising production costs. Coal producers were trying to renegotiate their long-term contracts with Japanese steelmakers at yearend because of higher than anticipated production costs. The search for domestic petroleum supplies continued both onshore and offshore with negative results. The country's petroleum refinery capacity increased and more expansion was planned.

PRODUCTION

Total value of mineral production increased almost 24% (in terms of rand) over that of 1971. Value of production, including uranium and platinum listed under "ores and minerals" in official statistics, was as follows:

Commodity	Value (thousands)	
	1971	1972
Gold	$1,249,963	$1,499,771
Silver	4,965	5,320
Diamond	90,558	116,407
Ores and minerals:		
Local sales	366,546	365,704
Exports	486,027	524,249
Total	2,198,059	2,511,451

In terms of quantity, output of most mineral commodities showed increases during the year, particularly copper, iron ore, manganese, platinum-group elements, diamond, iron and steel products, feldspar, vermiculite, and vanadium. Significant decreases in output were registered by chromite, gold, uranium, nickel, anthracite coal, pyrite, magnesite, fluorspar, and silver.

Table 1.—Republic of South Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum, smelter	--	22,353	52,000
Antimony, concentrates:			
Gross weight	28,759	23,996	24,109
Metal content	17,370	14,246	14,571
Beryllium, beryl concentrate, 11% to 12% BeO	322	491	250
Bismuth concentrate:			
Gross weight, kilograms	--	22	--
Metal content, do	--	13	--
Chromium, chromite, gross weight:			
More than 48% Cr_2O_3	97,116	100,835	48,404
44% to 48% Cr_2O_3	934,901	1,031,295	977,812
Less than 44% Cr_2O_3	395,242	512,066	456,943
Total	1,427,259	1,644,196	1,483,159
Columbium-tantalum concentrate, kilograms	3,000	1,000	240
Copper:			
Mine output, metal content	149,205	157,470	161,927
Metal:			
Smelter	144,700	152,300	167,800
Refined	75,348	79,220	79,307
Gold, primary, thousand troy ounces	32,164	31,389	29,245
Iron and steel:			
Iron ore and concentrate, thousand tons	7,354	10,496	11,223
Pig iron, do	3,924	3,971	4,406
Ferroalloys, do	417	448	490
Crude steel, do	4,757	4,920	5,320
Iron and steel semimanufactures:			
Cast iron and steel, do	446	400	380
Rolled products, do	3,184	3,269	NA

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Manganese ore and concentrate, gross weight:			
Metallurgical:			
Over 48% Mn	663,936	689,009	743,467
Over 45% to 48% Mn	113,054	86,688	116,509
Over 40% to 45% Mn	108,657	239,288	174,607
Over 30% to 40% Mn	1,666,593	2,140,752	2,142,653
Total metallurgical	2,552,240	3,155,737	3,177,236
Chemical:			
Over 65% MnO_2	10,967	6,784	7,999
Over 35% to 65% MnO_2	116,265	74,015	86,263
Total chemical	127,232	80,799	94,262
Grand total	2,679,472	3,236,536	3,271,498
Manganiferous iron ore, 15% to 30% Mn, 20 to 35% Fe	374,000	181,637	101,657
Nickel:			
Mine output, metal content [1]	11,557	12,757	11,656
Electrolytic metal	r 9,000	9,000	8,800
Platinum-group metals:			
Platinum group content of concentrates, matte and refinery products e, thousand troy ounces	1,500	1,250	1,450
Osmiridium from gold ore, troy ounces	2,800	3,200	3,000
Silver metal, primary, thousand troy ounces	3,527	3,378	3,294
Tin:			
Concentrate:			
Gross weight, long tons	3,247	3,364	3,624
Metal content, do	r 1,979	1,997	2,125
Metal, primary, do	603	702	767
Tungsten concentrate, 60% WO_3:			
Gross weight, kilograms	6,000	12,000	1,000
Tungsten content, do	3,000	7,000	550
Uranium oxide (U_3O_8)	3,737	3,800	3,629
Vanadium:			
Vanadiferous slag, gross weight, exports	NA	26,286	31,519
Vanadium content of:			
Vanadiferous slag produced e	r 4,400	3,680	4,400
Vanadium pentoxide and ammonium vanadate	r 2,418	e 2,240	e 3,060
Total e	r 6,818	5,920	7,460
Zinc:			
Concentrate:			
Gross weight	(2)	315	4,017
Metal content	(2)	158	2,009
Smelter	r 26,900	42,400	47,100
NONMETALS			
Asbestos:			
Amosite	97,380	98,464	102,278
Chrysotile	52,801	61,161	58,512
Crocidolite	137,235	159,671	159,838
Total	287,416	319,296	320,628
Barite	2,920	2,962	2,517
Cement, hydraulic, thousand tons	5,751	5,856	6,112
Clays:			
Bentonite	16,701	20,634	24,312
Fire clay	223,369	269,396	306,229
Flint clay	301,864	364,413	281,671
Fuller's earth	1,554	1,222	1,897
Kaolin	36,896	39,184	38,218
Corundum, natural	247	241	294
Diamond:			
Gem e, thousand carats	3,758	3,169	3,370
Industrial e, do	4,354	3,862	4,025
Total, do	8,112	7,031	7,395
Diatomite	848	325	314
Feldspar	18,896	12,240	25,322
Fertilizer materials, crude, natural, beneficiated phosphate rock, thousand tons	1,685	1,729	1,966

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NONMETALS—Continued			
Fluorspar:			
Acid grade	71,199	141,022	142,883
Ceramic grade	5,257	13,848	17,861
Metallurgical grade	96,538	84,171	50,062
Total	172,994	239,041	210,806
Gem stones, semiprecious:			
Emerald crystals—kilograms	1,500	1,986	489
Tiger's eye	1,045	223	72
Graphite	699	1,145	847
Gypsum, crude	410,101	408,236	419,392
Kyanite and related materials:			
Andalusite	42,522	44,471	45,857
Sillimanite	31,916	17,460	9,476
Lime [3]—thousand tons	1,079	1,093	1,194
Lithium minerals (spodumene)	9	1	--
Magnesite, crude	84,254	78,663	68,792
Mica:			
Sheet—kilograms	10,608	2,966	1,733
Waste	7,551	7,160	4,245
Pigments, natural mineral:			
Ochers	2,474	2,314	1,620
Oxides	999	783	6,827
Pyrite:			
Gross weight:			
Cupriferous	260,027	220,797	--
Noncupriferous	607,851	528,836	438,577
Total	867,878	749,633	438,577
Sulfur content:			
Cupriferous	104,000	88,300	--
Noncupriferous	243,200	211,600	175,400
Total	347,200	299,900	175,400
Quartz, quartzite and glass sand (silica)	542,598	576,909	682,513
Salt	420,060	352,466	370,423
Silcrete	29,083	25,955	22,456
Stone, sand and gravel, n.e.s.:			
Dimension stone, marble	14,029	11,969	3,237
Crushed and broken:			
Granite:			
Sawn slabs [3]	24,606	34,891	23,278
Rough blocks [3]	253,935	239,970	270,140
Limestone [3]—thousand tons	r 11,519	12,177	13,363
Shale—do	358	453	572
Sulfur, elemental byproduct e	12,000	13,000	13,000
Talc and related materials:			
Pyrophyllite (wonderstone)	4,821	3,333	2,059
Talc	7,568	8,438	8,760
Vermiculite	121,896	132,070	147,903
MINERAL FUELS AND RELATED MATERIALS			
Carbon black e	26,200	28,000	29,000
Coal:			
Anthracite—thousand tons	1,678	1,841	1,336
Bituminous—do	52,934	56,825	57,104
Total—do	54,612	58,666	58,440
Coke:			
Oven and beehive e—do	3,185	3,200	3,300
Gashouse, low and medium temperature—do	e 100	e 100	101
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	19,962	[4] 22,778	NA
Jet fuel—do	792	[4] 623	
Kerosine—do	2,266	[4] 2,991	
Distillate fuel oil—do	14,551	[4] 15,828	
Residual fuel oil—do	13,975	[4] 15,298	
Lubricants—do	782	[4] 710	
Other—do	3,154	[4] 3,438	
Refinery fuel and losses—do	5,181	[4] 5,127	
Total—do	60,663	[4] 66,793	NA

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Previously reported incorrectly as electrolytic nickel.
[2] Revised to none.
[3] Local sales plus exports (actual production not reported).
[4] Output of four refineries; excludes production by The National Petroleum Refineries of South Africa Ltd. (NATREF) refinery at Sasolberg, commissioned in 1971, for which data are not available.

TRADE

The Republic of South Africa's balance of payments position was aided significantly by export sales of mineral commodities during 1972. The effect of devaluing the rand in December 1971 led to a better competitive position and higher prices for exported mineral commodities. Imports fell because of higher prices and increased output, fabrication, and consumption of domestically produced mineral products. According to Department of Mines statistics, exports of crude mineral commodities were valued at $524 million in 1972, compared with $486 million in 1971. Export value of all mineral products increased significantly, mainly because of higher free market gold prices, a buoyant diamond market, and a turnaround in platinum sales in response to world interest in auto emission control. Antimony, nickel, silver, uranium, and vanadium registered gains in export earnings in 1972. Iron and steel raw materials—coal, chromite, manganese, iron ore, and fluorspar—showed declines whereas the export value of ferroalloys and semimanufactures increased dramatically. Crude oil imports continued to adversely affect the trade balance spurring the search for domestic oil. Although crude oil imports decreased 5.6% in 1972, the cost increased almost 15% (in terms of rand) to $169 million.

Table 2.—Republic of South Africa: Mineral products trade

(Million dollars)

Products	Exports		Imports	
	1971[r]	1972	1971[r]	1972
Mineral products	311	301	300	289
Chemicals and allied products	77	92	262	258
Articles of stone, etc., ceramic products, glass, and glassware	12	13	47	43
Precious and semi-precious stones, jewelry	271	417	25	32
Base metals and products	307	370	330	210
Total	978	1,193	964	832

[r] Revised.

Source: Commerce and Industry. V. 31, No. 9, May 1973, pp. 313–316.

Table 3.—Republic of South Africa: Export of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide and hydroxide	2	2	NA.
Metal, including alloys:			
Scrap	421	962	Japan 374; West Germany 246; France 131.
Unwrought and semimanufactures	2,977	2,317	NA.
Antimony, ore and concentrate	27,522	10,704	United States 5,475; United Kingdom; 5,077; Japan 102.
Arsenic trioxide, pentoxide and acids	472	1,783	United Kingdom 1,417; United States 181; Australia 172.
Chromium:			
Chromite—thousand tons	1,033	1,210	United States 377; Japan 355; West Germany 158.
Oxide and hydroxide	15	16	NA.
Copper:			
Ore and concentrate	16,455	10,743	Japan 10,397.
Matte	84	--	
Metal, including alloys:			
Scrap	72	116	NA.
Unwrought:			
Blister and other unrefined [2]	58,558	61,211	United States 20,519; Japan 19,362; Belgium 11,197.
Refined [2]	59,363	67,195	West Germany 34,683; United Kingdom 22,186; Italy 3,580.
Master alloys	--	2	NA.
Semimanufactures	3,325	3,267	NA.
Gold, metal, unworked or partly worked [3]—troy ounces	3,768	1,597	NA.

See footnotes at end of table.

Table 3.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Iron and steel:			
Ore and concentrate [2]—thousand tons	5,527	5,545	Japan 5,470.
Metal:			
Scrap	12,164	6,511	NA.
Pig iron	454,786	371,868	Japan 358,440; United States 9,488.
Spiegeleisen	1,301	--	
Sponge iron, powder and shot	282	234	NA.
Ferroalloys:			
Ferromanganese	213,424	170,082	United States 94,676; United Kingdom 19,952; Italy 17,367.
Ferrochrome	87,828	88,911	United States 32,315; Canada 16,551; West Germany 8,613.
Ferrosilicon	10,531	8,536	Australia 2,957; United Kingdom 913.
Other	11,009	5,993	West Germany 4,122; Australia 938.
Ingots and other primary forms	21,503	801	NA.
Semimanufactures:			
Bars and rods	44,116	19,781	NA.
Angles, shapes and sections	73,765	40,270	NA.
Plate and sheet	177,035	159,001	NA.
Hoop and strip	2,299	5,068	NA.
Rails and accessories	41,885	27,061	NA.
Wire	11,504	9,289	NA.
Tubes, pipes, and fittings	18,738	19,060	NA.
Castings and forgings	1,452	492	NA.
Total	370,794	280,022	
Lead: [2]			
Concentrate:			
Lead	9,264	2,540	United Kingdom 1,046; Japan 958; Netherlands 535.
Lead, vanadium	2,453	5,765	All to West Germany.
Oxide	158	100	NA.
Metal including alloys:			
Unwrought	48,306	60,782	Italy 22,301; United States 12,280; United Kingdom 9,968.
Semimanufactures	96	94	NA.
Magnesium, metal, scrap	92	134	United States 110.
Manganese:			
Ore and concentrate—thousand tons	2,005	2,623	Japan 1,020; Netherlands 558; France 335.
Oxides	27	16	NA.
Metal, electrolytic	8,857	9,782	Canada 2,613; United States 1,689.
Mercury—76-pound flasks	(4)	28	NA.
Nickel:			
Ore and concentrate	16	--	
Matte speiss and similar materials	--	349	Norway 324; Argentina 25.
Metal, including alloys:			
Scrap	41	12	NA.
Unwrought	3,454	4,801	United Kingdom 1,645; Italy 853; Netherlands 836.
Semimanufactures	185	187	NA.
Silver:			
Waste and sweepings [5]—troy ounces	261,767	592,799	United Kingdom 592,589.
Metal, including alloys [5] thousand troy ounces	2,500	3,574	NA.
Tin:			
Ore and concentrate—long tons	3,091	3,141	United Kingdom 2,339; Netherlands 742.
Metal, including alloys:			
Scrap—do	238	32	NA.
Unwrought and semimanufactures do	61	51	NA.
Titanium oxide	221	848	NA.
Tungsten:			
Ore and concentrate	185	192	West Germany 148; United Kingdom 24.
Metal, including alloys, all forms	26	15	Ireland 3.
Vanadium, pentoxide (fused) [6]	5,392	3,619	Japan 1,663; United Kingdom 498; Austria 435.
Zinc:			
Ore and concentrate [2]	r 26,957	22,721	Belgium 14,786; United States 5,430; West Germany 2,465.
Oxide	780	365	NA.
Metal, including alloys:			
Scrap, dust and powder	735	736	NA.
Unwrought and semimanufactures	56	40	NA.

See footnotes at end of table.

Table 3.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Other:			
Ore and concentrate:			
Of base and precious metals, n.e.s	1,060	1,208	United States 789; West Germany 249; Belgium 148.
Of molybdenum, tantalum, titanium, vanadium and zirconium	5,656	2,260	United States 1,012; West Germany 667.
Ash and residue containing nonferrous metals	4,540	1,597	West Germany 580; United Kingdom 335; Netherlands 238.
Waste and sweepings of precious metals troy ounces	1,275	--	
Metal, including alloys:			
Alkali, and alkaline earth kilograms	134	522,047	All to Japan.
Base metals, n.e.s	280	232	United Kingdom 62; Netherlands 45; France 25.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	15	20	NA.
Grinding and polishing wheels and stones	304	278	NA.
Asbestos	290,380	299,802	Japan 65,278; United Kingdom 46,847; United States 23,551.
Barite	63	84	NA.
Cement	58,231	54,942	NA.
Chalk	90	1,466	NA.
Clays and clay products:			
Crude clays, n.e.s.:			
Andalusite, kyanite and sillimanite	49,490	50,807	United Kingdom 20,106; Japan 13,077; West Germany 6,270.
Other	253,586	268,535	United Kingdom 41,198.
Products:			
Refractory	36,382	36,608	NA.
Nonrefractory [7]	1,384	787	NA.
Diamond:			
Gem, unworked and worked thousand carats	2,906	2,968	United Kingdom 2,348; Belgium 221; United States 200.
Industrial:			
Natural do	8,038	5,608	United Kingdom 4,394; Ireland 601; Netherlands 405.
Manufactured do	4,642	5,732	Ireland 5,032; West Germany 489.
Diatomite	245	46	NA.
Feldspar	15,661	13,972	United States 5,418; West Germany 3,006; Italy 2,460.
Fertilizer materials:			
Crude:			
Natural nitrate	1	5	NA.
Phosphate rock	229	2,208	NA.
Other	1,589	3,576	West Germany 1,978; Belgium 1,402.
Manufactured:			
Nitrogenous	65,486	57,283	NA.
Phosphatic	7,467	76,855	NA.
Potassic	5	920	NA.
Other	2,244	1,321	United Kingdom 915.
Ammonia	3,140	2,751	NA.
Fluorspar	120,381	180,301	Japan 125,132; Australia 14,217; West Germany 12,961.
Graphite, natural	271	388	NA.
Gypsum and plasters	15,492	14,543	NA.
Lime	4,618	5,877	NA.
Magnesite	2,367	2,222	NA.
Mica:			
Crude, including splittings and waste	8,967	7,549	United Kingdom 4,547; West Germany 732; France 658.
Worked including agglomerated splittings value thousands	$20	$12	NA.
Pigments, mineral:			
Natural, crude	1,153	859	United Kingdom 694.
Iron oxides, processed	369	156	NA.
Precious and semiprecious stones, except diamond:			
Precious thousand carats	1,741	580	Switzerland 534; United Kingdom 6.
Semiprecious kilograms	460,370	771,580	West Germany 368,937; Japan 122,081; United States 60,695.
Salt	43,013	44,555	NA.

See footnotes at end of table.

Table 3.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Sodium and potassium compounds, n.e.s.:			
Caustic soda	105	120	NA.
Caustic potash	114	49	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	2,412	700	NA.
Granite	218,718	213,496	France 46,810; Japan 41,651; Italy 35,464.
Slate	935	753	NA.
Worked including slate	66	809	NA.
Dolomite, chiefly refractory grade	2,626	2,259	NA.
Gravel and crushed rock	865	293	NA.
Limestone except dimension	9,066	13,924	NA.
Quartz and quartzite	1,091	1,979	United States 748; Netherlands 741.
Sand, excluding metal bearing	2,329	1,882	NA.
Sulfur:			
Elemental:			
Other than colloidal	517	115	NA.
Colloidal	2	[4]	NA.
Sulfuric acid	406	1,741	NA.
Talc and steatite	930	351	NA.
Vermiculite	115,768	123,640	United Kingdom 29,007; Italy 21,034; United States 16,447.
Nonmetals, n.e.s.:			
Crude	15,427	10,225	Netherlands 3,093; United Kingdom 3,016; West Germany 1,251.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture	20,076	44,324	West Germany 12,190; United States 9,283; Austria 7,568.
Building materials of asphalt, asbestos and fiber cement and unfired nonmetals, n.e.s.—value	$705,155	$831,061	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	4,630	13,322	NA.
Carbon black and gas carbon	3,458	4,215	NA.
Coke and briquets:			
Anthracite	1,202,970	1,167,065	Netherlands 243,417; Italy 210,368; West Germany 197,200.
Other	658,872	764,350	NA.
Coke and semicoke	94,198	50,895	NA.
Gas, hydrocarbon, natural and manufactured	2,707	1,575	NA.
Petroleum refinery products:			
Gasoline, motor—thousand 42-gallon barrels	129	161	Ship and aircraft stores 26.
Kerosine and jet fuel—do.	542	612	Ship and aircraft stores 541.
Distillate fuel oil—do.	1,581	1,494	Ship and aircraft stores 1,190.
Residual fuel oil—do.	20,682	21,886	Ship and aircraft stores 21,881.
Lubricants (including grease)—do.	463	466	NA.
Mineral jelly and wax—do.	101	104	United States 47; West Germany 19; United Kingdom 11.
Nonlubricating oils—do.	6	9	NA.
Pitch—42-gallon barrels	1,903	1,084	NA.
Bitumen and other residue—thousand 42-gallon barrels	47	73	NA.
Bituminous mixtures, n.e.s.—do.	65	27	NA.
Tar distilled from coal, from lignite or from peat, and other mineral tar	2,083	859	NA.

r Revised. NA Not available.

[1] Source: Foreign Trade Statistics. V. 1, 1971, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.

[2] Partially or wholly from Botswana, Lesotho, Swaziland, or the Territory of South-West Africa.

[3] Industrial gold only, excluding large quantities if monetary gold not reported officially in trade statistics.

[4] Less than ½ unit.

[5] Includes platinum.

[6] See lead for concentrate.

[7] Excluding material reported in original source in square yards.

Table 4.—Republic of South Africa: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite	r 14,047	24,254	Australia 9,525.
Oxide and hydroxide	r 15,167	77,677	Greece 48,794; France 27,126; Japan 744.
Metal, including alloys:			
Unwrought	49,119	22,500	Canada 17,476; Norway 3,367; Australia 684.
Semimanufactures	r 14,218	11,406	United States 3,588; West Germany 2,557; Belgium 942.
Arsenic:			
Oxides and acids	20	74	NA.
Metal	73	71	NA.
Chromium:			
Chromite	r 21,977	21,423	NA.
Oxide and hydroxide	6	32	NA.
Cobalt, oxide and hydroxide	13	13	NA.
Copper:			
Ore and concentrate	7,372	2,319	NA.
Metal including alloys:			
Scrap	47	41	NA.
Unwrought	1,170	5,231	NA.
Semimanufactures	2,644	3,675	United Kingdom 1,557; Canada 411; West Germany 373.
Gold, metal unworked or partly worked troy ounces	7,821	10,223	United Kingdom 5,847; West Germany 1,160.
Iron and steel:			
Ore and concentrate	9	--	
Metal:			
Scrap	5,223	29,146	NA.
Pig iron, ferroalloys, and similar materials	r 13,635	13,470	NA.
Steel ingots and other primary forms	r 113,547	74,477	NA.
Semimanufactures:			
Bars and rods	55,385	291,104	Japan 115,121; France 72,295; United Kingdom 62,635.
Angles, shapes and sections	18,759	71,875	Japan 26,101; Belgium 20,960; United Kingdom 14,438.
Plate and sheet	139,383	318,570	Japan 212,676; United Kingdom 68,078; France 15,582.
Hoop and strip	r 8,547	23,844	Japan 18,406; United Kingdom 2,879; West Germany 803.
Rails and accessories	5,527	37,421	United Kingdom 30,627; West Germany 3,695; Belgium 605.
Wire and wire rod	10,945	19,480	Belgium 6,802; Australia 2,357; United Kingdom 1,825.
Tubes, pipes and fittings	r 39,208	68,156	Japan 43,406; United Kingdom 13,404; West Germany 3,793.
Castings and forgings, rough	3,995	3,384	United Kingdom 1,251; France 603; Belgium 500.
Total	r 281,749	833,834	
Lead:			
Oxides	82	157	Mexico 100.
Metal including alloys:			
Scrap	5,497	2,047	Ceylon 276; Canada 187; Australia 67.
Unwrought	10,493	10,628	NA.
Semimanufactures	121	192	NA.
Magnesium, metal including alloys all forms	612	331	Norway 210; United States 104.
Manganese:			
Ore and concentrate	1,797	277	NA.
Oxides	977	412	Japan 187; United Kingdom 152.
Mercury 76-pound flasks	1,024	1,486	Spain 810; Mexico 348; United Kingdom 143.
Molybdenum, metal including alloys all forms	9	17	Austria 7; Italy 4; United Kingdom 4.
Nickel:			
Ore and concentrate	--	41	NA.
Metal, including alloys, all forms	561	620	United Kingdom 386; West Germany 80; Japan 72.
Platinum-group metals, including alloys all forms troy ounces	3,223	10,086	West Germany 6,453; United Kingdom 2,596.
Silicon and tellurium	563	469	France 134; Sweden 131; Norway 105; Canada 68.

See footnotes at end of table.

Table 4.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Silver:			
Waste and sweepings_____troy ounces__	175	5,518	United Kingdom 5,301; Italy 192.
Metal including alloys, all forms__do____	253,169	746,007	United Kingdom 227,568; Australia 134,475; West Germany 116,981.
Tin:			
Ore and concentrate_____long tons__	141	217	NA.
Oxides_____do____	55	18	United Kingdom 14.
Metal:			
Scrap_____do____	(2)	8	NA.
Unwrought and semimanufactures do____	453	507	NA.
Titanium (ilmenite):			
Ore and concentrate_____	144	297	Australia 272.
Oxides_____	975	991	West Germany 405; Norway 290.
Tungsten:			
Ore and concentrate_____	594	481	NA.
Metal, including alloys, all forms_____	125	70	United Kingdom 10; Australia 10.
Zinc:			
Ore and concentrate_____	11,538	34,851	United States 10,902; Australia 7,607.
Oxides_____	188	144	West Germany 80; United Kingdom 41.
Metal including alloys:			
Scrap, including powder and dust___	2,063	1,106	NA.
Unwrought_____	24,894	17,598	Australia 3,308; United Kingdom 96.
Semimanufactures_____	6,022	94	West Germany 24.
Zirconium ore and concentrate_____	620	530	Australia 509.
Other:			
Ore and concentrate of:			
Molybdenum, tantalum and vanadium_____	145	107	Chile 84; Brazil 20.
Other base metals, n.e.s_____	2,007	1,739	Australia 1,550; Brazil 108.
Ash and residue containing nonferrous metals_____	1,208	6,236	Australia 1,066; Mexico 500; United States 422.
Oxides, hydroxides and peroxides of metals, n.e.s_____	263	280	United States 184; West Germany 38; United Kingdom 32.
Elemental boron, phosphorous and/or selenium_____	100	132	United Kingdom 70; West Germany 35; Japan 6.
Metals, including alloys, all forms:			
Alkali, alkaline earth and rare-earth metals_____	13	28	United Kingdom 26.
Pyrophoric alloys_____	9	9	West Germany 2; United Kingdom 2.
Base metals, including alloys all forms, n.e.s. [3]_____	471	394	United Kingdom 142; Japan 71; Belgium 28.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc__	4,474	1,313	NA.
Grinding and polishing wheels and stones_	456	613	West Germany 216; United Kingdom 106; Italy 44; Japan 43.
Asbestos_____	17,191	11,792	NA.
Barite_____	1,823	2,510	West Germany 747; Israel 392; United Kingdom 154.
Boron materials:			
Crude natural borates_____	1,285	1,250	United States 917.
Acid_____	745	751	United States 409; France 257.
Bromine_____	22	17	NA.
Cement_____	277,176	224,957	United Kingdom 85,085; Belgium 63,862; Denmark 8,578.
Chalk_____	4,522	5,818	France 4,531; United Kingdom 716; West Germany 210.
Clays and products:			
Crude clay and refractory minerals_____	15,104	22,608	NA.
Products:			
Refractory_____	17,290	20,413	West Germany 5,509; United Kingdom 4,949; Austria 3,930.
Nonrefractory_____	8,161	13,857	NA.
Cryolite and chiolite_____	86	982	Australia 907.
Diamond:			
Gem_____carats__	51,344	114,202	United Kingdom 97,649.
Industrial_____thousand carats__	3,369	2,560	United Kingdom 932; Ireland 792.
Diatomite and other infusorial earth_____	r 4,900	4,728	United States 4,544.
Feldspar, leucite and nepheline syenite_____	78	62	NA.

See footnotes at end of table.

Table 4.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	681	599	West Germany 569.
Phosphatic	32	4	NA.
Potassic	93,655	209,413	France 44,896; Israel 44,801; West Germany 42,123.
Other	5	234	NA.
Manufactured:			
Nitrogenous	2,488	33,578	Netherlands 21,782; Australia 4,776; West Germany 2,381.
Phosphatic:			
Thomas slag	11,392	14,303	All from Belgium.
Other	1,095	34	NA.
Potassic	67,346	45,197	West Germany 35,250.
Other, including mixed	12	15	NA.
Graphite, natural	326	420	Norway 213; Ceylon 97.
Gypsum and plaster	6,433	5,911	West Germany 4,161; United Kingdom 1,262.
Lithium minerals, not further described	586	2,523	NA.
Lime	405	407	NA.
Magnesite	110,326	142,838	NA.
Mica:			
Crude, including splittings and waste	676	1,209	NA.
Worked, including agglomerated splittings	63	48	United Kingdom 31.
Pigments, mineral:			
Natural, crude	522	726	United Kingdom 292; Austria 289; West Germany 134.
Iron oxides, processed	3,458	3,574	West Germany 3,045; United Kingdom 237.
Precious and semiprecious gem stones, except diamond—value, thousands	$1,145	$1,447	NA.
Pyrite	14	14	NA.
Salt	2,676	2,629	United Kingdom 1,973.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	22,723	38,883	United States 26,335; Netherlands 4,773; United Kingdom 2,577.
Caustic potash	658	836	West Germany 348; France 165; Czechoslovakia 120.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	894	583	Italy 463.
Other	177	193	NA.
Worked	1,895	2,574	Italy 1,810; Portugal 294.
Dolomite	247	517	Japan 150.
Gravel and crushed stone	3,197	51,570	NA.
Limestone	514	100	NA.
Quartz and quartzite	41	183	NA.
Sand, excluding metal bearing	541	931	United States 201.
Sulfur:			
Elemental:			
Other than colloidal	167,584	210,866	France 48,399; United States 25,715; Canada 10,143.
Colloidal	338	421	West Germany 265; United Kingdom 145.
Sulfur dioxide	26	5	NA.
Sulfuric acid	7,099	19	NA.
Talc and steatite	2,050	2,785	Italy 1,158.
Other nonmetals, n.e.s.:			
Crude	1,042	1,577	Australia 718; United Kingdom 183; Japan 121.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	38,969	32,084	Canada 30,933.
Slag and ash, n.e.s	266	75	United States 46.
Oxides and hydroxides of magnesium, strontium and barium	186	208	United States 46; United Kingdom 45.
Iodine and fluorine	4	14	United Kingdom 4; Belgium 3.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,724	7,669	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	18,034	7,785	United States 2,652.
Carbon and carbon black	4,569	5,291	United States 2,957; Australia 910; Canada 601.
Coal, all grades, including briquets	60,720	86,872	NA.
Coke and semicoke	7,536	2,362	NA.
Gas, hydrocarbon, natural	851	67	NA.

See footnotes at end of table.

Table 4.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Hydrogen and rare gases	33	36	France 9.
Peat	351	283	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	63,661	90,978	NA.
Refinery products:			
Gasoline, motor do	3,295	3,833	NA.
Kerosine, including jet fuel and white spirit do	2,943	2,463	NA.
Distillate fuel oil do	4,308	6,191	Australia 343; United Kingdom 238.
Residual fuel oil do	8,252	11,162	United States 224; France 174.
Lubricant including grease do	1,040	1,290	United States 641; United Kingdom 213; Netherlands 126.
Jelly and wax do	237	251	United States 105; Japan 63; West Germany 48.
Other:			
Nonlubricating oils, n.e.s. do	5,346	3,643	Netherlands 65; United Kingdom 15; United States 11.
Pitch 42-gallon barrels	4,983	4,466	United Kingdom 4,285.
Petroleum coke do	33,468	23,788	United Kingdom 11,198; United States 9,603; West Germany 2,987.
Bitumen and other residue do	17,720	16,344	Netherlands 5,963; United States 5,587.
Bituminous mixture, n.e.s. do	2,085	3,715	United States 2,048.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand 42-gallon barrels	269	232	Netherlands 66; Netherlands Antilles 60; Japan 46.

r Revised. NA Not available.

[1] Source: Foreign Trade Statistics. V. 1, 1970, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.

[2] Less than ½ unit.

[3] Includes some manufactures, not separable from unwrought and semimanufactures in source.

Table 5.—Republic of South Africa: Major domestic mineral sales in 1972 [1]

Commodity	Value (thousands)
METALS	
Chromite	$2,919
Copper	44,943
Iron ore	18,200
Manganese ore	8,626
Nickel	7,721
Tin	2,425
NONMETALS	
Andalusite and sillimanite	714
Asbestos	3,721
Clays	2,909
Feldspar	757
Fluorspar	746
Gypsum	1,423
Limestone	15,158
Lime products, burnt	12,387
Magnesite	886
Phosphate rock	15,954
Pyrite (for sulfur)	3,605
Salt	4,800
Silica [2]	3,162
Slate	1,314
Stone, dimension	1,035
MINERAL FUELS AND RELATED MATERIALS	
Coal	153,559
MISCELLANEOUS	
Other minerals	58,740
Total	365,704

[1] Does not include gold, silver, and diamond for which data are not available.

[2] Includes silcrete.

Source: Republic of South Africa, Department of Mines. Quarterly Information Circular. October–December 1972, pp. 29–30.

Table 6.—Republic of South Africa: Major mineral exports in 1972

Commodity	Value (thousands)
METALS	
Antimony, concentrates	$14,303
Chromite	13,527
Copper	105,809
Gold [1]	1,499,770
Iron ore	20,996
Manganese ore	39,599
Nickel	25,751
Silver [1]	5,319
Tin, concentrate	4,433
Vanadium [2]	27,523
NONMETALS	
Andalusite and sillimanite	1,041
Asbestos	45,453
Clays	4,067
Diamond [1]	116,406
Feldspar	595
Fluorspar	5,003
Gem stones, semiprecious	360
Limestone	627
Mica	381
Salt	471
Stone, dimension	9,695
Vermiculite	3,380
MINERAL FUELS AND RELATED MATERIALS	
Coal	10,370
MISCELLANEOUS	
Other minerals [3]	189,965
Total	2,144,844

[1] Total value, including domestic sales, if any.

[2] Includes slag, polyvanadate and metavanadate, fused pentoxide, ferrovanadium, and Carvan.

[3] Mainly platinum and uranium.

Source: Republic of South Africa, Department of Mines. Quarterly Information Circular. October–December 1972, pp. 31–32.

COMMODITY REVIEW

METALS

Aluminum.—The first full year's operation of the Alusaf (Pty.) Ltd. smelter at Richards Bay resulted in a dramatic reduction in the Republic of South Africa's imports of aluminum ingot, rolling slabs, and extrusion billets. Production was 52,000 tons—3,000 tons below total domestic consumption.[4] In July, the company announced plans to increase capacity by 40%, to 75,000 tons annually to satisfy rising domestic requirements. Alumina for the smelter, presently imported through Durban Harbor and shipped by rail to Richards Bay, will be received directly at Richards Bay Harbor by mid-1976 at a rate of 150,000 tons annually, possibly increasing to 200,000 tons by 1980.[5] Alusuisse (Swiss Aluminum Ltd.) has a 20-year contract, valued at $280 million, to supply Alusaf with alumina from its Gove operation in Australia, beginning in 1973.

Alcan Aluminium of South Africa Ltd. dominated aluminum semifabricating in the country, consuming most of Alusaf's aluminum production. The company's facilities at Pietermaritzburg have a combined capacity of 35,000 tons per year and construction of new extrusion heat treatment facilities began at midyear.[6]

Antimony.—Consolidated Murchison Ltd., the non-Communist world's largest and the Republic of South Africa's only antimony producer, milled 547,000 tons of ore yielding 24,109 tons of concentrate in 1972, up slightly from 1971 production. A new shaft was planned at the Weigel ore body to exploit the central and older part of the mine. Sinking was to commence early in 1973 with completion in 1975.

Exports of antimony concentrate increased threefold in 1972, reducing Consolidated Murchison's stockpile from 17,631 tons in 1971 to 7,403 tons at yearend 1972. Demand was strong for antimony oxide, particularly in the United States where legislation required 1973 cars to have flame retardant interior trim.

A new company, Antimony Products (Pty.) Ltd. was registered in March. This new company was believed to have been formed by Consolidated Murchison's technical managers (Johannesburg Consolidated Investment Co. Ltd.), the secretaries (Anglo-Transvaal Consolidated Investment Co. Ltd.), and a principal overseas customer for the purpose of establishing a smelter and refinery in the vicinity of the mine to convert concentrate to antimony oxide for sale in domestic and foreign markets.

Chrome and Chromite.—Production fell 9.8% from 1971 levels, as the chrome market was adversely affected by a downturn in world economic activity. Local sales dropped from $3.8 million to $2.9 million and the value of exports from $16.9 million to $13.6 million. Increased local processing and beneficiation of ores to improve foreign earnings were urged by the Government to increase world demand for South Africa's immense reserves of lower-quality chrome-iron ratio ore.

African Metals Corp, Ltd. (Amcor), planned to increase monthly production at the Grasvally chrome mine from 3,000 tons to an estimated 20,000 tons of chrome concentrate by early 1976. When the expansion is completed 200,000 tons of concentrate per year will be for export and 50,000 tons for production of a high-carbon ferrochrome at a new ferroalloy plant at Witbank. A long-term contract to supply chrome concentrate to Mitsui of Japan was signed during the year.

Chrome Mines of South Africa Ltd. (CMSA) completed the extensions to the No. 1 concentration plant and the sinking of the No. 4 incline haulage to the sixth level at its Zwartkop mine, the country's largest chrome producer. At CMSA's Groothoek mine, sinking of the No. 5 incline shaft was suspended at a depth of 322 meters due to the weak chrome market. Consolidated Chrome Corp., Ltd., cut production during the year because a large stockpile of concentrate had accumulated.

Copper.—In 1972, copper production increased 2.8% and exports rose to a record 115,358 tons valued at $105.8 million; a new copper mine started production; and a new major copper discovery was announced.

At the Prieska copper-zinc mine, a joint

[4] Engineering and Mining Journal. V. 173, No. 11, November 1972, p. 164.
[5] Coal, Gold, and Base Minerals. V. 20, No. 4, June 1972, p. 31.
[6] Metal Bulletin. No. 17, May 1972, pp. 19–21.

venture of Anglovaal Consolidated Investments Co. Ltd., U.S. Steel Corp., and Middle Witwatersrand (Western Areas) Ltd. trial milling operations started in October. The milling rate was slated to reach 110,000 tons monthly by early 1973 and to attain full production of 227,500 tons in mid-1974 on commissioning of a second concentrating unit. At full production, approximately 115,000 tons of copper concentrate (26% Cu) and 100,000 tons of zinc (50% Zn) concentrate will be produced yearly. The entire copper production and three-quarters of its zinc output have been sold for the first 10 years of mine operation. The copper concentrate was sold to Norddeutsche Affinerie of West Germany, Azienda Minerali Metallici Italiane, S.p.A. (AMMI) of Italy, and O'okiep Copper Company of South Africa. The zinc concentrate was bought by A. G. Metall, Nordenham, West Germany, and the Zinc Corp. of South Africa Ltd. (ZINCOR). A 60-kilometer rail link, constructed from the mine to Upington, was to be completed in 1974. The concentrates will be transported by rail to Walvis Bay, in the Territory of South-West Africa for export.

Black Mountain Mineral Development Co. Ltd., a subsidiary of Phelps Dodge Corp., announced the discovery of a major copper-lead-zinc-silver mineralized zone in northwestern Cape Province. In August the company purchased 34,000 acres at the discovery site. Exploratory drilling indicated a deposit of about 70 million tons, averaging 0.8% copper, 2.2% lead, 0.44% zinc, and 0.5% ounce of silver per ton. Feasibility studies for a large open pit mine were begun in the latter part of the year.

Palabora Mining Co. Ltd., the largest copper producer in the Republic of South Africa, produced nearly 100,000 tons of copper in 1972 and had record sales of 102,921 tons. The average price realized per ton of copper was $1,008 whereas the c.i.f. cost of anodes produced was only $443, up $55 from 1971, but still one of the world's lowest production costs. Modifications to the tank house bus bars increased refined copper capacity by 17%.

Copper output at the Messina mine was 11,000 tons, the same as in 1971. Ore reserves at 5,343,000 tons were unchanged, but grade improved from 1.38% to 1.44% copper. Electric power shortages caused delays in operations in 1972. This condition will be corrected upon connection into the National Grid system in 1973.

O'okiep Copper Co. Ltd. produced 36,937 tons of blister copper (34,492 tons in 1971) from 3,147,100 tons of milled ore containing 1.28% copper. Reserves increased slightly to 25,436,000 tons of 1.56% copper. Water shortages caused by continuing drought, were expected to be alleviated in 1973 on completion of a 108-kilometer water pipeline from the Orange River. The company entered into a 10-year contract, commencing in 1974, for the smelting of 50,000 tons per year of copper concentrate produced by Prieska Copper Mines (Pty.) Ltd. Smelter facilities were to be expanded in 1973 to handle the additional concentrate.

Gold.—Working profits increased $238.4 million to $708.7 million in 1972, although production of gold declined by almost 7%. The total value increased to a record $1,500 million, as a result of increasing gold prices in the world market. The average price per ounce of gold realized was $51.50, an increase of $11.10 over that of 1971.

The higher return on the sale of gold permitted most operators to mine lower grade ores, thereby extending the life of the mines and increasing reserves. The expected life of Union Corp. Ltd.'s Grootvlei mine, for example, was extended from 1 year to 5 or 6 years.[7] The Republic of South Africa's total ore reserves increased 6.4% in 1972, but the average grade or ore was down slightly.

Working costs per ton milled were 11.5% higher than in 1971, owing to wage increases for all mine personnel and to higher costs of stores and materials. The labor supply remained tight, affecting production at some mines. Skilled workers were particularly in short supply.

Eighteen mines, producing about 12% of the Republic's total gold output, received state assistance during 1972, but the amount of assistance paid to these mines decreased considerably through the year as the gold price rose.

The East Driefontein mine of Gold Fields of South Africa Ltd. (GFSA) was officially opened in October. This opening was delayed more than a year because of

[7] Union Corp. Ltd. Annual Report, 1972, Mar. 13, 1973, p. 25.

the 1968 flooding of the adjacent West Driefontein mine. Although ore from its own lease area was not available until late in the year, milling commenced at the East Driefontein plant in April at a rate of about 47,000 tons per month of ore under an agreement with West Driefontein Gold Mining Co. Ltd., which leased the Ventersdorp Contact Reef in West Driefonteins' No. 4 shaft area on a royalty basis until March 1973. The milling rate was about 90,000 tons per month at yearend and was planned at 181,000 tons by 1976.[8]

Heavy rains in January caused flooding of the lower levels of Gold Fields' Vlakfontein mine and Anglo American Corp. (AAC) South African Lands mine. Vlakfontein was able to control the inrush of water, but South African Lands was less fortunate. By March, 85% of the underground workings were flooded. The mine was dewatered, but full production was not expected until March 1973. Vlakfontein's production for the year fell 96,450 ounces to 192,994 ounces while South African Lands' output was down 218,625 ounces to only 145,344 ounces. Two fires, one in January and the other in December, disrupted production at GFSA's West Driefontein mine, reducing planned ore output by 239,000 tons.

All development at AAC's East Daggafontein mine ceased in 1971, although mining operations continued throughout 1972 and were expected to end early in 1973. Reclamation continued at the waste rock dump.

At Western Deep Levels mine, workings were extended to a new record depth of 3,476 meters exceeding that of East Rand Proprietary Mines Ltd. by 44 meters. At AAC's President Steyn mine, the new No. 4 shaft, measuring 10.2 meters by 11 meters in cross section, was sunk to a depth of 2,366 meters. This shaft, reportedly the world's deepest single lift and largest capacity, was designed to hoist 246,000 tons of rocks per month and handle over 7,000 men and 340 cars of material per day.[9]

AAC began shaft-sinking operations in the northern section of the Vaals Reef mine in October. The new No. 5 shaft will be sunk to a depth of 2,159 meters with completion scheduled for June 1974. Initial production of 100,000 tons per month was targeted for March 1975. The Cooke section, No. 1 shaft systems of Randfontein Estates Ltd., reached its final depth of 927 meters in December. Production was expected to begin in late 1973, reaching a milling rate of 68,000 tons per month in 1974.[10]

In July 1972, under the terms of a merger agreement, Hartebeestfontein Gold Mining Co. Ltd. acquired the assets and mining lease of Zandpan Gold Mining Co. Ltd. Hartebeestfontein also suffered underground fires and production in the last

Table 7.—Republic of South Africa: Gold output, by major producer, in 1972
(Troy ounces)

Company or mine	Production
Barberton	45,365
Blyvooruitzicht	1,051,537
Bracken	396,781
Buffelsfontein	1,094,619
City Deep	75,464
Consolidated Main Reef	21,940
Crown Mines	81,869
Doorhfontein	655,977
Durban Deep	355,510
East Daggafontein	277,557
East Driefontein	340,797
East Rand Proprietary Mine Ltd	557,123
Elsburg	300,255
Freddies Consolidated	469,854
Free State Geduld	1,578,558
Free State Saaiplaas	546,932
Grootvlei	222,708
Harmony	995,804
Hartebeestfontein	1,097,876
Kinross	473,596
Kloof	921,548
Leslie	358,397
Libanon	651,460
Loraine	355,899
Marievale	238,848
President Brand	1,400,578
President Steyn	1,055,003
St. Helena	1,035,343
South African Land and Exploration Co. Ltd	145,344
Stilfontein	633,134
Vaals Reefs	2,122,332
Venterspost	370,575
Virginia	332,297
Vlakfontein	192,994
Welkom	733,454
West Driefontein	2,418,382
Western Areas	618,258
Western Deep Levels	1,938,057
Western Holdings	1,743,613
West Rand Consolidated	197,386
Winkelhaak	602,806
Witwatersrand Nigel Ltd	42,548
Zandpan [1]	161,631
Miscellaneous	306,129
Total	29,216,138

[1] January–June only; merged with Hartebeestfontein from July 1, 1972.

Source: Chamber of Mines of South Africa. Reports, January–December 1972.

[8] Mining Journal. V. 279, No. 7156, Oct. 13, 1972, p. 283.
[9] South African Digest. Jan. 12, 1973, p. 3.
[10] South African Mining and Engineering Journal. V. 84, No. 4068, May 1972, p. 29.

Table 8.—Republic of South Africa: Salient statistics of gold and uranium production by members of the Chamber of Mines, Transvaal and Orange Free State

	1971	1972
Number of operating gold mines	45	43
Ore milled thousand tons	73,615	72,046
Production of gold:		
Gross weight thousand troy ounces	31,398	28,910
Per ton of ore milled troy ounces	.421	.401
Number of uranium-producing mines	11	10
Ore treated for uranium recovery thousand tons	14,253	14,609
Production of uranium oxide (U_3O_8):		
Gross weight thousand pounds	8,377	8,001
Per ton of ore milled pounds	.59	.55
Average realized gold price, per ounce [1]	$40.40	$51.50
Working profit, gold and uranium thousands	$470,254	$708,668
Taxes and lease fees payable to government do	$191,800	e $310,320
Net dividends	$184,080	$239,166
Average number of employees in service:		
Whites	37,614	37,120
Nonwhites	379,171	367,982
Mine development, including shaft sinking meters	891,200	835,967
Ore reserves, payable thousand tons	137,045	145,810
Average grade of reserves troy ounces per ton	.553	.516

e Estimate.
[1] Includes premiums from private sales.

Source: Chamber of Mines of South Africa. Reports and Accounts 1972, p. 41.

quarter of 1972 declined from 1,388,000 tons (milled in the previous quarter) to 668,000 tons. Merger discussions between Harmony Gold Mining Co. Ltd., Merriespruit (Orange Free State) Gold Mining Co. Ltd. were announced in December.

The largest gold investment company in the world, Anglo American Gold Investment Co. Ltd. (Amgold) was formed in May as a result of the merger between West Rand Investment Trust Ltd. and Orange Free State Investment Trust Ltd. Consolidated earnings of Amgold in 1972 were almost $35 million.

Iron and Steel.—Demand for steel products was sluggish but picked up at yearend. Overall shipments increased, but company profits were reduced drastically owing to rising production costs without benefit of a price increase until June 1, when a 10% increase was approved. Imports of rolled, drawn and forged steel products decreased as a direct result of declining market demand. Iron ore production increased, local sales were up, but exports declined.

The controversial Sishen-Saldanha iron-ore export project remained a major issue throughout the year. The project, tentatively approved by the Government, will be one of the largest development programs undertaken in the Republic for decades. Plans called for additional expansion of the Sishen mine, construction of a 700-kilometer railway line capable of carrying 15 million tons of iron ore per year, and development of a suitable ore-loading harbor at Saldanha. Costs were estimated at $600 million to $700 million. In May, ISCOR invited tenders for the first stage of the project, an ore-blending and loading plant at Sishen. The project's approval was greatly enhanced by ISCOR's announcement that it had reached agreement in principle with Austria's Vereinigte Österreichische Eisenund Stahlwerke A. G. (VÖEST) to construct a $399 million steel works with 1.5 million tons (5 million tons eventually) of annual semifinished steel capacity somewhere along the proposed Sishen-Saldanha Bay rail line.

An interim proposal to develop the St. Croix bulk carrier terminal at Port Elizabeth to serve independent iron ore producers was still being considered by the Government. The private sector argued that St. Croix would be required to promote non-government iron-ore exports and to take advantage of export opportunities while awaiting the completion of Saldanha Bay sometime after 1980. The proposal received a boost after Japanese steelmakers extended the deadline on new iron-ore contract negotiations with private producers to April 15, 1973.

Iron Ore and Concentrates.—Total iron ore production increased 7% to 11.2 million tons in 1972. Hematite production was slightly less than that of 1971, but magnetite production was up 35%, to 3.0 million tons. ISCOR had the largest output, shipping 5.8 million tons in fiscal 1972 (ending

June 30). In midyear, ISCOR announced its intention to increase annual iron ore production at the Sishen mine from 3.8 million to 9.6 million tons by 1980. Cost of the expansion, which would serve the two ISCOR steelworks (Pretoria and Vanderbijlpark) and one under construction (Newcastle), was estimated at $27 million.

In October, Palabora concluded an agreement with Bechtel Corp. (United States) for a feasibility study of a 320-kilometer pipeline to pump about 4 million tons of magnetite concentrate annually to the Mozambique coast. It was reported that Kobe Steel Ltd., Hammersley Iron Pty. Ltd. of Australia, and Palabora Mining Co. were studying a plan under which Palabora magnetite mixed with Hammersley iron ore would be pelletized at a new plant to be built at Dampier, Western Australia.[11] The pellets would be shipped to Kobe, Japan.

Table 9.—Republic of South Africa: Estimated iron ore resources

Ore grade	Metric tons (millions)	Main locality and/or geological formation
High grade hematite ores (+60% Fe)	4,500	Postmasburg area.
Magnetic quartzite deposits (30%–40% Fe)	113,000	Pretoria Series, Transvaal.
Banded ironstone deposits (25%–40% Fe)	1,810,000	Pretoria Series, Griqualand-West and Transvaal.
Titaniferous iron ore (52%–60% Fe)	1,810	Bushveld Igneous Complex, Transvaal.
Chrome-rich iron ore (20% Fe)	1,810	Bushveld Igneous Complex, Transvaal.
Magnetite associated with carbonatite (60% Fe)	90	Phalaborwa Igneous Complex.
Manganese iron ores	NA	Postmasburg area.

NA Not available.

Source: Coal, Gold and Base Minerals. V. 20, No. 3, May 1972, p. 51.

Iron and Steel Semimanufactures.—The Government-controlled ISCOR operation continued its $1.5 billion expansion program for increased steel output. Stage one of the program, costing $130 million and due for completion in 1976, combined modernization at the Pretoria and Vanderbijlpark plants with the initial phases for production of structural shapes at Newcastle. The second stage, up to 1980–81, deals mainly with production facilities for flat products and structural shapes at Newcastle. The first major units of the second stage are due to begin operating in 1977–78. With the completion of the second stage, ISCOR's capacity will be about 10.5 million tons of ingot per year.

According to ISCOR's annual report for the year ending June 30, total production of ingot steel amounted to 3,816,342 tons, a 9.7%-increase over that of 1971. The Vanderbijlpark works contributed 2.5 million tons, and the Pretoria works, 1.3 million tons. The Newcastle works produced 1.1 million tons of hot metal, of which 1 million tons was pig iron and 63,000 tons was ferromanganese.

An estimated 3,834,500 tons of rolled, drawn, and forged steel products were supplied to consumers in the Republic, the Territory of South-West Africa, and neighboring African states during the fiscal year. ISCOR supplied 68.4% of these products, other Republic of South Africa producers 22%, and 9.6% was from imports. For 1971, the percentages were 63.0%, 20.9%, and 16.1%, respectively.

Highveld Steel and Vanadium Corp. (HSV) increased hot metal production 35%, to 420,309 tons in 1972 (312,127 tons in 1971). The firm also produced 426,184 tons of continuous-cast semimanufactures and 315,768 tons of rolled products. HSV planned to expand its integrated works at Witbank by adding a sixth kiln, a fifth submerged arc iron melting furnace, and a fourth continuous-casting machine. The expansion will result in a 25% increase in the HSV's vanadium slag and steel output, all for the export market.

Ferroalloys.—Amcor expected to be in a position to export 300,000 tons of ferroalloys annually when its four additional 48 MVA furnaces are in production by the end of 1973. In April, Amcor commissioned a new ferrosilicon furnace, reportedly the largest in the Southern Hemisphere, at the Ferrometals Ltd. plant, Witbank. A second furnace, completed in December, increased production capacity

[11] World Mining. V. 8, No. 13, December 1972, p. 57.

for high-carbon ferrochrome to 125,000 tons annually. The other two new electric furnaces, for production of high-carbon ferromanganese, are being constructed at Amcor's Meyerton Works.

The chairman of Consolidated Africa Mine Ltd., announced late in the year that plans to erect a ferrochrome smelter at Belfast, Transvaal, had been deferred due to unfavorable market conditions and temporary oversupplies of ferrochrome.[12]

Manganese.—Manganese production, nearly static during the year, amounted to approximately 3.2 million tons. South African Manganese Ltd. (SAM) reported production of 1,980,858 tons and sales of 2,044,123 tons in 1972. Stocks of mixed ore on hand at the end of the year amounted to 599,124 tons, mainly lower grade material.

Associated Manganese Mines of South Africa, part of the Anglo-Transvaal group of companies, shipped 1,156,000 tons of ore during 1972, approximately one third of the country's total. Profits were increased, due to higher average prices and stronger demand in the third and fourth quarters from local ferromanganese producers. Opening of South Africa's first underground manganese mine, SAM's Wessel mine, was delayed 4 months owing to a high flow of water struck at 400 meters in the incline shaft. The mine was scheduled for production in April 1973 at a rate of 400,000 tons annually.

Electrolytic Metal Corp. (Pty.) Ltd. (EMCOR), a subsidiary of General Mining and Finance Corp. Ltd., planned to boost electrolytic manganese production from 12,000 tons per year to 17,500 tons by July 1973, making the company the world's largest producer.

Delta Manganese (Pty.), a newly formed subsidiary of Delta Metal Co. Ltd. of the United Kingdom, planned to erect and operate an electrolytic manganese plant at Nelpruit in the eastern Transvaal. Production was scheduled to start early in 1974 with an annual capacity of 16,000 tons, which will be expanded later to 28,000 tons.[13]

Nickel.—Nickel was produced as a by-product of platinum mining. Production decreased 1,101 tons in 1972, but the value of exported nickel rose almost $4.7 million to $25.8 million, mainly because of a mid-year increase of 15% in the producers' price. Metallurgical Processes (Pty.) Ltd., a subsidiary of Impala Platinum Mines Ltd., produced nickel powder and nickel master alloys for the foundry industry. Capacity of this plant was 4,000 tons per year.

Platinum.—The United States Environmental Protection Agency's decision in May against an auto industry request for postponement of exhaust emission controls, gave a boost to the Republic of South Africa's platinum mines. With a potential new market almost assured, conventional users began building up stocks against a possible tight supply position and a price rise. From July to the end of the year, the producers' price for platinum was $130 per ounce, $20 higher than during the first half of 1972. Rustenburg Platinum Mines Ltd.'s 1972 sales exceeded the previous year by about one-third, and a $13.8 million stockpile of metal built up in the previous 12 months was reduced about 84% by September.[14]

In July, the Ford Motor Co. signed an agreement with Engelhard Minerals & Chemicals Corp. (principal seller of Rustenburg's output) for 60% (about 500,000 ounces) of Ford's platinum requirements for automobile catalytic converters for the years 1975–77. Toyota Motor Co. of Japan contracted in November to buy 50,000 ounces yearly for model years 1975–77 from Rustenburg.[15] In order to meet the anticipated need of conventional (industrial and jewelry) and new exhaust control markets, Rustenburg decided in October to reinstate the 1970 expansion program to increase mine capacity to 1.3 million ounces yearly by December 1973. Estimated Rustenburg output for the year was 500,000 ounces of platinum, about half the 1972 capacity.

Impala Platinum, the country's second largest producer, signed a contract for platinum supply with General Motors Corp. in December. Impala will supply 300,000 ounces of platinum and 120,000 ounces of palladium annually during the period 1974–83. To meet this commitment, the company embarked on a major expansion program to increase the present capacity of

[12] Metal Bulletin. No. 5756, Dec. 5, 1972, p. 22.
[13] Metal Bulletin. No. 5715, July 11, 1972, p. 13.
[14] Engineering and Mining Journal. V. 174, No. 3, March 1973, p. 208.
[15] Rustenburg Platinum Mine. Chairman's Annual Review. Johannesburg, Republic of South Africa, Feb. 15, 1973.

the Bafokeng mines and the refineries from 350,000 ounces of platinum annually to 400,000 ounces in 1974 and to 700,000 ounces by 1977.[16] Impala was negotiating a contract with Toyota late in the year for 30,000 ounces annually over an undisclosed period.

The Lonrho Ltd., Falconbridge Mines Ltd. and Superior Oil Co. joint venture at the Western Platinum Mines Ltd. mine expanded annual capacity to 80,000 ounces of platinum and 34,000 ounces of palladium. At yearend Lonrho was holding talks with Gerald Metals Co. of Los Angeles regarding a possible sales agreement for Western Platinum's entire production.

Anglo-Transvaal Consolidated Investment and U.S. Steel Corp. planned to increase annual capacity at the Atok mine from 16,000 ounces to 35,000 ounces. No timetable was disclosed.[17]

Johnson, Matthey and Co. Ltd. and Rustenburg have agreed, subject to government approval, to form Matthey Rustenburg Refiners (Pty.) Ltd. in the Republic of South Africa to treat and refine the platinum and other metals from Rustenburg's platinum mining operations.[18] The new arrangement will afford an opportunity to improve techniques and rationalize the treatment and refining operations in the United Kingdom and the Republic of South Africa with significant cost advantages.

Silicon.—Formation of a new company, Silicon Smelters Pty. Ltd., to manufacture silicon metal, primarily for making aluminum alloys, was announced in October. Partners in the venture included Dowson and Dobson (Pty.) Ltd. (a subsidiary of African Oxygen), Alcan Aluminium, and Foote Mineral Co. The plant, to be constructed in the Pietersburg District, Transvaal, near a high-purity quartz deposit, will have a capacity of 30,000 tons per year. It was expected to be fully onstream in 1975 at a capital cost of $25 million.

Tin.—Rooiberg Minerals Development Co., a member of the GFSA group of companies, increased production of tin-in-concentrates to 1,479 long tons, 4% more than the 1971 record tonnage. Encouraging results were obtained from diamond drilling 350 meters north of its Spruit workings. Payable tin intersections were encountered in 10 of 12 boreholes during the year.[19]

GFSA's other tin producer, Union Tin Mines Ltd., experienced a drop in ore grade, reserves, and profits. The tin content of the gravity concentrates recovered was only 204 long tons, 99 long tons less than that of 1971. Exploration revealed additional tin mineralization in the western part of the mine, but the economic significance was not assessed.

Uranium.—Uranium production was reduced by 4.5%, to 8.0 million pounds, reflecting the drop in gold ore tonnage milled and the policy of mining lower grade ores due to higher gold prices. Despite low uranium market prices, profits on sales showed an increase of $11.2 million,

[16] Impala Platinum Ltd. 1972 Annual Report. Aug. 29, 1972, p. 6.
[17] Engineering and Mining Journal. V. 174, No. 3, March 1973, p. 208.
[18] Coal, Gold, and Base Minerals. V. 20, No. 3, May 1972, p. 49.
[19] Engineering and Mining Journal. V. 173, No. 11, November 1972, p. 17.

Table 10.—Republic of South Africa: Uranium production, by company, in 1972

Gold-uranium producer	Gold ore treated (thousand metric tons)	Production U_3O_8 (pounds)	Grade (pounds per ton)
Blyvooruitzicht	755	416,755	0.551
Buffelsfontein	2,811	1,520,621	.540
Harmony	2,011	642,089	.319
Hartebeestfontein	2,256	949,369	.421
Vaals Reefs	3,365	2,029,613	.604
Virginia	917	336,233	.365
West Driefontein	800	492,977	.617
Western Deep Levels	616	350,684	.569
West Rand Consolidated	783	990,536	1.265
Zandpan [1]	295	272,273	.924
Total and average	14,609	8,001,150	.547

[1] January–June only; merged with Hartebeestfontein on July 1, 1972.

Source: Chamber of Mines of South Africa. Reports, January–December 1972.

to $32.3 million in 1972, due probably to increased sales following the 1971 stockpiling programs.

The Government announced plans to build a $700 million uranium enrichment plant to produce 2,400 tons of enriched uranium by processing 12,000 tons of uranium oxide annually. The timetable for producing uranium fuel and fuel elements for the Republic's first nuclear power station was extended to the middle or late 1980's and it was revealed that fuel for the Duinefontein Station (scheduled to go on-stream in 1981) would be imported initially.

The uranium mill erected at the President Brand gold mine remained on a care-and-maintenance basis and uranium-bearing slimes continued to be stockpiled. West Rand Consolidated Mines Ltd., the only primary uranium producer in the country will cease production of uranium next year owing to the weak uranium market. The company, however, planned to continue gold production.[20]

Vanadium.—Production of vanadium contained in pentoxides, ferrovanadium, metavanadates, and slag increased about 26% in 1972. Fused pentoxide production was probably about 10 million pounds, the greater part of which came from Highveld Steel & Vanadium Corp.'s (Highveld) Vantra plant at Witbank, Transvaal. Highveld, the country's only producer of vanadium slag, increased slag output to record levels in 1972. The vanadium market was weak early in the year, but firmed at midyear, becoming strong in the last quarter. Higher vanadium prices and increased production of vanadium products in the second half of the year helped producers offset considerable cost increases resulting from new wage agreements and a 23% rise in rail tariffs. Highveld had an estimated profit for the half year ended December 31, 1972, of $4.5 million compared to the previous 6-month profit of $290,000.

At yearend, Highveld was proceeding with an $18 million expansion program to increase production of vanadium slag and steel by 25%.

Zinc.—In October, trial milling started at the Preska copper-zinc mine, the Republic's only zinc producer. At full production in mid-1974, the mine will produce about 50,000 tons of zinc in concentrate, one-half of which will be processed by ZINCOR.

A 70-million-ton base metal discovery in northwest Cape Province by Black Mountain Mineral Development Co. Ltd. was reported to contain 0.44% zinc, among other metals, and could become a second zinc producer.

NONMETALS

Asbestos.—In spite of an anticipated weak market for chrysotile and a decline in demand for crocidolite and amosite, asbestos producers enjoyed good returns for overseas sales in 1972. The chrysotile market revived early in the year, and demand remained strong. The market for Cape blue asbestos (crocidolite) experienced difficulties, supposedly due to a health hazard associated with that variety of asbestos.[21]

The Msauli mine, the Republic's largest chrysotile producer, encountered poor ore from October 1971 to April 1972 before ore grade improved. Profits for the year declined 9%. Because of the higher cost of pit equipment and rapidly increasing overburden ratio, Msauli planned to switch to underground mining in approximately 2 years. The present mill tonnage, about 40,000 tons per month was not to be increased.[22]

The Penge mine of the Cape Asbestos Ltd., the largest amosite mine in the world, produced about 100,000 tons of amosite, or about 94% of the country's production of this type of asbestos.[23]

Cement.—Total sales of cement were at 1971 levels, but imports were reduced considerably because of higher domestic sales. Following large-scale expansion efforts in the last few years, the domestic cement industry reached a position of surplus capacity in 1972. New facilities at Lichtenburg and Dudfield increased the industry's capacity from 5.9 million tons in 1971 to 7.5 million tons in 1972. Further expansion costing $23 million was planned with an additional capacity of 450,000 tons.[24] In December, companies from the Cape and Transvaal formed a joint export marketing

[20] Metal Bulletin. No. 5697, May 20, 1972, p. 20.
[21] U.S. Embassy, Pretoria, Republic of South Africa. State Department Airgram A-052, June 15, 1973, p. 18.
[22] Coal, Gold, and Base Minerals. Msauli Brings Forward Switch to Underground Mining. V. 20, No. 3, May 1972, pp. 29-31.
[23] Coal, Gold, and Base Minerals. V. 20, No. 2, April 1972, p. 32.
[24] Cement, Lime, and Gravel. Cement in South Africa. V. 47, No. 12, December 1972, p. 281.

agency to establish long-term export markets.

Anglo-Alpha Cement Ltd. commissioned a new kiln at Dudfield with a clinker output of 780,000 tons per year. A $13 million sulfuric acid and cement clinker plant was near completion. Bosveld Kunsmis's wholly owned subsidiary, Palcaso, completed its $6 million plant at Phalaborwa and, at year-end, processing facilities were undergoing test runs. Daily production of 300 to 350 tons both of sulfuric acid and clinker cement from gypsum, a waste product from making phosphoric acid, was planned to commence early in 1973.

The new kiln at the Lichtenburg plant of White's South African Portland Cement Co. Ltd. was not fully operational until the second half of the year. White's output for the year (ended November 30, 1972) was 1,240,000 tons, an increase of 26% over that of 1971.

Diamond.—The production of diamond increased 5%, to 7.4 million carats in 1972. Demand was strong throughout the year. The Central Selling Organization had sales of $848 million, a record that exceeded 1971 sales by 47%.[25] The biggest advance in diamond demand came from Japan, followed by the United States and Western European countries.

DeBeers Consolidated Mines Ltd.'s Kimberley Mines Div., consisting of the DeBeers, Wesselton, Dutoitspan, and Bultfontein mines, produced 212,000 carats less in 1972 than that of 1971 because of the closing of the Bultfontein operation and the cessation of retreatment of old dumps.

Table 11.—Republic of South Africa: Diamond production of De Beers Consolidated Mines, Ltd.

(Carats)

Mine	1971	1972
Bultfontein	156,063	--
De Beers	232,063	206,965
Dutoitspan	170,533	303,184
Finsch	2,222,995	2,478,875
Jagersfontein	21,772	--
Kimberley dumps	57,272	--
Koffiefontein	78,336	307,652
Namaqualand areas	505,191	487,103
Premier	2,436,834	2,453,634
Wesselton	484,152	477,705
Miscellaneous	2,354	3,825
Total	6,367,565	6,618,943

Source: De Beers Consolidated Mines Ltd. Annual Report, 1972.

The modifications to the treatment plant at the Koffiefontein mine were completed during 1972, and in the latter half of the year the tonnage treated was in excess of the rated capacity of the plant. New mine development began during the last quarter of the year.

In Namaqualand, large diameter exploratory drilling between the known diamond reserves of Dreyers Pan and the Annex Kleinzee boundary proved successful and a 1-kilometer extension to the Dreyers Pan deposit was delineated.

[25] DeBeers Consolidated Mines, Ltd. 1972 Annual Report. Kimberley, Apr. 30, 1973, p. 5.

Table 12.—Republic of South Africa: Diamond production, by province

(Carats)

Province	1971			1972		
	Mine	Alluvial	Total	Mine	Alluvial	Total
Transvaal	2,606,747	25,192	2,631,939	2,612,980	20,331	2,633,311
Cape	3,354,335	840,229	4,194,564	3,503,375	859,480	4,362,855
Orange Free State	204,698	48	204,746	398,799	9	398,808
Total	6,165,780	865,469	7,031,249	6,515,154	879,820	7,394,974

Table 13.—Republic of South Africa: Diamond sales, by province

Province	1971		1972	
	Quantity (carats)	Value (thousands)	Quantity (carats)	Value (thousands)
Transvaal	2,736,981	$14,078	2,482,801	$14,842
Cape	3,880,592	71,368	4,374,230	91,593
Orange Free State	177,209	5,113	330,710	9,971
Total	6,794,782	90,559	7,187,741	116,406

Fertilizers and Chemical Materials.—The Phosphate Development Corp. Ltd. (FOSKOR) reported a 20% increase in sales because of an exceptionally favorable agricultural year. Sales exceeded production by 132,000 tons, the difference being met from surplus stocks. FOSKOR reported that its phosphate reserves are adequate to supply the Republic's needs for many years and, therefore, the company was actively seeking export markets for phosphate concentrate and phospate derivatives.

Crude phosphate production rose by almost 14% in 1972. Local sales were up from 454,894 tons in 1971 to 536,577 tons (contained P_2O_5) while exports doubled, reaching 1,529 tons in 1972.

Bosveld Kunsmis expanded its Phalaborwa chemical operation of Chemical Industries of South Africa, manufacturers of phosphatic animal feeds and chemicals from FOSKOR materials. Bosvelds' output during 1972 was about 65,000 tons of phosphoric acid and 250,000 tons of bulk phosphates.

African Explosives & Chemical Industries Ltd. (AE&CI) let contracts for construction of a $92 million nitrogen complex at Modderfontein. The complex, expected onstream in 1974, will include a 300,000-ton-per-year ammonia plant, a nitric acid plant and a 550-ton-per-day limestone ammonium nitrate fertilizer plant. The ammonia plant, one of world's largest, is based on a gasification process and will consume 2,000 tons of coal per day at full production. On completion of the project, South Africa will be self-sufficient in ammonia.[26]

Fluorspar.—Despite a general decline in fluorspar production, local sales, and exports in 1972, the fluorspar industry was expanding, mainly in acid-grade production, to meet anticipated growing world demand. The Republic's percentage of world production, 4.1% in 1972, was expected to rise to 6.62% by 1974. Fluorspar flotation capacity was planned to increase 69% to 287,000 tons during this period.[27]

In December, a $9.2 million expansion program was completed at General Mining's Buffalo mine at Naboomspruit. Mine and mill capacity were increased fourfold to 110,000 tons per month. Approximately 150,000 tons acid-grade concentrate were to be produced annually starting in mid-1973.[28] Over 90% of this production was planned for export to Japan and West Germany.

GFSA's Zwartkloof Fluorspar Ltd. reported contracts calling for about 40,000 tons annually of all grades. A new producer, Marico Fluorspar Ltd. formed at yearend by U.S. Steel Corp., began pilot-plant-scale testwork on ore from its deposits in the Marico District.

A study by the National Institute for Metallurgy placed South Africa's known reserves of all grades of fluorspar at 63 million tons, estimated to be 43% of total world reserves.

Vermiculite.—Palabora Mining Co. Ltd., the country's only vermiculite producer, increased production by 16,000 tons in 1972. Export demand was strong, particularly in Europe, where most of the vermiculite was marketed. New facilities, completed early in the year, allowed a higher degree of utilization of available reserves (50% more ore at lower head grades) and increased production of finer particle sizes.[29] A new company, Micronized Products (Pty.) Ltd., was formed to market processed vermiculite in the filter-aid and related fields.

MINERAL FUELS

Coal.—Coal production remained at the 1971 level. Bituminous production increased slightly whereas anthracite production fell 27% because of a significant decrease in local and export sales. Profits, squeezed by inflationary trends in a stagnant market, were up only slightly despite a price increase granted by the Government in February. The only collieries not affected by the cost spiral were those supplying the Government-owned electric power and steel industries on a cost plus basis.

Domestic bituminous coal sales increased marginally because of rising demand by the Electricity Supply Commission (ESCOM) and the iron and steel industry. Some producers were planning expansions in production and facilities and several merged operations. At the Durnacol mine,

[26] Coal, Gold, and Base Minerals. V. 20, No. 7, September 1972, p. 59.
[27] Mining Journal. V. 279, No. 7152, Sept. 15, 1972, p. 208.
[28] Coal, Gold, and Base Minerals. R7 Million Expansion Project. V. 20, No. 6, August 1972, pp. 41–44.
[29] Industrial Minerals. No. 61, October 1972, p. 37.

ISCOR planned to double production to 136,000 tons of washed straight coking coal per month by 1976 in anticipation of future coal requirements. Late in the year, the company began sinking a new inclined shaft to open a new area for production. Also planned was a new washing plant with a capacity of 250,000 tons of run-of-mill coal per month. Eventually, the new washing plant will process all coal from the mine.[30]

Exports, which only amounted to about 2% of total production, decreased in 1972 due to weakened economic conditions in Europe and Japan. Significant increases in coal exports were anticipated in 1976 when the Richards Bay port facilities and connecting railway to Vryheid in northern Natal are completed. Two major agreements, involving export of 3.1 million tons of coal annually have been entered into with foreign countries. The Transvaal Coal Owners Association (TCOA) and eight Japanese steel companies negotiated a contract whereby, beginning late in 1972, 100,000 tons of coal will be shipped annually via Lourenço Marques, Mozambique, until 1976 at which time the annual rate will be increased to 2.7 million tons routed through Richards Bay until 1986. TCOA representatives opened negotiations late in the year with the Japanese companies to increase prices in the $323 million blend coking coal contract. The original contract provided for an annual increase of 1.5% to 1986; however, operating costs of the coal mines rose by 12% during 1972.[31] The first consignment of 12,000 tons of coal from the newly constructed $3.7 million low-ash plant of South African Coal Estates (Witbank) Ltd. (SACE) Landau Estates was shipped to Japan during November. Coal treatment at the other collieries participating in the Japanese contract was in the planning stage at yearend.[32] ISCOR contracted to buy 300,000 tons annually of low-ash coal from SACE until April 1976 when deliveries via Richards Bay to Japan were to commence.

The second major contract, calling for the export of 400,000 tons of coal annually during the period 1976 and 1981, was negotiated between the Natal Associated Collieries (NAC) and Nord-Westdeutsch Kraft Werke, a coal-fired power station in West Germany.[33]

ISCOR spent $4 million testing formed coke briquets produced from coal at Hoornbosch, near Ellisras. Problems encountered at the Vanderbijlpark form-coke pilot plant have been mainly overcome, and large-scale blast furnace tests were expected in 1973.[34] If these tests are successful, additional reserves of 145 million tons of coal for briquetting will be available to ISCOR from the Hoornbosch mines.

Two batteries of coke ovens, under construction at ISCOR's Newcastle Works, were scheduled for completion in December 1973. The facilities were designed to produce 5,000 tons of coke, consuming 9,000 tons of coal every 24 hours. The coal will be supplied from local mines.

Petroleum.—The Republic of South Africa's 7-year, $91 million, search for domestic natural oil and gas continued in 1972. The state-owned Southern Oil Exploration Corp. (Pty.) Ltd. (SOEKOR) completed a four-well drilling program in Zululand in April with unsuccessful results. SOEKOR began another onshore drilling program in the middle of the year in the Harrisburg-Ficksburg area, near the northern border of Lesotho. The third of six planned wells was being drilled at yearend. No positive results were reported.[35]

In December, Caltex Oil (S.A.) (Pty.) Ltd. spudded in a well in the Chevron-Caltex concessions, 14 nautical miles off Still Bay, Cape Province. On completion of this well, the drilling platform, Sedco 135, was scheduled to test three more areas along the southern Cape, including one area for SOEKOR, south of Cape Infanta, and two areas for SOEKOR-Société Nationale des Pétroles d'Aquitaine off Gerikes Point and Mossel Bay. Offshore drilling with the same rig was scheduled for late in 1973 north of Saldanha Bay and near the mouth of the Orange River.[36]

Refineries.—South Africa's refineries had the following crude oil throughput capacities at yearend.

[30] Coal, Gold, and Base Minerals. V. 20, No. 10, December 1972, p. 21.
[31] Metal Bulletin. No. 5750, Nov. 14, 1972, p. 36.
[32] U.S. Embassy, Pretoria, Republic of South Africa. State Department Airgram A-052, June 15, 1973, p. 18.
[33] Mining Journal (London). V. 279, No. 7150, Sept. 1, 1972, p. 174.
[34] Metal Bulletin. No. 5752, Nov. 21, 1973, p. 32.
[35] World Petroleum Report. V. 19, 1973, p. 68.
[36] South African Digest. Apr. 28, 1972, p. 5.

Company	Quantity (barrels per day)
Caltex Oil (S.A.) (Pty.) Ltd., Cape Town	46,000
Mobile Refining Co. South Africa Pty. Ltd., Durban	60,000
National Petroleum Refiners of South Africa (Pty.) Ltd., Sasolburg	50,000
Shell & BP South Africa Petroleum Refineries (Pty.) Ltd., Durban	84,000
South African Torbanite Mining and Refining Co. Ltd., Boksburg North	2,600
Total	242,600

Source: Oil and Gas Journal. V. 70, No. 52, Dec. 25, 1972, p. 100.

The Shell & BP South Africa Petroleum Refineries (Pty.) Ltd. was expanding its Durban plant capacity from 84,000 barrels per day to 154,000 barrels per day. The project was planned for completion early in 1973. Mobile Refining Co. South Africa Pty. Ltd., awarded a $34 million engineering and construction contract to Japan's Chiyoda Chemical Co. for expansion of its Durban refinery to 90,000 barrels daily. Completion was scheduled for the end of 1974. The first phase of a new PD Oil and Chemical Storage installation at Durban became operational during the year.

South African Coal, Oil, & Gas Corp. Ltd. (SASOL) reported gross sales (for the year ending June 24) of $233 million, slightly more than double 1971 sales. The newly commissioned National Petroleum Refiners of South Africa (Pty.) Ltd. (NATREF) refinery contributed $40 million to the total. A fire in June put the hydrocracking plant at the NATREF refinery out of operation, seriously hampering the general efficiency of crude oil processing and the production of diesel oil. The damaged plant was expected to be fully operational in the first quarter of 1973.[37]

SASOL's Sigma mine provided a record 4,186,036 tons of coal in fiscal 1972 to its oil-from-coal plant at Sasolburg. An important change in the composition of the feed gas to the Kellogg reactors resulted in increased overall production capacity by saving steam and oxygen in the reforming process. The feed gas, previously consisting entirely of reformed gas, now contains a considerable amount of unreformed gas.

SASOL began pilot plant work in July to confirm the effectiveness of a methanation process developed by Lurgi Mineralöl Technik G.m.b.H. of West Germany. El Paso Natural Gas Co. of Texas appointed SASOL as consultant for the planning, design, erection, and commissioning of the first large-scale facilities in the United States for coal gasification. SASOL was also approached by other gas distribution companies regarding gasification advisory services.

A plan for the underground storage of oil in coal mines was announced in March. Part of the workings at Witbank Consolidated Coal Mine (a Lonrho colliery) were tested, and some oil was stored.

[37] South African Coal, Oil, & Gas Corp. Ltd. 1972 Annual Report. Sasolburg, Republic of South Africa, Oct. 23, 1972, p. 3.

The Mineral Industry of the Territory of South-West Africa

By James H. Jolly [1]

The mineral industry of the Territory of South-West Africa continued to be a major factor in the country's economy accounting for about 60% of the overseas capital investment, contributing approximately 60% of the exports, and comprising about 45% of the gross domestic product.[2] Although statistics are not available, mineral sales, estimated at about $323 million,[3] probably exceeded those of 1971 even though the output of most commodities declined in 1972.

The mining industry and other segments of the economy were jolted by a nationwide strike by Ovambo miners and workers from mid-December 1971 through January 1972. The striking workers were seeking better pay and modifications in the long-established contract labor system. There were major strikes at Windhoek, Walvis Bay, and Tsumeb as well as at most other mines in the Territory. Mineral production was severely curtailed at most operations, and some mines were shut down by the strike. Tsumeb Corp. Ltd. operations were among the most seriously affected as 75% of the company's 5,440 African laborers joined the strike. Tsumeb's mines and mills continued to operate although at a reduced tonnage. A European staff kept the copper smelter operating at about 30% capacity, but the lead smelter was closed down.

The Consolidated Diamond Mines of South-West Africa Ltd. (CDM), another large employer of mine labor, reported that its operations were unaffected by the strike as less than 7% of their African workers left their jobs. Settlement of the dispute was reached in late January 1972 between the Republic of South Africa Government and the Executive Council of Ovamboland when improved terms of employment and wage increases were adopted in the Territory.

The Territory experienced a boom in mineral exploration in 1972 as a record number of prospecting rights were issued by the office of the Commissioner of Mines.[4] Greatest interest centered on Windhoek, Rehoboth, the Rossing area, and the extreme southeast part of the Territory. The search for petroleum and gas intensified during the year as most offshore concession areas were allocated by the Government agency, Southern Oil Exploration Corp. (South-West Africa) (Pty.) Ltd. (SWAKOR). Several test wells were to be drilled in 1973.

The Asis Ost copper prospect was under development with production planned for 1974. A new major copper discovery at Otjihose, northeast of Windhoek, was reported by Johannesburg Consolidated Investment Co. Ltd. (JCI) and Minerts Development (Pty.) Ltd. The deposit reportedly has 16 million tons of ore averaging 2% copper with minor amounts of silver and zinc. Development of the Rossing uranium project continued on schedule as contracts for the construction of plant facilities were awarded. Onshore diamond production increased, and exploration was active in offshore areas.

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[1] Physical scientist, Division of Nonferrous Metals—Minerals Supply.

[2] World Minerals and Metals. South-West Africa. No. 7, May–June 1972, p. 26.

[3] Where necessary, values have been converted from South African Rand (R) to U.S. dollars at a rate of R1=US$1.293 (average of monthly averages as given in volumes 25 and 26 of International Financial Statistics). The rate for 1970–71 was R1=US$1.40.

[4] U.S. Embassy, Johannesburg, Republic of South Africa. State Department Telegram 0670, August 1973, p. 3.

PRODUCTION AND TRADE

The South-West Africa Administration has not disclosed official mineral production statistics for the Territory since 1966. Most of the statistical data on production were derived from the annual reports of three major mining companies operating in the country, Tsumeb Corp. Ltd., CDM, and The South-West Africa Co. Ltd. (SWACO). The Territory traditionally produces a large variety of minerals, particularly among the nonmetals, but output data are not available, and these commodities are not listed in table 1.

The Ovambo strike decreased to varying degrees the production of mineral commodities in the Territory in 1972. Official statistical data are not available and corporate data used in compiling the accompanying production tables do not permit exact comparisons of performance of Tsumeb Corp. between calendar 1971 and calendar 1972. In general however, for the

Table 1.—South-West Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS [1]			
Arsenic, white [3 4]	r 4,478	3,701	2,370
Cadmium:			
Mine output metal content, recoverable [4]	315	266	198
Metal, refined [4]	232	196	156
Copper:			
Mine output metal content, recoverable [4]	31,393	32,039	21,618
Metal, blister [4]	28,593	26,922	26,119
Lead:			
Mine output metal content, recoverable [4]	r 73,119	71,498	59,990
Metal, refined [4]	70,129	58,820	63,961
Silver:			
Mine output metal content, recoverable [4] ---thousand troy ounces	r 1,553	1,728	1,361
Smelter output, content of blister copper [4] ---do---	1,533	1,413	1,679
Tin, mine output metal content, recoverable ---long tons---	r 1,027	949	980
Tungsten, mine output metal content, recoverable	r 62	95	89
Vanadium, mine output metal content of concentrates	402	794	529
Zinc, mine output metal content [4]	r 46,685	43,696	34,742
NONMETALS			
Diamond: [6]			
Gem [e] ---thousand carats---	1,772	1,566	1,516
Industrial [e] ---do---	93	82	80
Total ---do---	1,865	1,648	1,596
Lithium minerals, all types [6]	6,909	8,207	6,592

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

[1] In addition to the commodities listed, South-West Africa, prior to 1967, produced bismuth concentrates, cesium ore, columbium-tantalum concentrates, gold, salt, manganese ore, molybdenum concentrates, graphite, lime, mica, precious stones, salt, kyanite and sillimanite, wollastonite and a variety of crude construction materials (clays, stone, sand and gravel). No official statistics have been published since yearend 1966, and available information is inadequate to ascertain whether production has continued or not, and if so, at what levels.

[2] Data are compiled from operating company reports as follows: Tsumeb Corp. Ltd. (arsenic, mine and smelter cadmium, mine and smelter copper, mine and smelter lead, mine and smelter silver, and mine zinc); South-West Africa Corp. Ltd. (mine lead, mine tin, mine tungsten, mine vanadium, and mine zinc); South African Iron and Steel Industrial Corp., Ltd. (ISCOR) for Imcor Zinc (Pty.) Ltd.'s Rosh Pinah mine (mine lead and mine zinc), and for ISCOR's own Uis mine (mine tin); General Mining and Finance Corp., Ltd. for Klein Aub Koper Maatskappy Ltd.'s mine near Rehoboth (mine copper and mine silver). All data for 1970 are for fiscal year ending June 30, 1970; all data for 1971 are for fiscal year ending June 30, 1971; data for 1972 are a summation of company figures for calendar year 1972 for the Tsumeb Corp. Ltd. and for fiscal year ending June 30, 1972, for all other companies. (This practice differs from that used in past editions owing to a change in reporting by Tsumeb Corp. Ltd. The change results in the omission from tabular statistics on South-West Africa's mineral production of Tsumeb Corp. for July 1, 1971, through December 31, 1971; Tsumeb Corp. Ltd. output for this period is detailed in footnote 4.

[3] White arsenic equivalent of black arsenic oxide produced.

[4] Tsumeb Corp. Ltd. output for July 1, 1971, through December 31, 1971, was as follows in metric tons unless otherwise specified: Arsenic, white—2,711; cadmium, mine—109; cadmium, refined—79; copper, mine—11,624; copper, blister—13,490; lead, mine—27,751; lead, refined—33,118; silver, mine—649,343 troy ounces; silver, content of blister copper—849,210 troy ounces; zinc, mine—2,868. (See also footnote 2.)

[5] Total figures reported for calendar years by DeBeers Consolidated Mines Ltd. in company annual reports; detail on gem and industrial estimated, assuming output to be 95% gem quality.

[6] Estimated, based on recorded imports by selected countries from the statistical territory of South Africa (South Africa, South-West Africa, Botswana, Lesotho and Swaziland) minus known production from the Republic of South Africa. (There is no known production in the other three nations in this group.)

calendar year, it would appear that mine production of copper, lead, zinc, cadmium, arsenic, and silver by Tsumeb Corp. decreased substantially, however, Tsumeb's smelter production of refined lead and blister copper was maintained at 1971 levels. Vanadium output declined as higher grade ores at SWACO's Berg Aukas mine were depleted. Arsenic, cadmium, and tungsten production decreased whereas tin output increased modestly. Diamond production by CDM declined slightly, but the value of diamond exports (sales) was about $103 million, almost double that of 1971.

The Territory's foreign trade in mineral commodities is included in the trade statistics of Republic of South Africa and cannot be differentiated. Most mineral commodities produced in the Territory of South-West Africa are processed in South Africa or shipped to world markets.

COMMODITY REVIEW

METALS

In 1972, Tsumeb Corp. Ltd., the major producer of base metals in the Territory, had metal sales of about $48 million, slightly less than that of the previous year. Although ore production was adversely affected by the Ovambo workers strike early in the year, smelter production of copper and lead was maintained by large increases in the amount of custom concentrates treated. Tsumeb's smelters produced 63,961 tons of refined lead and 26,119 tons of blister copper, compared with an estimated 62,528 tons of lead and 26,951 tons of blister copper in 1971.

Exploration and development continued at all operations of Tsumeb Corp. Ltd. At the Tsumeb mine the No. 6 and No. 7 subvertical shafts were completed to a depth of 1,572.4 and 1,591 meters, respectively. There were no further develop-

Table 2.—South-West Africa: Operations of Tsumeb Corp. Ltd.

	6 months ended December 31, 1971 [1]	1972
Tsumeb mine and mill:		
Ore mined, gross weight, metric tons	255,191	438,638
Ore milled, gross weight, do	253,343	438,638
Metal content:		
Copper, %	3.50	3.37
Lead, do	11.34	11.49
Zinc, do	3.34	3.20
Silver, ounces per metric ton	2.87	2.65
Concentrate production:		
Lead concentrate:		
Gross weight, metric tons	58,897	110,490
Metal content:		
Copper, %	6.56	6.37
Lead, do	42.72	40.79
Zinc, do	5.34	4.98
Silver, ounces per metric ton	5.18	4.96
Copper concentrate:		
Gross weight, metric tons	10,407	16,206
Metal content:		
Copper, %	40.59	39.91
Lead, do	11.55	11.48
Silver, ounces per metric ton	27.45	29.65
Zinc concentrate:		
Gross weight, metric tons	6,377	9,661
Metal content:		
Zinc, %	54.12	53.65
Cadmium, do	1.17	1.07
Mill recovery (from all concentrates):		
Copper, % of metal in ore milled	91.31	91.53
Lead, do	91.78	93.09
Zinc, do	40.76	36.93
Kombat mine and mill:		
Ore mined and milled:		
Gross weight, metric tons	192,103	376,987
Metal content:		
Copper, %	1.71	1.30
Lead, do	1.62	1.47
Silver, ounces per metric ton	.55	.44

See footnotes at end of table.

Table 2.—South-West Africa: Operations of Tsumeb Corp. Ltd.—Continued

		6 months ended December 31, 1971 [1]	1972
Kombat mine and mill—Continued			
Concentrate production:			
Copper concentrate:			
Gross weight	metric tons	10,690	15,819
Metal content:			
Copper	%	24.67	23.06
Lead	do	6.03	5.79
Silver	ounces per metric ton	4.08	5.08
Lead concentrate:			
Gross weight	metric tons	4,520	8,521
Metal content:			
Copper	%	10.31	11.00
Lead	do	50.63	49.69
Silver	ounces per metric ton	2.76	3.20
Mill recovery (from all concentrates):			
Copper	% of metal in ore milled	94.61	93.53
Lead	do	94.16	92.89
Matchless mine and mill:			
Ore mined and milled:			
Gross weight	metric tons	67,130	13,049
Metal content:			
Copper	%	.91	.81
Sulfur	do	18.85	17.45
Bulk concentrate production:			
Gross weight	metric tons	11,546	4,346
Metal content:			
Copper	%	4.96	2.31
Sulfur	do	e 44.45	48.37
Mill recovery (from all concentrates):			
Copper	% of metal in ore milled	93.62	95.05
Sulfur	do	41.34	92.32
Smelting and refining:			
Direct smelting ore [2]	metric tons	2,298	--
Average assay:			
Copper	%	21.44	--
Lead	do	4.42	--
Silver	ounces per metric ton	7.94	--
Copper concentrates smelted [2]	metric tons	23,533	33,195
Average assay:			
Copper	%	30.89	31.33
Lead	do	7.71	8.55
Silver	ounces per metric ton	13.34	16.86
Lead concentrates smelted [2]	metric tons	60,817	125,582
Average assay:			
Copper	%	6.83	6.53
Lead	do	44.47	41.04
Silver	ounces per metric ton	4.52	4.63
Custom materials smelted:			
Copper concentrate	metric tons	3,855	18,364
Average assay:			
Copper	%	43.18	31.33
Lead	do	.59	8.55
Silver	ounces per metric ton	23.92	16.20
Lead concentrate	metric tons	8,471	19,712
Average assay:			
Copper	%	2.68	1.14
Lead	do	60.37	64.47
Silver	ounces per metric ton	25.90	21.05
Metal sales:			
Value	thousands	$23,464	$48,229
Arsenic, refined As_2O_3 [3]	metric tons	1,088	1,465
Cadmium	kilograms	102,810	173,282
Copper, electrolytic	metric tons	9,683	25,626
Lead	do	39,010	50,335
Silver	troy ounces	685,386	1,749,620
Zinc	metric tons	4,177	3,883

e Estimate.
[1] Fiscal year basis ending June 30 changed to calendar year basis ending December 31 at end of fiscal 1971.
[2] Concentrates from Tsumeb Corp. Ltd.
[3] Production for period stated.

Table 3.—Ore reserves of Tsumeb Corp. Ltd.[1]

	Quantity (thousand metric tons)	Grade (%)			
		Copper	Lead	Zinc	Sulfur
Positive ore:					
Tsumeb	5,236	4.63	8.98	2.22	--
Kombat	1,376	1.96	3.11	--	--
Matchless	1,031	2.46	--	--	14.85
Asis Ost	591	2.14	.53	--	--
Probable ore:					
Kombat	1,375	1.73	2.06	--	--
Matchless	248	2.67	--	--	12.75
Tentative ore:					
Tsumeb	1,778	3.81	4.74	1.63	--
Matchless	973	2.69	--	--	15.54
Asis Ost	288	.70	1.80	--	--

[1] As of December 31, 1972.

ments of the ore body below 34 level, but an exploration drift on 44 level was scheduled to start in February 1973. At the Kombat mine, the eight level main haulage was nearing completion, and an East ore body stope was under development. Production at the Matchless mine was discontinued in January because the operation became unprofitable. The mine and mill were placed on a care and maintenance basis as the company planned to resume production when metal prices improved. Exploration and development of the Matchless East, West, and Western Extension oreshoots continued and additional claims were pegged to protect possible extensions of the known oreshoots.

In general exploration, Tsumeb Corp. investigated several prospects in various parts of the Territory both independently and jointly with SWACO and Anglo-Transvaal Consolidated Investment Co. Exploratory drilling projects continued or were conducted at Uris, Karavatu, Gross Otavi, Guchab Mountain, Nosib, and in the Teco mining area. The prospect at Asis Ost, a joint venture between Tsumeb and SWACO, proved commercially viable, and plans were made to bring the deposit into production in 1974.

Arsenic.—A total of 5,483 tons of reverberatory and converter baghouse dusts and 13,900 tons of dross skims were roasted at Tsumeb in 1972, producing 2,495 tons of black arsenic oxide, from which 537 tons of 98% and 345 tons of 95% As_2O_3 material were drummed. Tsumeb's arsenic refining furnaces produced 1,465 tons of refined arsenic trioxide during 1972.

Cadmium.—Tsumeb Corp. processed 4,179 tons of sinter baghouse dust producing 156 tons of 99.98% cadmium during the year.

Copper.—Oamites Mining Co. (Pty.), Ltd., a joint venture of Falconbridge Nickel Mines Ltd., Canada, and the International Development Corp. (IDC), an agency of the Republic of South Africa Government, reached full capacity of 45,000 tons per month at yearend despite difficulties caused by the general strike.[5] The mine and mill are located 55 kilometers south of Windhoek. Indicated ore reserves were 4.3 million tons containing 1.45% copper and 0.66 ounces silver per ton. Production statistics of the Oamites mine for its first and second year operations were as follows:

	1971	1972
Tons ore milled	43,000	353,000
Mill-head-grade (% Cu)	1.10	1.39
Mill recovery	86.50	92.29
Concentrate produced (dry tons)	1,000	12,000
Tons recoverable copper	416	4,543

Klein Aub Koper Maatskappy Ltd., a subsidiary of General Mining and Finance Corp., Ltd., reported a 17% decline in production of concentrates at its mine near Rehoboth in fiscal 1972, due largely to the Ovambo strike. Production for the year was 8,124 tons of copper concentrate. Exploration and development during the year added about 6 million tons averaging 3% copper to the mine's ore reserves. In early 1972, Klein Aub commenced the sinking of a new shaft to develop a new ore body adjacent to the existing workings.

Tsumeb Corp. and SWACO, joint owners of a copper prospect at Asis Ost, planned to bring the deposit into production in 1974. Diamond drilling indicated ore reserves of 590,685 tons averaging 2.14% copper and 0.53% lead. The property has been leased to the operators of Tsumeb's Kombat mine, and ore from Asis Ost will be processed in the Kombat mill. A shaft was being sunk at yearend.

Navarro Exploration, Ltd., continued development of the Onganja copper mine with production scheduled for 1973. Ore reserves were 320,000 tons averaging 2.7% copper.

JCI and Minerts Development (Pty.) Ltd. (jointly owned by Continental Ore Corp. of New York and Fedmar Ltd. of

[5] Falconbridge Nickel Mines Ltd. 1972 Annual Report, p. 7.

the Republic of South Africa) discovered a large copper deposit at Otjihase, 27 kilometers northeast of Windhoek. The ore body varies from 1 to 5 meters in width and occurs in the same southwest-northeast striking amphibolite belt as Tsumeb's Matchless mine. Reserves at the deposit have been estimated at 16 million tons of sulfide ore averaging 2% copper with minor amounts of silver and zinc.[6] JCI and Minerts planned to invest $26 million by mid-1975 to establish mine and mill facilities for a 100,000-ton-per-month operation. Establishment of a smelter at Walvis Bay to process the concentrate was under study.[7]

The Société Minière et Métallurgique de Peñarroya and Nord Resources Corp. discovered a copper deposit estimated at 1 million tons of ore grading 2.5% copper at its Gorob prospect. Further exploration in the area was planned. General Mining suspended exploration activities in the Fedswa Prospkteerders (Pty.), Ltd., concession, east of Windhoek, but continued to evaluate a major copper deposit in the same concession area. The deposit reportedly has reserves of 7 million tons of ore grading 1.9% copper. A 100-meter shaft was sunk at the site to provide bulk samples for pilot plant testing.[8]

Lead, Zinc, and Vandium.—At SWACO's Berg Aukas mine, the total tonnage of concentrates produced increased slightly although the amount of ore hoisted and ore milled decreased 13.5% and 3.8%, respectively, in fiscal year 1972. The production of lead vanadate concentrate decreased 32% due to the depletion of higher grade vanadiferous ores on the 14 level. Production statistics for the Berg Aukas mine in 1972 were as follows:

	Quantity (metric tons)		Grade (%)		
	1971	1972	V_2O_5	Lead	Zinc
Ore hoisted	196,200	169,700	.83	3.4	16.7
Ore milled	135,700	130,600	1.04	4.1	21.3
Concentrates:					
Lead vanadates	8,197	5,571	16.96	42.1	18.5
Zinc sulfide	6,721	10,268	--	3.1	54.2
Lead sulfide	598	821	--	44.4	23.2
Zinc silicates	23,674	23,690	--	2.4	46.5

Ore reserves at the end of fiscal 1972 were 1,620,000 tons averaging 0.5% vanadium oxide, 5% lead, and 19% zinc. The ore below the 14 level, which constitutes about two-thirds of the reserves, is below average and poor in vanadium. The 17 level was under development, and deepening of the No. 2 shaft 250 meters to the footwall of the known economic horizon in the trough of the Berg Aukas syncline, was underway at yearend.

Mine production at the Rosh Pinah mine of Imcor Zinc (Pty) Ltd., a subsidiary of the South African Iron and Steel Industrial Corp. Ltd. (ISCOR), declined as a result of the Ovambo strike. Zinc concentrate production decreased 38% to 23,201 tons, whereas lead concentrate production increased 39% to 9,556 tons. All concentrates were shipped to the Republic of South Africa for processing. A new open pit was scheduled for production in November 1973. Monthly milling of 100,000 tons of ore, grading about 8% zinc and 2% lead, was planned. About 45,000 tons of ore was milled monthly in 1972.

Silver.—Silver was produced as a byproduct of copper and lead mining in 1972. Tsumeb Corp., the largest silver producer in the Territory, recovered 1,110,658 ounces from company-produced copper and lead concentrates during the year. Tsumeb's output decreased from 1971 levels, but smelter production increased due mainly to custom smelting of larger tonnages of silver-rich copper and lead concentrates. Sales increased 38% over those of fiscal 1971, rising to 1,749,620 ounces in 1972.

Tin-Tungsten.—SWACO increased production of tin-tungsten concentrate at the Brandberg West open pit mine by about 7% in fiscal 1972 (year ending June 30, 1972), but overall results were below expectations due to lower metal prices, the Ovambo workers strike, declining ore grade on the west face, and mechanical break-

[6] Mining Journal. A New Copper Mine for S.W. Africa. V. 280, No. 7175, Feb. 23, 1973, p. 156.
[7] Metal Bulletin. Six Months to Windhoek. No. 5777, Feb. 20, 1973, p. 10.
[8] World Mining. V. 8, No. 7, June 25, 1972, p. 116.

down of quarry equipment. The mine's ore reserves at the end of the fiscal year were recalculated and estimated to be 6.1 million tons at a grade of 0.153% tin and 0.079% tungsten. Fiscal 1972 production statistics for the Brandberg West mine were as follows:

	Quantity (metric tons)	Grade (%)	
		Tin	WO_3
Tons loaded	1,052,000	--	--
Tons milled	109,500	0.26	0.16
Concentrate produced	635	33.58	17.66

The Uis tin mine of ISCOR produced 1,227 tons of tin concentrate containing 781.6 tons of recoverable tin in fiscal year 1972. The concentrates were shipped to ISCOR's Vanderbijlpark Works in the Republic of South Africa for smelting.

A tungsten deposit previously worked during World War II and again in the early 1950's at Krantzberg, approximately 100 kilometers northwest of Windhoek, was planned to be bought into production in 1973 by Nord Resources Corp. Mine development and construction of a 7,500-ton-per-month mill were started in 1972. Production of about 50 tons per month of concentrate containing 65% WO_3 was planned. Ore reserves containing 0.6% WO_3 were estimated to be sufficient for about 10 years at the planned production rate.

Uranium.—Rossing Uranium, Ltd., comprised of Rio Tinto South Africa, Ltd., General Mining and Finance Corp. and IDC, continued development of its uranium mine in the Rossing area, 48 kilometers inland from Swakopmund in the Namib Desert. Another participant in the project, Urangesellschaft m.b.h., a German consortium established with West German Government support, might withdraw from the Rossing project because Government financing was discontinued.[9] Western Knapp Engineering Division of Arthur G. McKee & Co., San Francisco, Calif., and Power Gas Ltd., London, won a joint contract for the design, engineering, procurement, and construction of plant facilities. The design of the main plant will be based on pilot plant test work conducted early in the year on bulk underground samples. Planned mill capacity is 5,000 tons of concentrate per year from 20,000 tons of mill feed per day.

Rossing's uranium grade and ore reserves have not been revealed, but the deposit, which is large and low-grade, was being developed as an open pit operation. Reserves were estimated at 100,000 tons U_3O_8 (at $10 per pound U_3O_8).[10] Rossing planned to begin production in 1976. Sufficient sales contracts have been arranged to insure a profitable operation.

Exploration for other uranium deposits in the Rossing area was active during 1972. Goldfields of South Africa Ltd. was allocated an area for exploration at Trekkopje, adjacent to the Rossing uranium discovery. One promising prospect was under investigation. General Mining terminated prospecting in the Mile-72, prospect, north of Swakopmund, because the deposit proved to be too small but continued prospecting in the Langer-Heinrich concession, east of Swakopmund. Anglo-American Corp. of South Africa Ltd. (AAC) in conjunction with Union Corp. Ltd., Compagnie Française de Pétroles and Aquitaine S.W.A. Ltd., began exploration in the Husab joint venture area, near Rossing, in 1972. AAC and Aquitaine discovered a uranium occurrence in an adjacent area, but its significance has not been evaluated.

NONMETALS

Cement.—South-West African Portland Cement, Ltd., postponed erection of a cement plant at Karibib pending indication of a more favorable economic climate in the Territory.

Diamond.—Consolidated Diamond Mines of South-West Africa, Ltd. (CDM), a subsidiary of DeBeers Consolidated Mines, Ltd., produced most of the diamond recovered in the Territory in 1972. CDM's diamond production decreased slightly to 1,596,144 carats, almost all of which were of gem quality. Production costs rose during the year, owing to wage increases, higher costs for equipment and stores, and a 16% increase in the amount of overburden stripped. Operations were only affected slightly by the Ovambo unrest early in the year.

Virtually all of CDM's diamond production came from large-scale, onshore, open-cast alluvial workings along a 100-

[9] Mining Journal. V. 278, No. 7124, Mar. 3, 1972, p. 173.

[10] Coal, Gold, and Base Metals. South Africa's First and Only Uranium Mine. V. 21, No. 1, March 1973, pp. 49–51.

kilometer coastal zone of Diamond Area No. 1. In 1972, no diamond, other than those recovered in sampling programs, were produced in foreshore and offshore operations. Mining activity in the Western block increased in 1972, and systematic bulk sampling in the block proved considerable additional reserves. The amount of conglomerate in the headfeed of the No. 1 treatment plant increased from 39% in 1971 to 51% in 1972. Despite the increase in conglomerate treated, the throughput of the plant was maintained. A 200-ton-per-hour boulder/conglomerate separation unit at the No. 4 plant site was being constructed at yearend. The new unit, expected to come into service in late 1973, will mechanically separate the high waste-boulder content from the diamondiferous conglomerate. Two additional large-scale treatment plants were planned in order to process ore reserves between the two existing plants. Preparatory work on the No. 2 plant began during 1972. This plant, which has a planned throughput of 160,000 cubic meters of diamondiferous conglomerate per month, was scheduled for completion in late 1974. The No. 3 plant was planned for production 1 year later.

CDM continued exploration of offshore marine sediments in the leased Marine Diamond Corp., Ltd. (MDC), concession area. The prospecting vessel, *Ontginner*, fitted with an Alpine Vibracore drill, sampled broad areas of previously unexplored thick sediments in relatively deep water, but no economic deposits were reported. Diamond reserves in shallow water and under-thinner overburden were exhausted. Although CDM suspended foreshore mining operations in 1971, owing to oversupply of medium grade stones, the company continued exploration and experimental mining research in MDC's foreshore areas.[11] Experimental barrier construction programs in the Western block area have extended the minable foreshore zone to about 70 meters seaward of the high water mark. About 3 years' diamond reserves reportedly remain in MDC's foreshore lease area.

Table 4.—South-West Africa: Operations of the Consolidated Diamond Mines of South-West Africa, Ltd.

Operation	1971 [1]	1972
Overburden stripped-bank thousand cubic meters	19,119	14,631
Gravels mined and screened do	6,269	6,027
Carats recovered	1,647,810	1,596,144
Mining grade carats per cubic meter	.26	.26
Average diamond size carats per stone	.86	.88
Cost per cubic meter of gravels mined and screened, dollars	4.01	3.60
Cost per carat recovered do	15.04	13.63

[1] 1971 data include offshore and foreshore operations.

MINERAL FUELS

Petroleum.—SWAKOR, an agency of the South-West Africa Administration, announced that the following offshore oil exploration blocks were awarded during the year:

Block No.	Leased to
3, 4, 5, 6	Mr. B. J. H. duPreez.
9	Aracco Exploration, Ltd. of New York.
10, 12, 13	Chevron Oil Co. of South-West Africa and Texaco Inc.
14, 17	Aquitaine (S.W.A.), Ltd.
15, 16	Consortium consisting of Continental Overseas Oil Co., Getty Oil Co., and Phillips Petroleum Co.

The terms of the leases require an expenditure of approximately $1.2 million in the first year and drilling after the third year.[12] SWAKOR estimated that oil exploration expenditures and drilling costs would be about $26 million annually, starting in 1976. Geophysical Services, Inc., using seismic methods, located a promising structure in blocks 12 and 13. Chevron-Texaco, the concession holders, planned to drill a test hole before the end of 1973.

[11] South African Mining and Engineering Journal. Advances in Sea and Beach Diamond Mining Techniques. V. 85, No. 4079, April 1973, pp. 25–49.

[12] World Petroleum Report. V. 19, 1973, p. 69.

The Mineral Industry of Spain

By John D. Corrick [1]

Spain's economy at the end of 1972 was best described as being expansive and dynamic. Industrial production grew at a 16% rate, and exports and tourism grew at a 22% rate compared with those of 1971. International reserves at yearend were approximately $5 billion, an increase of nearly $1.6 billion over that of 1971. The gross national product (GNP) growth rate which had slipped to 4.9% in 1971, rebounded in 1972 to 7.5%. The growth of Spain's GNP remained one of the highest in Europe, with yearend per capita GNP approaching the $1,200 level. Spain's dynamic economy in 1972 was marked by a decrease in excess bank deposits resulting from Spanish businesses investing their assets more fully.

The positive growth of Spain's economy in 1972 was reflected in foreign trade data which showed imports growing at a much faster rate than in 1971. In 1972 imports were 37.8% above those in 1971. Exports were up 30.4 in 1972 compared with 1971. The balance of trade in ore and metals in 1972 showed a deficit of $635.5 million,[2] compared with $446.2 million in 1971 and $673.5 million in 1970.

Spain's rapid rate of economic expansion was not without cost. An inflation rate of 9.3% during a 12-month period ending August 1972 was second in Europe only to that of Portugal. Increased wages (up 15% in the first 6 months of 1972) along with an expansionary budget were strong contributory factors to Spain's inflation. The Spanish Government maintained that inflation was the price the country must pay in order to sustain its high rate of economic expansion. Spain was fifth among European nations in terms of industrial production and GNP, and sixth in international monetary reserves.

Spain's Government-owned Instituto Nacional de Industria (INI) maintained its position as the principal force behind the Nation's industries. INI was involved in 62% of Spain's automobile production, 66% of its shipbuilding, 55% of the coal output, 38% of the steel output, and 6% of the aluminum output. INI was in aerospace, banking, telecommunications, electricity, food, textiles, and services. During the last 15 years, INI has become an influencial branch of government which controls both business and capital in Spain.

PRODUCTION

Mineral commodities showing significant production gains in 1972 when compared with those in 1971 were aluminum metal (11%), blister and refined copper (34% and 7%, respectively), crude steel (22%), primary lead (21%), mercury (6%), primary zinc (16%), cement (14%), nitrogenous fertilizers (13%), phosphatic fertilizers (64%), metallurgical- and acid-grade fluorspar (23%), coal, all types (2%), and refined crude petroleum (17%).

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from Spanish pesetas (Ptas) to U.S. dollars at the rate of Ptas1.00=US$0.0166667 for 1971 and Ptas1.00=US$0.0156250 for 1972.

Table 1.—Spain: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Bauxite	5,013	5,432	4,000
Metal:			
Primary	r 119,926	125,848	140,070
Secondary	50,234	35,546	NA
Antimony:			
Mine output, metal content	79	111	136
Metal (regulus)	360	319	NA
Arsenic, white	17	--	--
Bismuth, mine output, metal content, kilograms	12,450	25,080	e 25,000
Cadmium metal	111	102	111
Copper:			
Mine output, metal content	9,522	34,032	32,170
Metal:			
Blister	r 55,071	66,267	88,625
Refined, primary:			
Thermal	6,605	17,467	NA
Electrolytic	79,664	93,255	NA
Total	r 86,269	110,722	118,080
Refined, secondary	24,643	22,256	NA
Iron and steel:			
Iron ore and concentrate, thousand tons	7,051	7,328	6,711
Pig iron, do	4,164	4,825	5,922
Electric furnace ferroalloys, do	112	130	175
Crude steel, do	7,429	7,794	9,530
Semimanufactures, do	5,633	5,771	NA
Lead:			
Mine output, metal content	72,715	70,150	66,576
Metal:			
Primary	r 75,541	75,843	92,139
Secondary	4,454	3,761	NA
Manganese ore and concentrate	10,678	18,079	12,742
Mercury:			
Mine output, metal content, 76-pound flasks	r 45,552	50,831	53,994
Metal, do	r 44,737	49,317	e 47,000
Silver:			
Mine output, metal content, thousand troy ounces	r 1,700	1,701	e 1,700
Metal including secondary, do	6,559	6,237	NA
Tin:			
Mine output, metal content, long tons	436	396	193
Metal:			
Primary, do	r 3,846	4,584	4,206
Secondary, do	r 573	386	e 400
Titanium:			
Ilmenite concentrates:			
Gross weight	r 27,126	24,349	22,942
Titanium dioxide content	13,011	11,455	10,949
Titanium dioxide	r 16,051	16,334	19,004
Tungsten, mine output, metal content	408	407	294
Uranium, mine output, U_3O_8 content	84	148	137
Zinc:			
Mine output, metal content	98,065	87,540	89,459
Metal:			
Primary	r 88,165	85,671	99,179
Secondary	1,063	829	NA
NONMETALS			
Barite	r 94,048	97,232	120,000
Cement, hydraulic:			
Natural, thousand tons	302	166	NA
Other, do	16,536	16,993	19,440
Chalk, cubic meters	93,420	105,724	NA
Clays:			
Bentonite	37,354	38,253	40,000
Kaolin:			
Crude	444,018	107,280	105,000
Marketable	174,054	323,875	350,000
Refractory	121,928	188,977	200,000
Other, thousand cubic meters	6,327	6,356	NA
Diatomite and tripoli	18,357	18,335	20,000
Earths, industrial, n.e.s	11,528	14,827	15,000
Feldspar and pegmatite	55,084	61,732	75,000
Fertilizer materials:			
Crude potash salts, K_2O equivalent	598,319	604,484	632,809
Manufactured:			
Nitrogenous, nitrogen content, thousand tons	r 577	589	667
Phosphatic, P_2O_5 content, do	r 287	268	440
Potassic, K_2O equivalent, do	r 521	505	539

See footnotes at end of table.

Table 1.—Spain: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
NONMETALS—Continued				
Fluorspar:				
Gross weight:				
Acid grade		199,722	245,572	266,671
Metallurgical grade		141,943	150,826	220,107
Total		341,665	396,398	486,778
Calcium fluoride content:				
Acid grade		194,054	238,702	257,722
Metallurgical grade		66,627	69,815	101,889
Total		260,681	308,517	359,611
Gypsum and anhydrite, crude	thousand tons	4,228	4,030	e 4,100
Kyanite and related materials: Andalusite		3,050	5,850	6,000
Lime (quicklime and hydrated lime)	thousand tons	409	e 500	e 500
Magnesite, crude		222,445	258,500	270,000
Meerschaum (sepiolite), crude		31,589	30,058	40,000
Mineral pigments, ocher		12,480	12,897	14,000
Pumice		199,902	156,454	e 160,000
Pyrite, including cupreous:				
Gross weight	thousand tons	r 2,729	2,440	2,166
Sulfur content	do	r 1,276	1,142	1,024
Salt:				
Rock	do	1,126	1,189	1,137
Marine and other evaporated	do	r 954	790	663
Sand and gravel:				
Sand, silica	thousand cubic meters	538	631	NA
Other	do	4,686	5,712	NA
Stone:				
Calcareous:				
Dolomite	do	394	598	NA
Limestone	do	28,416	28,147	NA
Marble	do	153	155	NA
Marl	do	2,811	2,536	NA
Basalt	do	1,407	1,437	NA
Diabase	do	--	5	NA
Granite	do	1,933	2,037	NA
Ofite	do	170	147	NA
Phonolite	do	236	215	NA
Porphyry	do	47	55	NA
Quartz	thousand tons	275	287	NA
Quartzite	thousand cubic meters	523	168	NA
Sandstone	do	568	568	NA
Serpentine	do	16	28	NA
Slate	do	96	265	NA
Trachyte	do	89	64	NA
Trass and tufa	do	207	191	NA
Strontium minerals		7,000	8,500	8,000
Sulfur, elemental, all forms		6,251	2,964	5,000
Sulfates, natural:				
Glauberite, Na_2SO_4 content		14,931	15,482	NA
Thenardite, Na_2SO_4 content		r 79,792	72,950	NA
Talc and steatite		39,612	40,743	40,000
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		r 19,930	18,050	20,000
Carbon black		r 46,100	50,000	e 50,000
Coal:				
Anthracite	thousand tons	2,808	2,876	3,005
Bituminous	do	7,943	7,811	8,001
Lignite	do	2,831	3,081	3,056
Total	do	13,582	13,768	14,062
Coke:				
Metallurgical	do	4,029	4,066	4,449
Gashouse	do	9	10	4
Fuel briquets, all types	do	195	180	e 180
Gas:				
Natural, marketed	million cubic feet	106	71	e 85
Manufactured:				
Gas works	do	25,109	25,780	NA
Coke ovens	do	62,860	60,105	NA
Blast furnaces	do	83,625	92,453	NA
Total	do	171,594	178,338	NA

See footnotes at end of table.

Table 1.—Spain: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS—Continued				
Peat		16,338	18,195	20,000
Petroleum:				
Crude	thousand 42-gallon barrels	1,457	874	1,020
Refinery products:				
Gasoline, aviation	do	27	9	--
Gasoline, motor	do	27,846	29,536	32,549
Jet fuel	do	10,768	11,093	14,205
Kerosine	do	1,837	2,387	1,708
Distillate fuel oil	do	52,392	57,360	62,997
Residual fuel oil	do	104,256	103,243	113,572
Lubricants including grease	do	1,869	1,500	1,584
Other	do	35,030	42,681	38,833
Refinery fuel and losses	do	4,439	11,861	10,597
Total	do	238,464	259,670	276,040

e Estimate. p Preliminary. r Revised. NA Not available.

TRADE

Spain's trade deficit in mineral commodities rose to nearly $1,659 million in 1972, more than 46% above the 1971 deficit. Values for mineral commodity trade and total commodity trade for the last 3 years were as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1970	339	2,387
1971	388	2,938
1972	520	3,831
Imports:		
1970	1,524	4,747
1971	1,521	4,963
1972	2,179	6,837

Source: 1970, 1971, and 1972: Estadistica del Comercio Exterior de España (Madrid).

Exports of mineral commodities were valued at $520 million, an increase of 34% over those of 1971. Increased exports of iron and steel and mineral fuels were partly offset by decreased exports of copper, aluminum, and mercury. Mineral fuels, valued at $203 million accounted for approximately 39% of Spain's total mineral exports in 1972.

The value of mineral commodities imported during 1972 increased 43% from that of the previous year. The value of nearly all minerals and metals imported in 1972 increased when compared with those of 1971, and were valued at $2,179 million. Mineral fuels accounted for 56% of Spain's total mineral imports in 1972, and when combined with imports of iron and steel accounted for nearly 75% of the total.

Mineral commodity trade in 1970 and 1971 is given in tables 2 and 3.

Table 2.—Spain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	--	8	All to Netherlands.
Oxide and hydroxide	5	28	United Kingdom 11; Kenya 10.
Metal, including alloys:			
Scrap	77	74	Mainly to West Germany.
Unwrought	2,463	6,682	United States 2,041; Greece 1,500; France 1,031.
Semimanufactures	10,754	8,617	United States 2,290; United Kingdom 1,126; Portugal 907.
Antimony, metal, including alloys, all forms	104	117	France 92; Netherlands 20.
Cadmium, metal, including alloys, all forms	18	36	United States 15; Belgium 11.
Chromium:			
Chromite	--	55	All to Portugal.
Oxide and hydroxide	19	16	Portugal 9; Colombia 5.
Copper:			
Matte	682	38	Hungary 19.
Copper sulfate	380	(1)	NA.
Metal, including alloys:			
Scrap	34	26	West Germany 23; United States 2.
Unwrought	r 17,753	6,415	West Germany 2,825; Netherlands 2,306.
Semimanufactures	3,148	3,559	Hungary 741; Portugal 456; Israel 320.
Gold, waste and sweepings--kilograms	503	--	
Iron and steel:			
Ore and concentrate, except roasted pyrite--thousand tons	2,037	2,345	West Germany 887; United Kingdom 654; France 550.
Roasted pyrite--do	671	796	West Germany 652; United Kingdom 47; France 44.
Metal:			
Scrap	1,218	409	Netherlands 132.
Pig iron, including cast iron	20,465	8	Mainly to France.
Sponge iron, powder and shot	6,922	12,389	Portugal 11,642; France 658.
Ferroalloys:			
Ferromanganese	1,488	6,075	West Germany 3,120; Portugal 1,400; United Kingdom 1,023.
Other	4,879	9,118	United Kingdom 5,607; West Germany 1,252; Chile 737.
Steel, primary forms	r 100,254	221,883	United States 80,731; France 35,672; Italy 32,291.
Semimanufactures:			
Bars, rods, angles, shapes, sections	101,476	512,803	West Germany 80,521; Iran 79,970; United States 51,653.
Universals, plates and sheets	6,929	98,941	United States 53,643; West Germany 23,234; Iceland 10,144.
Hoop and strip	2,674	2,248	Portugal 1,522; France 437.
Rails and accessories	--	507	Turkey 418; Syria 83.
Wire	2,295	3,527	Portugal 1,810.
Tubes, pipes, and fittings	39,244	78,030	West Germany 30,625; France 13,300; Belgium-Luxembourg 8,809.
Castings and forgings, rough	2,358	3,635	West Germany 960; Iraq 845.
Lead:			
Oxides	315	5	Mainly to Andorra.
Metal, including alloys:			
Scrap	701	22	All to United Kingdom.
Unwrought	69	45	France 30; United Kingdom 14.
Semimanufactures	159	88	Arab Republic of Egypt 36; Equatorial Guinea 17; Angolia 13.
Magnesium, metal, including alloys, all forms	113	29	Mainly to United Kingdom.
Manganese:			
Ore and concentrates	--	19	All to France.
Oxides	--	5	All to Portugal.
Mercury--76-pound flasks	43,280	32,895	East Germany 9,167; West Germany 6,672; United States 3,365.
Molybdenum metal, including alloys, all forms--kilograms	r 307	46	Portugal 35; United States 6; Andorra 5.
Nickel:			
Metal, including alloys:			
Scrap	r 94	177	West Germany 145; Netherlands 23.
Unwrought	r 5	6	Portugal 4.
Semimanufactures	46	43	Brazil 9.
Selenium, elemental--kilograms	--	660	All to West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Silver, metal, including alloys troy ounces	2,894	482	West Germany 161; Republic of South Africa 129.
Tin:			
Metal, including alloys:			
Scrap long tons	93	4	All to West Germany.
Unwrought do	1,494	1,434	Netherlands 1,033; Morocco 136; United Kingdom 90.
Semimanufactures do	r 2	3	Equatorial Guinea 1.
Titanium:			
Ore and concentrate (ilmenite)	1	--	
Oxides	2,878	2,558	Poland 1,000; United States 960; Netherlands 209.
Tungsten:			
Ore and concentrate	669	592	West Germany 221; United Kingdom 168; Netherlands 67.
Metal, including alloys, all forms	20	7	United Kingdom 5; West Germany 1.
Zinc:			
Ore and concentrate	11,594	5,022	West Germany 4,181; Belgium 841.
Oxide and peroxide	1,231	782	West Germany 280; Netherlands 250; Colombia 140.
Metal, including alloys, all forms:			
Blue powder	20	547	United States 497; India 49.
Unwrought and semimanufactures	3,910	21,882	Morocco 5,275; United States 4,000; Portugal 2,921.
Other:			
Ore and concentrate:			
Of molybdenum, tantalum, titanium, vanadium and zirconium	36	7	United States 6.
Of base metals, n.e.s	186	8	All to United States.
Ash and residue containing nonferrous metals	14,828	5,181	Belgium-Luxembourg 3,585; West Germany 1,385.
Oxides, hydroxides and peroxides of metals, n.e.s	541	202	Portugal 75; Netherlands 66; West Germany 16.
Metals, including alloys, all forms:			
Rare-earth metals	--	12	All to Sweden.
Pyrophoric alloys kilograms	110	15	All to Portugal.
Other	r 14	1	Mainly to Portugal.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	822	635	West Germany 608; United Kingdom 10; Morocco 10.
Grinding and polishing wheels and stones	1,396	2,113	West Germany 956; France 547; Austria 101.
Asbestos	20	2	Mainly to Portugal.
Barite and witherite	48,458	60,457	West Germany 33,996; United Kingdom 12,594; Italy 9,669.
Cement	r 170,552	645,514	Nigeria 232,808; Morocco 130,976; Algeria 71,350.
Chalk	1	25	Venezuela 22; Portugal 3.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	5,046	9,249	West Germany 3,485; Sweden 2,004; France 1,954.
Kaolin (china clay)	40,218	54,937	West Germany 25,987; Italy 13,777; Greece 4,630.
Other	29,036	18,293	Andorra 4,844; West Germany 3,003; France 2,862.
Products:			
Refractory (including nonclay bricks)	r 5,378	7,524	Belgium-Luxembourg 3,404; Cuba 1,064; Venezuela 822.
Nonrefractory	r 67,702	106,922	West Germany 22,286; France 20,548; Andorra 9,274.
Diamond:			
Natural:			
Gem value, thousands	$2	$12	Colombia $10.
Industrial do	$4	$ 6	United States $3; Mexico $2.
Total do	$6	$18	

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Diatomite and other infusorial earths	1,741	2,056	Belgium 867; France 342; United Kingdom 276.
Feldspar	45	487	France 485.
Fertilizer materials:			
Nitrogenous	98	997	United Kingdom 741; Andorra 183.
Phosphatic	91,072	71,582	Algeria 71,402.
Potassic	472,956	469,751	United Kingdom 91,472; Portugal 39,415; Algeria 36,215.
Other including mixed	1,297	1,355	West Germany 975.
Ammonia	10	4	Equatorial Guinea 1.
Fluorspar	170,431	209,354	United States 119,676; West Germany 62,305; Canada 9,482.
Graphite, natural	(1)	10	Mainly to Ecuador.
Gypsum and plasters	4,136	17,805	Sweden 13,241; Republic of South Africa 558.
Lime	5,411	6,577	Equatorial Guinea 6,171.
Magnesite	54,325	58,267	United Kingdom 45,748; West Germany 10,998.
Mica, all forms	89	112	West Germany 28; Turkey 21; Colombia 17.
Pigments, minerals, including processed iron oxides	14,079	13,342	United Kingdom 2,242; United States 1,757; Australia 1,309.
Precious and semiprecious stones (except diamond):			
Natural, gem—value, thousands	r $1	$1	Mainly to United States.
Manufactured—do	$26	$234	France $86; Switzerland $64; United States $47.
Powder, natural or manufactured—do	(1)	$1	Mainly to Italy.
Pyrite (gross weight)—thousand tons	885	937	West Germany 467; Belgium 201; Denmark 131.
Salt and brine—do	179	168	Norway 34; Denmark 29; Iceland 25.
Sodium and potassium compounds, n.e.s.	6,593	18,066	Turkey 4,361; Venezuela 2,816; Belgium 2,000.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	17,754	13,189	Italy 9,033; West Germany 1,811; France 868.
Slate	89	109	France 86; Andorra 23.
Other	20,070	28,092	Italy 13,704; France 11,175; West Germany 2,954.
Worked:			
Slate	31,418	34,943	France 31,435; West Germany 2,243; Andorra 887.
Paving and flagstone	373	247	France 228; Canada 13.
Other	12,408	13,978	West Germany 11,512; France 1,171; Andorra 393.
Dolomite, chiefly refractory grade	19,933	19,155	United Kingdom 17,537; Argentina 950; Algeria 400.
Gravel and crushed rock	2,643	4,938	Andorra 1,586; West Germany 1,000; Portugal 920.
Limestone	--	700	All to United Kingdom.
Quartz and quartzite	92,705	90,135	Norway 81,729; Sweden 7,490; Italy 857.
Sand, excluding metal bearing	18,354	16,817	Andorra 15,728; France 750.
Sulfur:			
Elemental, all forms	530	175	Morocco 173.
Sulfur dioxide	1,069	265	Algeria 217; Portugal 32.
Sulfuric acid	5	10,096	France 10,069; Portugal 20.
Talc, steatite, soapstone, and pyrophyllite	130	164	United Kingdom 133; Venezuela 10.
Other nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, jet	17,060	26,150	United Kingdom 8,135; West Germany 6,818; France 5,025.
Other	19,080	69,964	France 40,820; West Germany 18,174; Japan 6,751.
Slag, dross and similar waste, not metal bearing	1	--	
Oxides and hydroxides of magnesium, strontium and barium	65	52	Republic of South Africa 30; West Germany 21.
Building materials of asphalt asbestos, and fibre-cement, and unfired nonmetals, n.e.s	30,912	35,818	France 28,562; Equatorial Guinea 2,162; Portugal 1,334.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	78	140	Portugal 92; Equatorial Guinea 44.
Carbon black and gas carbon	8,570	8,120	Portugal 4,455; France 1,957.
Coal and briquets:			
Anthracite	203,736	97,374	West Germany 41,586; Italy 38,494; Netherlands 6,640.
Bituminous	374,443	47,328	Netherlands 30,702; West Germany 16,590.
Briquets of coal	9,734	980	All to Lebanon.
Lignite and lignite briquets	772	601	Andorra 584; France 17.
Coke and semicoke	254,889	7,974	Mainly to Portugal.
Peat, including peat briquets and litter	40	176	Portugal 175; Andorra 1.
Hydrogen, helium and rare gases	28	2	Mainly to Greece.
Petroleum, refinery products:			
Gasoline (including natural) thousand 42-gallon barrels	r 6,680	5,162	United Kingdom 2,991; Netherlands 975; Italy 330.
Kerosine and jet fuel ——do——	r 1,064	883	United Kingdom 288; Sweden 210; West Germany 144.
Distillate fuel oil ——do——	13,402	13,011	Netherlands 4,348; Sweden 1,267; West Germany 1,166.
Residual fuel oil ——do——	r 17,936	13,823	United States 4,741; Italy 3,568; Sweden 795.
Lubricants ——do——	175	85	Italy 70; Arab Republic of Egypt 2; Equatorial Guinea 2.
Mineral jelly and wax ——do——	3	8	United Kingdom 5; Portugal 2.
Other:			
Liquefied petroleum gas ——do——	673	760	Portugal 606; France 92; Italy 15.
Other ——do——	r 645	508	Portugal 20; Arab Republic of Egypt 11; Nigeria 8; Zaire 6.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	3,390	3,932	Netherlands 2,610; Portugal 327; Arab Republic of Egypt 259.

r Revised.
1 Less than ½ unit.

Table 3.—Spain: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	r 93,212	110,421	Guyana 36,707; Surinam 11,478; Ghana 11,000.
Oxide and hydroxide	r 245,506	279,007	Guinea 125,508; Jamaica 59,999; France 51,171.
Metal, including alloys:			
Scrap	4	1,084	Canada 401; Ghana 244; France 171.
Unwrought	13,877	29,079	Canada 15,775; Ghana 6,396; Poland 3,094.
Semimanufactures	5,720	5,923	West Germany 1,518; Italy 1,134; France 830.
Antimony:			
Ore and concentrate	432	352	Morocco 310; Greece 41.
Metal, including alloys, all forms	r 246	204	Japan 120; Belgium 38; Malaysia 20.
Arsenic:			
Trioxide, pentoxide, and acids	425	470	France 439; Portugal 30.
Metal, including alloys, all forms	9	10	All from Sweden.
Bismuth, metal, including alloys, all forms	r 32	44	Japan 15; Belgium 13; Mexico 5.
Cadmium, metal, including alloys, all forms	6	7	Mainly from Canada.
Chromium:			
Chromite	58,911	49,490	Republic of South Africa 40,437; Turkey 3,305; Philippines 2,525.
Oxide and hydroxide	145	226	West Germany 160; Poland 65.
Metal, including alloys, all forms	18	22	United Kingdom 20; West Germany 1.
Cobalt oxide and hydroxide	65	84	Canada 51; Belgium 25.
Copper:			
Ore and concentrate	72,433	69,586	Ireland 23,621; Cyprus 16,977; Norway 6,403.
Matte	r 18,705	22,738	Israel 12,324; Chile 6,010; Peru 2,153.
Copper sulfate	161	222	Belgium 203; Czechoslovakia 10.
Metal, including alloys:			
Scrap	16,609	16,025	United States 4,107; France 2,808; Canada 2,018.
Unwrought	r 55,381	39,351	Chile 9,061; Belgium-Luxembourg 8,570; Zambia 7,046.
Semimanufactures	r 7,206	9,827	United Kingdom 2,047; West Germany 1,679; Italy 1,074.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Gold:			
Metal, unworked and partly worked, all forms--thousand troy ounces--	900	707	Switzerland 450; United Kingdom 257.
Waste and sweepings---kilograms--	--	409	All from West Germany.
Iron and steel:			
Ore and concentrate, except roasted pyrite----------thousand tons--	2,431	3,248	Brazil 1,347; Mauritania 707; Canada 568.
Roasted pyrite----------	20,839	1	All from West Germany.
Metal:			
Scrap---------thousand tons--	1,364	1,382	United Kingdom 661; United States 584; France 49.
Pig iron, including cast iron ----do----	66	37	West Germany 14; Canada 10; Algeria 5.
Sponge iron, powder and shot ----do----	6	6	Sweden 4; France 2.
Ferroalloys----------do----	16	19	Republic of South Africa 4; Norway 3; France 3.
Steel, primary forms----do----	r 838	252	West Germany 83; Netherlands 51; Italy 23.
Semimanufactures:			
Bars, rods, angles, shapes, sections---------do----	147	116	United Kingdom 28; West Germany 24; Norway 16.
Universal plates and sheets ----do----	855	413	United Kingdom 78; Japan 70; West Germany 69.
Hoop and strip----do----	32	28	France 8; West Germany 8; Belgium-Luxembourg 5.
Rails and accessories ----do----	3	2	West Germany 1.
Wire----------do----	11	9	West Germany 2; France 2; Belgium-Luxembourg 1.
Tubes, pipes, and fittings ----do----	r 37	37	West Germany 12; France 6; United Kingdom 4.
Castings and forgings, rough----------	641	349	United States 65.
Lead:			
Ore and concentrate----------	r 5,025	8,820	Algeria 4,635; Ireland 2,821; Italy 1,364.
Oxides----------	7	5	Mainly from United Kingdom.
Metal, including alloys:			
Scrap----------	10	26	Andorra 9; Gambia 9; Guinea 5.
Unwrought----------	r 5,287	2,264	Mexico 1,040; West Germany 950.
Semimanufactures----------	83	337	West Germany 227.
Magnesium metal, including alloys, all forms----------	622	582	United States 480; Norway 53.
Manganese:			
Ore and concentrate----------	200,350	173,993	Ghana 92,981; Australia 32,842; Ivory Coast 12,579.
Oxides----------	743	865	Japan 614; Belgium 115; United States 99.
Metal----------	344	323	Republic of South Africa 120; France 80; United States 60.
Mercury----------76-pound flasks--	4	6	Austria 3; West Germany 1.
Molybdenum metal, including alloys, all forms----------	15	16	United Kingdom 5; Austria 4; Netherlands 2.
Nickel:			
Ore and concentrate----------	2	15	All from Morocco.
Matte, speiss, and similar materials-	355	363	Canada 161; Cuba 109.
Metal, including alloys:			
Scrap----------	48	112	France 57; West Germany 22; United States 19.
Unwrought----------	2,567	2,717	United Kingdom 1,071; Canada 599; Finland 266.
Semimanufactures----------	r 1,452	1,902	France 682; United Kingdom 323; West Germany 307.
Platinum-group metals:			
Ore and concentrate----------	--	5	All from United States.
Waste and sweepings, including those of silver----------	75	295	Do.
Metals, including alloys, all forms troy ounces--	37,231	62,983	United Kingdom 27,232; France 22,731; Brazil 7,202.
Rare-earth metals:			
Oxides----------	r 77	82	France 42; United Kingdom 17; United States 17.
Metals, including alloys-kilograms--	50	100	All from France.
Selenium, elemental----------	6	7	West Germany 1; United Kingdom 1; Canada 1.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Silicon, elemental	4,262	3,656	France 1,126; Norway 1,076; Switzerland 950.
Silver metal, including alloys thousand troy ounces	2,797	4,565	Mexico 1,833; France 1,511; West Germany 450.
Tellurium, elemental	4	5	United States 2.
Tin:			
Ore and concentrate long tons	r 5,364	5,428	Zaire 1,590; Australia 1,425; Indonesia 725.
Oxides do	r 120	134	United Kingdom 93; West Germany 31.
Metal, including alloys, all forms do	r 98	157	United Kingdom 85; West Germany 27; United States 14.
Titanium:			
Ore and concentrate	12,648	30,268	Norway 30,235.
Oxides	6,606	6,917	United Kingdom 3,101; West Germany 1,606; Finland 742.
Tungsten:			
Ore and concentrate	41	--	
Metal, including alloys, all forms	r 10	8	West Germany 2; United Kingdom 2; France 1.
Uranium and thorium:			
Ore and concentrate (uranium) kilograms	--	55	United States 37; United Kingdom 18.
Oxides	18	3	France 1; United Kingdom 1.
Metal, including alloys, all forms kilograms	1	61	Japan 60.
Vanadium pentoxide do	3	342	United States 341; West Germany 1.
Zinc:			
Ore and concentrate	9,158	6,227	Sweden 4,606; Algeria 1,621.
Oxide and peroxide	279	297	West Germany 280; France 9; United Kingdom 5.
Metal, including alloys, all forms	r 463	196	Netherlands 97; United States 23; Belgium 19; Denmark 19.
Zirconium metal, including alloys, all forms kilograms	r 2,000	430	United Kingdom 351.
Other:			
Ore and concentrate:			
Of molybdenum, tantalum, titanium, vanadium, and zirconium	1,241	1,241	Australia 786; United States 153; Belgium 126.
Of base metals, not elsewhere specified	10,595	6,560	Australia 6,229; Austria 304; Bolivia 20.
Ash and residue containing nonferrous metals	13,602	19,641	United States 5,106; West Germany 2,402; Canada 2,096.
Oxides, hydroxides and peroxides of metals, n.e.s	1,032	1,105	West Germany 407; France 264; United States 117.
Metals, including alloys, all forms:			
Alkali and alkaline earth	2	559	West Germany 364; United Kingdom 193.
Pyrophoric alloys	6	9	West Germany 4.
Base metals, including alloys, all forms, n.e.s	144	150	Belgium 50; United Kingdom 31; West Germany 24.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	1,964	1,550	Greece 1,000; United States 167; Italy 167.
Dust and powder of precious and semiprecious stones value, thousands	$86	$92	Netherlands 32; United Kingdom $27; Belgium $17.
Grinding and polishing wheels and stones	r 824	734	Italy 168; West Germany 162; France 103.
Asbestos	r 77,773	65,288	Republic of South Africa 32,138; Canada 30,626.
Barite and witherite	918	1,105	France 993; West Germany 94; United Kingdom 17.
Boron materials:			
Crude natural borates	27,828	44,574	United States 29,300; Turkey 14,820.
Oxide and acid	636	602	France 393; Turkey 149; Italy 35.
Cement	300,635	419,673	France 200,839; United Kingdom 163,346; Lebanon 26,426.
Chalk	11,583	11,131	France 7,701; United Kingdom 1,445; Belgium 1,408.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	21,147	17,864	Italy 6,653; Morocco 6,345; United Kingdom 2,896.
Kaolin (china clay)	77,022	69,795	United Kingdom 57,041; United States 6,074; France 6,526.
Other	37,855	35,718	United Kingdom 21,966; France 7,729.
Products:			
Refractory (including nonclay bricks)	r 18,372	20,081	Austria 6,960; West Germany 5,336; United Kingdom 3,180.
Nonrefractory	r 9,062	11,543	Italy 6,139; West Germany 2,063; France 1,912.
Cryolite and chiolite	971	872	Denmark 860.
Diamond:			
Natural:			
Gem, not set or strung value, thousands	$321	$4,187	Belgium $3,593; Netherlands $110; India $90.
Industrial do	$1,333	$780	Belgium $253; Netherlands $139; Ireland $131.
Total do	$1,654	$4,967	
Manufactured, industrial do	--	$176	Ireland $86; United Kingdom $81.
Diatomite and other infusorial earths	4,137	1,672	United States 866; France 567.
Feldspar, leucite, nepheline and nepheline syenite	3,830	4,677	Norway 1,915; Republic of South Africa 914; France 824.
Fertilizer materials:			
Crude:			
Nitrogenous	r 75,608	78,387	All from Chile.
Phosphatic thousand tons	1,402	1,556	Morocco 1,408; United States 115; Algeria 32.
Potassic	r 15	--	
Manufactured:			
Nitrogenous	r 340,227	186,615	West Germany 85,656; Norway 50,165; France 16,823.
Phosphatic	r 60,969	58,471	Belgium-Luxembourg 20,285; Tunisia 11,891; France 11,475.
Potassic	r 1,566	669	Mainly from West Germany.
Other, including mixed	r 118,181	75,404	Romania 36,135; United States 29,791; West Germany 4,708.
Fluorspar	1,195	1	All from Republic of South Africa.
Graphite, natural	1,263	917	Malagasy Republic 319; West Germany 261; France 195.
Gypsum and plasters	1,246	3,966	France 3,080; Morocco 603; United Kingdom 187.
Iodine	34	35	Japan 25; Chile 10.
Lime	2,480	595	United Kingdom 372; Morocco 156; Portugal 48.
Magnesite	35,878	40,268	Greece 7,905; Brazil 7,805; Austria 5,987.
Mica, all forms	r 1,132	1,135	United Kingdom 282; Norway 220; Argentina 198.
Pigments, mineral, including processed iron oxides	2,377	3,211	West Germany 2,280; France 450; United Kingdom 238.
Precious and semiprecious stones (except diamond):			
Natural:			
Gem value, thousands	$1,924	$1,170	Belgium $458; West Germany $267; India $152.
Industrial do	$348	$39	West Germany $37.
Manufactured do	$521	$461	Switzerland $346; France $64.
Powder, natural or manufactured do	$86	$92	Netherlands $32; United Kingdom $27; Belgium $17.
Pyrite (gross weight)	81	68	Italy 59; United States 9.
Salt and brine	1,388	1,583	Netherlands 856; United Kingdom 588.
Sodium and potassium compounds, n.e.s.	27,035	37,182	Belgium 26,548; Italy 9,736.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	26,192	32,889	Italy 19,693; Portugal 11,565.
Slate	155	128	France 79; Andorra 44.
Other	9,026	11,300	Norway 3,939; Sweden 1,719; Brazil 1,702.
Worked:			
Slate	710	818	Italy 728; France 61.
Paving and flagstone	161	17	Mostly from Belgium.
Other	1,591	1,310	Portugal 587; Italy 511.
Dolomite, chiefly refractory grade	4,012	3,986	Belgium 1,649; France 1,256; Norway 1,060.
Gravel and crushed rock	18,746	36,834	Morocco 29,771; France 5,278.
Quartz and quartzite	1,837	994	Sweden 634; Belgium 100; United States 80.
Sand, excluding metal bearing	63,816	68,581	Morocco 29,929; Belgium 27,292; Netherlands 4,991.
Sulfur:			
Elemental:			
Other than colloidal	67,592	80,675	France 52,918; United States 10,808; Poland 10,030.
Colloidal	653	1,271	France 1,002; West Germany 268.
Sulfur dioxide	119	93	Netherlands 79; Italy 12.
Sulfuric acid	18,053	21,475	Belgium 8,917; Portugal 8,111; Netherlands 2,609.
Talc, steatite, soapstone, and pyrophyllite	5,001	4,825	France 2,182; Norway 1,599.
Other nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, jet	158	81	Republic of South Africa 45; United Kingdom 36.
Other	38,038	46,709	Greece 9,933; U.S.S.R. 9,327; Australia 8,585.
Slag, dross and similar waste, not metal bearing	3,181	333	West Germany 151; France 126.
Oxides and hydroxides of magnesium, stronium and barium	1,921	1,908	United Kingdom 630; Brazil 300; Japan 300.
Building materials of asphalt, asbestos, and fibre-cement, and unfired nonmetals, n.e.s	1,054	1,108	Belgium-Luxembourg 652.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	750	919	United States 763; United Kingdom 136.
Carbon black and gas carbon	17,868	17,586	France 6,726; United Kingdom 4,565; United States 2,869.
Coal and briquets:			
Anthracite—thousand tons	14	42	Mainly from Republic of South Africa.
Bituminous—do	3,450	2,895	United States 2,344; Poland 529; Iceland 21.
Briquets of coal	27	2	All from Venezuela.
Lignite and lignite briquets	25,968	13,914	Mainly from France.
Coke and semicoke—thousand tons	159	87	West Germany 25; France 18; Italy 16.
Peat, including peat briquets and litter	2,037	3,212	Ireland 928; Sweden 742; West Germany 643.
Gas, natural, liquefied thousand cubic feet	--	15,764	All from Libya.
Hydrogen, helium and rare gases	r 500	171	United Kingdom 68; France 66.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 228,116	259,337	Saudi Arabia 89,488; Libya 47,141; Kuwait 23,563.
Refinery products:			
Gasoline (including natural) do	458	599	Surinam 296; Netherlands 168; United Kingdom 135.
Kerosine and jet fuel—do	r 231	266	Netherlands 131; Italy 45; Belgium 42.
Distillate fuel oil—do	15	415	Netherlands 150; Italy 198; Kuwait 45.
Residual fuel oil—do	633	5,006	Italy 2,137; Kuwait 786; Netherlands 641.
Lubricants—do	r 370	327	United States 109; United Kingdom 59; West Germany 28.
Mineral jelly and wax—do	111	101	United States 39; West Germany 22; France 9.
Other:			
Liquefied petroleum gas do	4,098	3,920	France 2,376; Netherlands 472; United Kingdom 277.
Other—do	r 1,253	1,116	United States 576; West Germany 236; Swaziland 76.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	142	100	United States 64; France 12; Netherlands 11.

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COMMODITY REVIEW

METALS

Aluminum.—Spain's production of primary aluminum exceeded 140,000 tons in 1972 compared with approximately 126,000 tons in 1971. Although production data from individual companies were not available, the output came principally from plants owned by Empresa National del Aluminio, S.A. (ENDASA) and Aluminio de Galicia, S.A. (ALUMIGASA). Installed aluminum capacity in Spain in 1972 was 151,000 tons. Primary aluminum consumption was 156,000 tons, an 8.8% increase over that of 1971. Imports remained at a high level during 1972 and contributed to an approximate 10% rise in aluminum stocks.

The Spanish Government's desire to make Spain less dependent on foreign countries for its supply of aluminum ore (bauxite) was implimented when Spain's Mining Board announced plans to spend $370,000 to investigate bauxite deposits in the provinces of Teruel and Tarragona (northeast Spain). Development of these bauxite deposits, estimated to contain 150 million tons of ore, would allow Spain to build an alumina plant and thereby complete integration of its aluminum production facilities. Spain has to import about 250,000 tons of alumina annually from Guinea, France, and Jamaica to meet demand. According to the Ministry of Industry a processing plant for treating 1.2 million tons of bauxite per year would be needed to keep abreast of expansions in the domestic metal and manufacturing industries. The development of alumina production facilities gained little favor in Spain because of the lack of sizable exploitable bauxite reserves and the fact that the high-silica content of known bauxite reserves make them economically unattractive. Nevertheless, Spain's Plan Nacional de la Minería (PNM) recommended construction of a 200,000-ton-per-year alumina plant on the coast of Tarragona province. The Spanish Government also evaluated a plan in 1972 for establishing an alumina plant at Villagarcía de Aresa in Galicia province about 20 kilometers north of Pontevedra. If approved the project would be undertaken by INI through its subsidiary ENDASA and several international groups. Banco del Nordeste of La Coruña also indicated an interest in participating in the project. Annual consumption of bauxite by this plant was estimated at 1 million tons.

At the end of 1971, ENDASA commissioned a new pot-line at its La Coruña smelter. In 1972 ENDASA budgeted expenditures of about $10.4 million on its Valladolid and Avilés smelters and $3.3 million on its Alicante semimanufactures plant. The company had under construction a 20,000-ton-per-year expansion to its Avilés plant. This was the third expansion at Avilés. ENDASA also was expanding the capacity of its Alicante rolling mill from 30,000 tons to 40,000 tons per year, installing a 3,000-ton-per-year extrusion press and a 3,500-ton-per-year anodizing unit. ENDASA acquired 55% interest in Industrias Semi-Metálicas, S.A., of Barcelona in 1972. Semi-Meláticas was an important aluminum semifabricator in Cataluña and reportedly was considering participating in the alumina project being evaluated by the Government for location at Villagarcía de Aresa. During 1972 ALUMIGASA acquired Industrial Navarra de Aluminio, S.A., which was controlled by Reynolds Metals Co. of the United States. Navarra operated aluminum mills at Vigo and Pamplona and produced 5,000 tons annually of foil, extrusions, and wire.

Bismuth.—Spain's only producer of bismuth, Industriales Arsenicales Reunidas of Córdoba, invested $143,000 in mine development work and ore processing equipment in 1972. The improvements were to permit doubling annual production to 100 tons. Domestic production of bismuth reportedly was sufficient to meet Spanish requirements.

Copper.—Spain's copper industry produced 118,080 tons of refined copper in 1972, an increase of 7% over that produced in 1971. Mine production of copper decreased 6%, but output of blister copper increased 34% compared with that of 1971.

Rio Tinto-Patiño (RTP) continued partial operation of its Cerro Colorado open pit mine during 1972. When in full operation, 13 million tons of overburden per year will be excavated. The net result will be the treatment of 3 million tons of copper-bearing porphyry ore by flotation to yield a concentrate grading 16% to 20% copper. One and a half million tons of

gossan per year will be leached with cyanide solution to yield bullion containing 20% and 80% gold and silver, respectively. Annual production of metal will amount to 20,000 tons of copper, 300 tons of silver, and 3,000 kilograms of gold. RTP continued to develop its Arenteiro reserves, near Santiago de Compostela, in northwest Spain. The mine was expected to become operational in 1973. RTP signed a 7-year agreement of technical cooperation with Technika of Sofia, Bulgaria, in 1972. The agreement covered production of electrolytic copper and copper sheet at RTP's Huelva operation. The new agreement reportedly replaced one previously signed with Nippon Mining of Japan in July 1971.

Gold.—RTP confirmed the 1971 discovery of a low-grade, gold-bearing ore body in the Tapia de Casariego (Oviedo) region. The company planned to continue exploration of the region. Company officials stated that the feasibility of developing the deposit had not been determined.

Iron Ore.—Output of iron ore in 1972 was 6,710,622 tons (3,326,177 tons iron content) compared with 7,328,000 tons (3,601,619 tons iron content) in 1971. Exports increased to 1,006,284 tons in the first half of 1972 compared with 817,237 tons in the first half of 1971. Principal destinations were West Germany (435,324 tons), France (200,860 tons), the Netherlands (133,501 tons), and the United Kingdom (123,391 tons). During the first 6 months of 1972 Spain imported 1,869,108 tons of iron ore compared with 1,369,507 tons the previous year. Principal sources of supply were Brazil (673,801 tons), Canada (358,216 tons), Liberia (319,736 tons), and Mauritania (185,276 tons).

Compañia Andaluza de Minas, S.A. (CAM), inaugurated numerous new facilities in 1972 at its Marquesado mine located 80 kilometers from Granada. The new facilities consisted of an ore transporting system (from mine to crushing and screening plants) and a concentration plant. The company requested authority to enlarge iron ore loading facilities at the Port of Almeriá. The Marquesado mine had an annual capacity of 2.5 million tons. The ore grade ranged from 55% to 60% iron with 2.0% manganese, 4.0% silica, 1.0% to 6.0% limestone, and .02% phosphorous and sulfur content.

Compañia Minera de Sierra Menera reported the discovery of new iron ore reserves totaling 100 million tons with an iron content of 50%. The prospecting was carried out on a 3,600-hectare area in eastern Guadalajara and western Teruel Provinces. Total proven reserves in this area were estimated at 132 million tons. As a result of these discoveries, Sierra Menera reportedly will construct a pellet plant in the area with its production to be consumed at the yet to be built Sagunto steelworks. Other companies prospected for iron ore in the El Pobo and El Pedregal regions and reported encouraging results.

Agrupacion Minera, S.A. (Agruminsa), a subsidiary of Altos Hornos de Vizaya, S.A. (AHV), gained approval of the Ministry of Labor to gradually shutdown its iron ore mines at Alquife over a period of 1 year. Officials of Agruminsa offered its 350 employees at the Alquife mines transfers to iron ore mines in the Bilbao region or to Sagunto when construction commences in June 1973 on the Altos Hornos del Mediterraneo (AHM) steelworks. In 1972 AHV acquired Sociedad Española de Minas Somorrastro and its subsidiary, Franco-Belga, which had reserves of carbonate iron ore at Gallarta estimated at 13 million tons. AHV planned to upgrade the ore from these deposits by concentration and sintering at Agruminsa's plant. At midyear Española de Minas de Somorrastro was preparing to begin opencast mining of iron ore at the Concha II, Concha VIII, Manuelita, and Demasia a Manuelita concessions in the Gallarta (Bilboa) region.

Iron and Steel.—Spain's steel industry continued its program of rapid expansion and modernization to meet domestic demand and export opportunities. Present plans were for growth to continue through 1980. Steel production in 1972 was 9.5 million tons, an increase of 22% over that produced in 1971. Demand was estimated to be 9 million tons, compared with 8 million tons in 1971. Increased demand came principally from rising requirements for shipbuilding, public works, housing, and exports.

Exports of iron and steel products in 1972 totaled 1.85 million tons of raw steel equivalent, a 56% increase over that exported in 1971. Spain's exports of ordinary steel (96% of the total) included the following: Sections 43.1% (51.7% heavy, 48.3% light), semimanufactures 37.6%, flat

products 7.6% (98.5% cold-rolled products), and wire rod 4.5%. Imports in 1972 of iron and steel products amounted to 1.53 million tons raw steel equivalent, a 32% increase over that imported in 1971. Imports of ordinary steel (87.7% of the total) included the following: Flat products 77.1% (56.1 hot-rolled, 43.9% cold-rolled), sections 9.9% (64% light sections, 35.7% heavy sections), and semimanufactures 6.2%.

The state-controlled, Unión de Siderúrgicas Asturianas, S.A. (UNINSA), commissioned its second blast furnace at the Veriña complex. The first unit was commissioned in September 1971. The two blast furnaces have a combined annual capacity of 1.25 million tons, the largest in Spain. The company also installed a billet mill with a capacity of half a million tons per year. During 1972 a 13-kilometer railway linking UNINSA's Veriña works and Empresa Nacional Siderúrgica, S.A. (ENSIDESA), Avilés works was completed. The railway enabled hot metal to be transported in a 200-ton torpedo car from the blast furnaces at Veriña to the No. 2 Linz-Donawitz (LD) shop at Avilés. UNINSA and ENSIDESA proposed the joint development and use of handling equipment on the north quay at the port of Gijón. The proposal called for a 5-year agreement. Principal use of the port and loading facilities would be to supply coking coal and iron ore to the Avilés and Veriña steelworks. The proposal also took into consideration use of the Abono coal storage yard at Gijón, which was to have a capacity to stockpile 725,000 tons of blended coal when completed early in 1974. The storage area was to be owned jointly by ENSIDESA, UNINSA, and AHV. Invitations for bids on the construction of the blending plant were issued during 1972.

ENSIDESA, the second steel company controlled by INI, produced 940,000 tons of steel in the first 4 months of 1972. ENSIDESA's investment program for 1972–75 was distributed as follows: 45% for primary installations, 20% for completion of existing projects, and 35% for finishing facilities. The capacity for Avilés was to be raised to 3 million tons of steel per year by 1973 and 3.5 million tons per year by 1975. Part of the increased capacity was to result from ENSIDESA's rebuilding the No. 1 blast furnace at the Avilés works. Head Wrightson of the United Kingdom and its Spanish subsidiary, Indeinwrightson, were to rebuild the furnace by mid-1973. The president of INI stressed the need for restructuring the company. ENSIDESA's fundamental problem was that the Avilés steelworks had never been fully integrated, but consisted of three separate units; steelmaking, cold-rolling, and billet production. Under a new investment program, the steelworks was to be integrated fully within 15 years. The proposed merger between ENSIDESA and UNINSA was held up because of the problems of unequal private participation in the two companies (8.9% in ENSIDESA against 31.9% in UNINSA) and of redeploying personnel.

Spain's largest privately owned steel company, AHV, produced 953,968 tons of pig iron in the first half of 1972 compared with 855,457 tons in the first half of 1971. Raw steel production in the first half of 1972 amounted to 1 million tons against 900,000 tons in the first half of 1971: rolled products in the first half of 1972 amounted to 1.2 million tons against 1.1 million tons in the first half of 1972. AHV increased capacity 30% at its Echevarri continuous pickling line in 1972. The president of AHV stated that the company's raw steel production in 1972 had reached 140 tons per man-year, representing a new European high. At the same time costs were reduced by improvements in technology and organization. Yearend stocks were expected to equal about 20 days output.

Early in 1972 AHM was awarded a concession by the Spanish Government for a $2.1 billion integrated steel mill to be built at Sagunto. The steel mill was to be Spain's fourth integrated steelworks. The steelworks was to be a joint venture controlled by AHV (46.2%), U.S. Steel (15%), seven commercial banks (8%), and seven savings banks (15%). The massive projects, reportedly the largest in Spain's history, were to be constructed in several stages. A 1-million-ton-per-year cold-rolling and finishing mill was scheduled for completion in 1975 and an electrolytic tin operation by 1976. Two phases of a basic steel mill complex, each rated at 3 million tons per year, were to be completed over the periods of 1977–79 and 1979–81. The Sagunto steelworks were designed for an ultimate annual capacity of 10 to 12 million tons. AHV joined AHM in forming

an engineering subsidiary, Altos Hornos Ingenieros Consultors, S.A. (AHICSA), which was to be responsible for construction of the Sagunto steelworks.

Construction of the stainless steel plant of Cia. Española para la Fabricación de Acero Inoxidable (ACERINOX) at Algeciras continued to progress in 1972. The Spanish Ministry of Industry authorized three cooperative agreements between Japan's Nisshin Steel Co. and ACERINOX. These agreements covered the engineering, construction, and installation of the Lolos Barrios plant; a license for production of stainless steel flat products and coils; and assistance in training workers. ACERINOX also signed a license agreement for a Sendzimir cold-rolling mill. Sidernaval Equipos Siderurgicos, S.A. of Spain, a subsidary of Demag Aktiengesellschaft of West Germany, was to supply two stainless steel processing lines to ACERINOX. The first stage of the Lolos Barrios works was inaugrated at the end of 1972 and included a Sendzimir cold-rolling mill with a capacity of 2,800 tons per month and a rolling speed of 370 meters per minute. A major portion of equipment for the works was supplied by the Japanese companies Nisshin Steel, Nissho Iwai Co. Ltd., Sumitomo Metal Industries, Ltd., and Mitsubishi Metal Mining Co. Ltd. Arthur G. McKee & Co. of the United States was involved in certain aspects of the plant's engineering.

Lead, Zinc, and Associated Metals.—Mine output of lead ore showed a 4% decrease from that produced in 1971. Output of primary lead by Spanish smelters increased in 1972 to 92,139 tons, a 28% increase over that of 1971.

State-controlled lead deposits were classified as either veins, as in the province of Jaén, or ore bodies, as in the province of Cartagena. Vein deposits were mined underground and worked by means of raised stopes. Ore body deposits were mined principally by open pit techniques and employed modern mechanization. Twenty percent of present lead production comes from open pit mines, the remaining 80% comes from underground mines. By 1980 it was estimated that 50% of Spain's production will be from open pit mines and come principally from complex lead-zinc-pyrite deposits. Present metallurgical production capacity for lead was about 92,000 tons per year, 70% of this production came from the modern foundry at Santa Lucia and the province of Cartagena. The remaining production was distributed between the provinces of Jaén and Asturias. Reorganization of the metallurgical subsector under the PNM was to include enlargement of Santa Lucia's capacity to 75,000 tons per year and updating of old foundry equipment in the province of Jaén.

Zinc mine production increased from 87,540 tons in 1971 to 89,459 tons in 1972; the major portion was mined in the provinces of Santander and Murcia. Production of primary zinc in 1972 was 99,179 tons compared with 85,671 tons in 1971. Spanish zinc deposits could be classified into three distinct types. In the first type, lead and zinc occur together in vein ore bodies. These deposits were estimated to contain 44,700 tons of metal and accounted for 10% of the nation's production. The second type of deposit was comprised of lead-zinc-pyrite ore bodies. Known reserves of these deposits were estimated to contain 1.4 million tons of metal and accounted for 90% of the national production. These ore bodies were located in two provinces, Santander and Cartagena. The third type of deposit was composed of complex minerals. Reserves of this type were estimated at 2.7 million tons of metal and were not being mined. As a result of technological progress during the last decade in treating these complex minerals, they were to contribute 100,000 tons of zinc to the Nation's mine output by the end of the decade. The zinc will be recovered from pyrite, ash. As a result of Spain's increased capability to recover zinc from pyrite ash, Cerro de Pasco of Peru shipped 12,000 tons of zinc leach residues to Spain in 1972. Cerro de Pasco had a contract to supply 500,000 tons of zinc residues to Spanish firms over the next 2 years. During 1972, the third section of the Roberto flotation concentrator at Sociedad Minera y Metalurgica de Peñarroya-España's La Union lead-zinc mine was opened. The new section increased total milling capacity from 6,000 to 7,000 tons per day of low-grade, lead-zinc sulfide ore. The next stage, to become operational in 1973, was to be a pyrite processing plant. The Roberto mill was on the Mediterranean coast and used sea water in its flotation process.

Mercury.—Spain's internationally famous mercury mine at Alamadén accounted for 85% of the Nation's production of mer-

cury. World demand for mercury during 1972 remained low. Prices that had dropped to new lows in 1972 rallied toward the end of the year. Factors affecting the supply-demand posture of mercury during the year were pollution and related environmental factors and a switch by chlorine manufacturers from a mercury system to the iron diaphram process.

Officials of Minas de Almadén reportedly held discussions with their Italian counterparts at Monte Amiata during the year. Although the subject of the talks officially was not known, it was believed that the two companies involved had agreed to establish a minimum price for mercury. By not selling mercury below an established price, it was hoped to encourage a better overall price and bring supply and demand more in line. Prices had reached such a low level during the year that one of Spain's smaller quicksilver producers, Astur Belga de Minas, sought and received authorization from the provincial branch of the Spanish Ministry of Employment to lay off approximately 150 of its 185 employees. Another producer, Minas de la Soderrana, was to reduce its labor force by 50%. Reportedly, the two companies suspended operations near yearend after claiming that maintaining production and employment at current price levels would entail too great an annual loss.

Officials of Almadén announced a number of projects on which it was working during the year. These projects included installation of a conveyor belt system for zones 19 through 23, setting up equipment for utilization of propane gas in the furnaces of the metallurgical plant, automation of controls on furnaces one, two, and three, and additional equipment for furnace four.

Although the mercury market was depressed in 1972, Spain was able to increase exports in the first half of 1972 to 13,700 flasks, compared with 12,300 flasks for a similar period of 1971. However, as a result of the sharp decline in prices, sales in terms of value fell sharply in 1972.

Tin and Tungsten.—Spain's principal deposits of tin are in the northeast zone, including the Provinces of La Coruña, Orense, and Pontevedra; west-central zone, including the provinces of Salamanca and Zamora; the southwestern zone, including the provinces of Caceres and Badajoz; and the south-central zone, in the province of Córdoba. The principal mineral mined in 1972 was cassiterite, which occurred alone or with tungsten, titanium, tantalite, and other minerals. Production of primary tin in 1972 amounted to 4,206 long tons; consumption was estimated at 6,500 long tons. Under the PNM, the mines were to be reorganized on the bases of two new projects, one in Orense and the other in Badajoz and Cáceres provinces. Asturiana del Cinc and Minas de San Finx applied to the Spanish Ministry of Industry for rights to prospect for cassiterite in the Villadepera region of Spain.

Tungsten deposits are in the western and southewestern zones of the Spanish Peninsula, principally in the provinces of Salamanca, La Coruña, Galicia, Leoñ, Zamora, and Andalucía. Principal tungsten minerals mined were wolframite and scheelite. Reserves were estimated at 184.8 million tons of ore containing 472,000 tons of salable mineral. Wolframite accounted for 61% of the reserve tonnage, and scheelite accounted for the remainder. Mine production, mainly open pit, of tungsten in 1972 amounted to 294 tons and consumption was estimated to be 500 tons. The PNM called for mechanization of the mines.

NONMETALS

Cement.—Spain produced 19.4 million tons of cement in 1972 compared with approximately 17 million tons in 1971. Spain was the sixth largest cement producer in the world in 1972.

American Cement Corp. of Los Angeles, Calif., in the United States, agreed to sell its 67% interest in Portland de Mallorca, S.A., to the Spanish company Cementos del Mar, S.A., for approximately $6 million. Portland de Mallorca's operations were principally on the Island of Mallorca off the Spanish coast.

Clays.—*Kaolin.*—Spain was the fourth largest producer of kaolin in Western Europe in 1971. Output has been expanded nearly two and a half times since 1960 and according to the PNM, will double again by 1976. Deposits of kaolin in Spain are widely scattered; however, commercially important workings are in the districts of Galicia-Asturias in the northwest and Cuenca-Teruel-Valencia in the east. There were over 100 mines operating in Spain in

1972; however, most mines employed less than 25 people. Despite Spain's increased production in recent years, out-dated treatment processes remained an obstacle in providing an adequate supply of good-quality kaolin for domestic markets. The PNM called for complete modernization of many operations.

Fertilizer Materials.—During 1971–72, Spain's fertilizer industry became self-sufficient. The net result was that imports fell and a beginning was made toward exporting manufactured fertilizers. There was a marked increase in the production and consumption of more concentrated fertilizers and a corresponding decrease in the use of ammonium sulfate. Commissioning of many new fertilizer plants in recent years was stimulated by large foreign investments in the Spanish chemical industry. Spain's fertilizer industry benefited greatly from the expertise of many large overseas firms. Chilean nitrate of soda, used extensively in Spain in the past, lost its popularity during recent years because of its low nitrogen content compared with ammonium nitrate.

Nitrogen.—Ammonium nitrate and ammonium sulfate were the principal nitrogen fertilizers used in Spain, and together accounted for about 60% of the total nitrogen consumed. The demand for urea as a direct application material decreased considerably in 1971, but usage of compound fertilizers of the nitrogen-phosphorus-potassium (NPK) types continued to increase. Within the next few years the complex type fertilizers will undoubtedly dominate the Spanish market.

Union Explosivos Rio Tinto, S.A. (UERT) ordered a 120-ton-per-day nitric acid plant to be installed at Tarragona by late 1973. The order was valued at over $5 million. The Tarragona complex in 1972 was comprised of one complex NPK unit. The nitric acid plant was to provide ammonium nitrate and additional NPK capacity. Early in 1972 Sociedad de Fabricaciones de Nitrogenadas, S.A., awarded a contract to Friedrich Uhde G.m.b.H. of Dortmund, West Germany, for the construction of a 325-ton-per-day nitric acid plant at Balboa. Later in the year, the company awarded a turnkey contract for its Luchana-Barracalda complex to Tecnicas Reunitas, S.A. The fertilizer plant, to be built in the province of Viscaya, was to be capable of producing up to 500 tons per day of 28% calcium ammonium nitrate, with an option to produce granulated ammonium nitrate (33.5% nitrogen), lower grade calcium ammonium nitrate, or ammonium sulfate nitrate. Plant completion was expected in late 1973.

Phosphate.—Progress was made in 1972 on development of the phosphate rock deposit at Bu-Craa in the Spanish Sahara by Fosfatos de Bu-Craa, S.A. (FOSBUCRAA), an operating subsidiary of Empresa Nacional Minera del Sahara, S.A. (ENMINSA). West Germany's Friedrich Krupp G.m.b.H. completed construction of a 10-unit, 62-mile-long conveyor belt system linking the phosphate mines at El Bu-Craa to the port at El Aaium. Transfer capacity of the conveyor belt was 2,000 tons per day and was built at a cost of $62 million. Ships were loaded at El Aaium on a test-run basis beginning in April 1972 with the first shipload bound for Japan. FOSBUCRAA set up a $200 million development program of staggered production beginning with 100,000 tons per year in 1972, 3 million tons in 1973, 6 million tons by 1975, and 10 million tons in 1980. Spain's major problem appeared to be pricing. Reportedly, Spain did not want to undercut Morocco, which was modernizing its production facilities.

Fosforico Español, S.A., commissioned a second phosphoric acid plant in 1972 at Huelva. The combined capacity of the two plants was 100,000 tons per year. The second plant was built by Coppee-Rust of Belgium at a cost of about $5 million. The company also awarded the design, engineering, and supply of a third phosphoric acid plant to Coppee-Rust and Internacional de Ingenieria y Estudios Technicos (INTECSA), of Madrid. The facility, to cost $6 million, was to be built west of Huelva and would have a capacity of 100,000 tons of P_2O_5 per year in the form of concentrated phosphoric acid. Phosphate rock for the process would come from either Morocco or the United States. The plant was expected to start operating within 18 months and was to include a rock-grinding unit, production units for weak and concentrated phosphoric acids, plus sulfuric and phosphoric acid storage units. The three identical-capacity plants will rank Fosforico as one of the largest European producers of phosphoric acid.

Potash.—Spain's two known potash salt basins are in the provinces of Barcelona and Navarra. The two types of potash salts mined in Spain were silvinite and carnalite, whose average grades were 16% and 12%, respectively. Estimated reserves (K_2O content) were 175 million tons of silvinite and 25 million tons of carnalite. Production of potash in 1972 amounted to 1.2 million tons (K_2O content).

Fluorspar.—Production of metallurgical-grade fluorspar in 1972 increased 46% over that produced in 1971. Acid-grade production increased 9%.

Spanish deposits of fluorspar were classified as either fluorspar or fluorspar deposits associated with lead-zinc. The former deposits were found in Oviedo province, and the latter were scattered throughout the country. Reserves of fluorspar were estimated at over 14 million tons, with an average grade of 35% CaF_2. Deposits in Oviedo province were mined by open pit techniques except for the one at Caravia. The remaining deposits in Spain were worked by underground backstoping techniques. Ore dressing was done by heavy media except where lead and zinc were associated with the fluorspar, in which case differential flotation was used.

Minerales y Productos Derivados, S.A. (MINERSA), of Balboa and Metallgesellschaft, A.G., of West Germany prospected for fluorspar deposits near Almeriá in 1972.

Pyrite.—Europe's most important pyrite mineral deposit in 1972 was in the southwest portion of the Ibernian Peninsula. Reserves were estimated in excess of 500 million tons and represented one half of the world's pyrite resources.

In 1972 Spain's annual capacity for treating pyrite ash was reported as 600,000 tons. A new company, Aprovachamiento Integral de Piritas, S.A., was formed in 1972 by UERT and Tharsis Sulphur and Copper Co. Ltd. of Glasgow, Scotland, to process pyrite ash. A new plant was to be built at a cost of $54.6 million and would perform functions similar to that of the Bilbao plant of Metal Quimica del Nervión, S.A., in which UERT had a 13% interest. The plant was to have a capacity for treating 1 million tons of pyrite ash per year. Hydrometallurgical treatment of 1.6 million annual tons of ash was to yield 9,600 tons of copper, 12,000 tons of lead, 19,000 tons of zinc, 32 tons of silver, 1.2 tons of gold, nearly 1 million tons of iron pellets (63% Fe), and 600,000 tons of fines for iron sinter.

MINERAL FUELS

Coal and Lignite.—Coal reserves in Spain were estimated at 1,720 million tons. Of these reserves, 16% corresponded to coking coal, 13% to steam coal, 9% to gas coal, 42% to intermediate types between coking and gas, and the remainder to long-flaming coal.

Coal production in 1972 amounted to 14.1 million tons compared with 13.7 million tons produced in 1971. Spain's coal production was centered in six provinces, Oviedo, León, Ciudad Real, Córdoba, Sevilla, and Valencia. Restructuring of the coal mining industry under the PNM was to result in coal production being confined to the three provinces with the largest reserves (Oviedo, León, and Valencia). Production was to be extended at a later date to the province of Ciudad Real when a projected open pit mine in the Puertollano coal basin became operational.

A new coal processing company, Parque de Carbones de Aboño, S.A., was set up in 1972 by ENSIDESA, UNINSA, Nueva Montana, Quijano, Empresa Nacional Hulleras del Norte, S.A. (HUNOSA), and Minero Siderúrgica de Panferrada. The company's principal objective was to prepare and blend about 6.3 million tons per year of coking coal for the Spanish steel industry. The company would have the capacity to stock 725,000 tons of coal near the port of Gijoñ-Musel, which would be located close to UNINSA's Veriña steelworks, the coalfields of Asturias, and about 18 kilometers from ENSIDESA's Avilés steelworks.

Consumption of coal was estimated to be 12.5 million tons in 1972 an increase of nearly 1 million tons over that of 1971. The steel industry consumed 50% of the coal produced, and thermal power generating stations consumed 33%. With steel production on the increase, coking coal already in short supply was expected to become more scarce by 1980.

Spanish lignite reserves were estimated to exceed 1,100 million tons, with the main basins in the provinces of Teruel (450 million tons), La Coruña (400,000 tons), and Cataluña (200,000 tons). Caloric value of Spanish lignite ranged from

2,000 to 6,000 kilocalories per kilogram. Spain consumed practically all the lignite it produced; 70% of the production was consumed in thermal power generating stations.

Natural Gas.—In April 1972 the Algerian company, Societé Nationale pour la Recherche, la Production, la Transport, la Transformation et la Commercialisation des Hydro carbures (SONATRACH), and the Spanish company, Gas Natural, signed a contract for delivery of 23 billion cubic meters of Algerian natural gas to Spain over a period of 18 years. Deliveries were scheduled to begin in 1974. Reportedly, SONATRACH and Gas Natural were attempting to establish a 50–50 joint venture to promote the sale of Algerian gas in Europe and develop regasification plants in the Mediterranean area. The Spanish Government held talks during 1972 with Algerian officials regarding a trans-Mediterranean pipeline for transporting Algerian natural gas to Europe. The U.S. Export-Import Bank authorized a $500,000 loan to Algeria's SONATRACH to assist in financing a feasibility study of the project.

INI formed a new company in 1972 known as Empresa Nacional del Gas, S.A. (ENGASA). ENGASA was to be responsible for all industrial and commercial activity related to natural and city gas. The firm was to be responsible for the purchase of gas products in Spain and from foreign markets as well as being the importer of such products on behalf of the state. ENGASA was to supervise and control construction and operation of pipelines within Spain. However, secondary provincial or local pipelines could be built and operated by private parties, after obtaining authorization from the Ministry of Industry.

Nuclear Energy and Uranium.—It was announced in 1972 that under Spain's PNM, the firm Electra de Viesgo was to construct a 750-megawatt nuclear powerplant in the northern province of Santander. The new plant was to be Spain's fourth. The Santander plant was to be similar to the Santa Maria de Garona plant in Burgos Province. The other two nuclear power generating plants were located at Zorita de los Canes in the province of Guadalajara and at Vandellos in Tarragona. It was estimated that by 1973, 16.9% of Spain's electricity would be from nuclear plants, and by 1983, 53.9%. To meet Spain's growing demand for uranium, the country signed a sales agreement in 1972 with Canada for nearly $60 million, involving about 9 million pounds of Canadian uranium oxide. The uranium oxide was to be used to power planned electrical generating facilities.

In 1972 the Ministry of Industry authorized a new company Empresa Nacional del Uranio, S.A. (ENUSA). ENUSA functions were to include the following: Evaluation of uranium reserves discovered by ENUSA or the Spanish Nuclear Energy Board; establishment of methods to be applied in utilization of radioactive minerals, production of concentrates, and manufacture of intermediate products; implementing technical and financial studies for the possible enrichment of uranium; and determining technology and techniques best suited for production of nuclear fuels, and for construction and operation of industrial plants for treatment of nuclear fuels. ENUSA was to negotiate with foreign suppliers for nuclear fuel requirements on behalf of the Spanish companies. The new company was to be responsible for development of the Ciudad Rodrigo (Salamanca) uranium mining site, which included an enrichment plant. Spain's known uranium reserves are in the provinces of Lugo, Jaén, Salamanca, Cáceres, and Badajoz.

Petroleum.—Spokesmen for the Royal Dutch-Shell petroleum group stated that the company had begun construction of five production wells on the Amposta field off the Ebro Delta on Spain's east coast. Shell had a 51.7% interest and was operator for a consortium that included INI (24%), the state-owned Compañiá Arrendataria del Monopolio de Petróleos, S.A. (CAMPSA) (8.3%), and Coparex Española, S.A. (16%). The Spanish Ministry of Industry estimated reserves in the Amposta and neighboring Castellón field at 40 million tons. The wells, when completed at the end of 1972, were to produce approximately 50,000 barrels per day of crude oil.

New petroleum discoveries off Spain's coast spurred considerable exploration interest in 1972. A total of 16 companies applied for 43 new exploration permits covering about 5,000 square miles, mostly off the Mediterranean coast. However, there was a delay by the Government in granting permits. Reportedly the delay was

caused by conflicting applications. In the offshore Tarragona area north of the Amposta oilfield, seven groups representing 21 companies had submitted applications for permits.

Offshore activity increased significantly in 1972 compared with that of 1971. The increased activity was the result of the arrival of a second drilling unit (the Transworld 61 rig) in Spanish waters. During 1972 the rig began a new drilling program for Shell España, N.V., and Compsa in the Gulf of Cadiz with a well spudded in October 1972. Esso Exploration Spain Inc. conducted a search for oil in 1972 off the Spanish coast at Guiduzzoa, Vizcaya, and Santander. Hispánica de Petróleos, S.A. (HISPANOIL), in searching new territories for oil, turned to Egypt where it acquired a 15% interest in a group comprised of the state company Egyptian General Petroleum Corp. (EGPC) and Phillips Petroleum Co. Reportedly, HISPANOIL also signed an agreement in principal with the state owned Peruvian oil company, Petroperu, to search for oil in the northern jungle areas of Peru.

Spain's demand for petroleum continued to rise during 1972. Demand rose from just under 14 million tons in 1966 to 27.5 million tons in 1971, almost doubling in a 5-year span. During this period of rapid growth, refining capacity kept ahead of consumption through Spain's continued construction of refinery complexes. The total capacity of Spain's seven established refineries was approximately 40 million tons per year. With consumption running 28 to 30 million tons per year, potential export capacity from the refineries was between 9 and 11 million tons per year. Spain's refineries processed 37.6 million tons of crude oil in 1972 compared with 35.0 million tons in 1971 and 32.3 million tons in 1970.

In April 1972 the Spanish Government granted a financial group headed by UERT, 40% of the shares in Empresa Nacional de Petróleos de Tarragona, S.A. (ENTASA). ENTASA was to build a 7-million-ton-per-year refinery at Tarragona. During 1972 Empresa Nacional "CALVO SOTELO" de Combustibles Liquidos y Lubricantes, S.A. (ENCASO), outlined a major expansion plan for the Puertollano refinery. Puertollano's 3-million-ton-per-year refinery was being enlarged to process 6 million tons per year of crude oil. This enlargement was to be completed during 1973. A pipeline linking Puertollano to the port at Málaga was being expanded to a capacity of 7.5 million tons per year. Terminal facilities at Málaga were enlarged to accommodate tankers up to 250,000 tons. Capacities of ENCASO's base petrochemical plants also were being increased to meet the demand of other plants owned by subsidiary companies.

The Mineral Industry of Sweden

By F. L. Klinger [1]

The weakened world demand for iron ore and iron and steel products, which had developed in 1971, carried over into 1972 and kept Swedish production and exports at relatively low levels during the first half of the year. In the last 6 months, however, foreign demand increased so that Swedish exports for the year were appreciably higher than in 1971 and further gains were expected in 1973. Swedish iron ore prices were substantially reduced in late 1972, because of increased competition from foreign ores that resulted mainly from devaluation of the U.S. dollar in 1971.

Productive capacity for many commodities was being increased in 1972. Expansion of the Aitik copper mine was completed, and production of tungsten-copper-fluorspar ore was begun at Yxsjöberg. The Zinkgruvan lead-zinc-silver mine was being developed to double its production by 1977. New plants for production of iron ore pellets, iron and steel (including iron powder and stainless steel), and metallic arsenic were expected to be completed in 1973. In nonmetals, a new plant for production of phosphoric acid (and byproduct gypsum) was completed at Hälsingborg, and an export terminal for cement was under construction at Malmö. In the fuels sector, construction of a new petroleum refinery was continued at Lysekil, as were several nuclear powerplants in south Sweden. A large coking plant was authorized to be built at Luleå.

On the international scene, Swedish companies continued efforts to develop potential sources of copper, as in Canada and Peru, and the Government formed a new prospecting company for international exploration of oil and gas. In mid-1972, a free-trade agreement was signed with the European Communities (EC) covering industrial goods.

PRODUCTION

Preliminary indices of production volume in different sectors of the mineral industry in 1971 and 1972 were as follows:

Industry sector	(1968=100)	
	1971	1972
Iron ore mining	r 105	104
All mining and quarrying	r 108	110
Primary metals	r 111	114
Nonmetallic mineral manufacturing	98	97
Petroleum refining	129	125
All industry	r 113	116

r Revised.

Source: Central Bureau of Statistics (SCB), Stockholm. Statistiska Meddelanden (SM) I. No. 29 July 23, 1973, pp. 2–3.

The rise in the index for all mining and quarrying in 1972 was apparently generated by increased output of nonferrous metals ores and nonmetallic materials, but specific information was scarce. Iron ore production was less than in 1971. The basis for the higher index for primary metals was also not clear, since there was an 8% drop in production of pig iron, and output of steel was almost the same as in 1971. However, there was increased production of mine zinc and primary copper, lead, silver and aluminum. A decline in building construction led to reduced output of cement and other construction materials, although exports in this sector increased. There was a sharp rise in output of sulfuric acid in 1972, and increased production of chemical fertilizers. Production of petroleum products declined.

Production of mineral commodities is detailed in table 1.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Sweden: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum, unalloyed:			
Primary	[r] 64,509	75,500	77,500
Secondary	20,000	20,000	22,000
Arsenic:			
White, refined	16,400	17,500	16,200
Metallic	1,000	1,000	1,100
Bismuth, mine output, metal content [e]	15	15	15
Copper:			
Mine output, metal content	26,283	30,221	30,619
Matte	2,277	599	--
Metal, unrefined	485	8,770	3,883
Metal, refined:			
Primary	36,661	34,542	41,456
Secondary	14,541	15,089	10,140
Total	51,202	49,631	51,596
Gold:			
Mine output, metal content, troy ounces	44,207	54,528	57,550
Metal, including alloys, do	[r] 135,258	98,928	125,902
Iron and steel:			
Iron ore and concentrate, gross weight:			
Direct shipping ore, thousand tons	[r] 24,092	25,673	23,917
Concentrates, do	[r] 7,417	8,694	10,062
Total, do	[r] 31,509	34,367	33,979
Roasted pyrites, gross weight, do	243	NA	NA
Pig iron and sponge iron [2], do	2,793	2,759	2,533
Electric furnace ferroalloys, do	234	236	251
Crude steel, do	5,496	5,253	5,255
Steel semimanufactures:			
Bars, rods and sections, do	[r] 1,581	1,512	1,451
Plate and sheet, do	[r] 1,765	1,783	1,907
Strip, do	[r] 160	145	128
Rails and accessories, do	50	50	45
Pipe and tube stock, do	272	235	236
Other, including forgings and castings, do	[r] 212	233	215
Total, do	[r] 4,040	3,958	3,982
Lead:			
Mine output, metal content	[r] 78,312	79,454	75,841
Metal (refined):			
Primary	[r] 43,341	39,305	47,532
Secondary and remelted	[r] 9,393	[p] 10,000	[p] 10,000
Selenium, elemental (refined) [e]	110	110	110
Silicon, elemental	12,100	13,300	18,000
Silver:			
Mine output, metal content, thousand troy ounces	[r] 3,949	3,895	4,255
Metal including alloys, do	[r] 6,110	4,825	5,412
Uranium oxide (U_3O_8) [e]	[r] 70	[r] 70	70
Zinc:			
Mine output, metal content	[r] 93,376	99,043	113,728
Clinker (70% to 75% zinc)	30,800	26,800	32,400
NONMETALS			
Cement, hydraulic, thousand tons	[r] 4,061	3,950	3,732
Chalk	[r] 21,952	25,756	29,240
Clays:			
Fire clay	[3] 44,492	NA	NA
Kaolin:			
Crude	21,952	--	--
Washed	NA	--	--
Other (clinker clay)	[3] 49,739	NA	NA
Diatomite:			
Crude	5,870	5,067	[p] 5,000
Calcined	627	514	NA
Feldspar, salable, crude and ground	31,915	28,706	34,091
Fertilizer materials, manufactured, gross weight:			
Nitrogenous, thousand tons	60	NA	NA
Phosphatic, Thomas slag, do	352	265	NA
Other, including mixed, do	313	NA	NA
Lime (quicklime and hydrated lime), do	[r] 778	882	851
Pigments, natural mineral	1,195	1,345	1,438
Pyrite and pyrrhotite (including cupreous):			
Gross weight, thousand tons	575	592	486
Sulfur content, do	289	298	250

See footnotes at end of table.

Table 1.—Sweden: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
NONMETALS—Continued				
Stone, including gravel:				
Dimension stone:				
Unworked:				
Limestone and marble	thousand tons	[r] 62	57	49
Granite and gneiss (crude blocks)	do	27	26	26
Quartz (crude blocks)	do	77	75	46
Quartzite (crude blocks)	do	42	23	23
Slate (for sale)	do	5	4	1
Other	do	[r] 233	130	120
Worked, all types	do	[r] 158	118	NA
Crushed, gravel and other:				
Dolomite:				
Crude	do	[r] 323	319	269
Burnt	do	[r] 58	50	41
Limestone and other calcareous:				
For cement, lime and flux	do	9,922	9,641	9,693
Other	do	[r] 437	365	435
Granite and gneiss	do	7,767	10,092	6,802
Quartz	do	[r] 20	17	20
Quartzite	do	[r] 1,478	1,529	1,612
Other	do	[r] 915	977	957
Sulfur:				
Elemental (recovered from oil shale)		5,000	5,000	5,000
Sulfuric acid (100%) and oleum		699,780	758,000	NA
Talc and steatite		[r] 32,376	24,045	26,405
MINERAL FUELS AND RELATED MATERIALS				
Coal, all grades	thousand tons	12	[e] 10	[e] 10
Coke:				
Coke oven	do	[r] 530	499	647
Gashouse	do	[r] 367	371	[e] 360
Peat:				
For agricultural use	do	102	[e r] 120	[e] 120
For fuel use [e]	do	23	27	33
Oil shale:				
For fuel production use	do	176	136	133
For other use	do	94	55	44
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	11,050	11,407	10,702
Jet fuel	do	936	1,096	864
Kerosine	do	349	78	78
Distillate fuel oil	do	24,417	26,043	26,177
Residual fuel oil	do	35,751	34,206	32,781
Lubricants	do	455	576	588
Other	do	8,784	7,751	9,116
Refinery fuel and losses	do	5,347	4,623	4,240
Total	do	87,089	85,780	84,546

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

[1] In addition to the commodities listed, cobalt, molybdenum, nickel (as nickel sulfate), metallic titanium, fluorspar and tungsten concentrates are also produced, but output is not reported and information is inadequate to make reliable estimates of output levels. Output of fluorspar and tungsten concentrates commenced in 1972.

[2] Includes sponge iron as follows, in thousand tons: 1970—184, 1971—174, 1972—178.

[3] Figures are those published for 1969, the last year for which output is reported; no basis for estimation for subsequent years is presently available.

TRADE

Sweden continued to show a deficit in mineral commodity trade, but the deficit in 1972 was 25% less than that in the previous 2 years. The improved trade balance in this sector was mainly due to increased exports of iron ore and reduced imports of crude oil and coal in 1972. Compared with 1971, the value of mineral commodity imports was about 3% less, while the value of exports increased about 9%.

In July, Sweden signed a free-trade agreement with the Common Market countries. The agreement covered industrial goods only. Tariffs on most products will be eliminated over a period of 5 years, but a longer period will be required for certain products such as specialty steels.

Sweden's trade in mineral commodities in 1970 and 1971 is detailed in tables 2 and 3.

Table 2.—Sweden: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, metal, including alloys:			
Scrap	r 2,001	1,692	West Germany 1,240.
Unwrought	16,206	23,662	Norway 10,018; East Germany 6,019; People's Republic of China 3,018.
Semimanufactures	r 27,567	28,915	Finland 6,514; United Kingdom 5,937; Denmark 5,323.
Arsenic, oxides and acids	r 16,449	12,669	United States 7,387.
Copper:			
Ore and concentrate	r 1,633	3,650	All to East Germany.
Matte	2,315	706	Belgium-Luxembourg 606; West Germany 100.
Metal, including alloys:			
Scrap	1,374	758	West Germany 461; Denmark 197.
Unwrought	32,104	33,892	United Kingdom 12,746; West Germany 8,363.
Semimanufactures	r 33,856	35,874	Norway 10,620; Denmark 9,631; United States 5,491.
Iron and steel:			
Iron ore and concentrate except roasted pyrite—thousand tons	r 27,971	26,180	West Germany 9,621; Belgium-Luxembourg 8,017.
Roasted pyrite—do	r 449	378	West Germany 211; United Kingdom 164.
Metal:			
Scrap—do	15	13	West Germany 8.
Pig iron including spiegeleisen [1]—do	230	73	United Kingdom 11; West Germany 9; France 9.
Ferroalloys—do	59	64	United Kingdom 19; United States 10; West Germany 7.
Steel, primary forms—do	99	79	Netherlands 21; West Germany 13; Algeria 12.
Steel, semimanufactures:			
Bars, rods, angles, shapes, sections—do	426	388	United Kingdom 88; West Germany 52; United States 43.
Universals, plates, and sheets—do	572	641	West Germany 122; Denmark 118; Norway 88.
Hoop and strip—do	68	60	United States 7; Denmark 7; West Germany 6.
Rails and accessories—do	27	35	People's Republic of China 18; Norway 10.
Wire—do	58	58	United States 10; West Germany 6; United Kingdom 5.
Tubes, pipes, and fittings—do	206	180	U.S.S.R. 30; United Kingdom 19; France 14.
Castings and forgings, rough—do	5	4	Finland 1; Belgium-Luxembourg 1.
Total semimanufactures—do	1,362	1,366	
Lead:			
Ore and concentrate	47,215	70,452	West Germany 40,736; Netherlands 6,663; United Kingdom 6,375.
Oxides	1,502	1,460	Norway 536; Finland 423; Denmark 242.
Metals, including alloys, all forms	r 10,605	26,885	West Germany 17,499.
Magnesium metal, including alloys:			
Scrap	165	59	NA.
Unwrought and semimanufactures	11	4	NA.
Manganese ore and concentrate	522	293	NA.
Nickel metal, including alloys:			
Scrap	495	491	West Germany 293.
Unwrought	r 2,068	2,650	Netherlands 2,361.
Semimanufactures	r 1,233	1,853	United States 288; Netherlands 222; Romania 178.
Platinum-group metals and silver:			
Waste and sweepings—value, thousands	r $3,025	$3,131	West Germany $1,453; United Kingdom $1,405.
Metals, including alloys, unworked or partly worked:			
Platinum group—do	r $416	$237	Finland $175.
Silver—do	r $10,215	$9,115	West Germany $6,523; Switzerland $1,438.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Silicon, elemental	8,349	8,891	NA.
Tin metal, including alloys:			
Scrap—long tons	r 85	55	Norway 44.
Unwrought and semimanufactures—do	r 446	124	Finland 46; Denmark 41.
Tungsten:			
Ore and concentrate	279	21	NA.
Metal	r 74	163	NA.
Zinc:			
Ore and concentrate	r 179,499	211,257	West Germany 49,028; Belgium-Luxembourg 44,153; France 33,389.
Oxide and peroxide	293	639	Norway 363; United Kingdom 159.
Metal, including alloys:			
Scrap	1,842	2,330	Norway 1,516; West Germany 242.
Unwrought and semimanufactures	602	376	Finland 283.
Other:			
Ore and concentrate	761	746	West Germany 341; Belgium-Luxembourg 65.
Ash and residues containing nonferrous metals	r 45,824	49,816	Norway 36,386; Belgium-Luxembourg 5,990.
Oxides, hydroxides, and peroxides of metals, n.e.s.	r 55	34	NA.
Base metals, including alloys, all forms	r 411	372	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.—value, thousands	r (2)	$5	NA.
Dust and powder of precious and semiprecious stones—do	r $12	$8	NA.
Grinding and polishing wheels and stones	r 2,468	2,701	West Germany 485; United Kingdom 405; France 394.
Cement	r 9,354	94,398	Portugal 33,102; West Germany 23,231; Ireland 21,559.
Chalk	3,962	5,306	Finland 2,294; Norway 2,101.
Clay and clay products (including all refractory brick):			
Crude clays	647	563	NA.
Products:			
Refractory (including nonclay bricks)	40,062	34,725	Norway 12,307; Finland 10,412.
Nonrefractory	r 30,642	29,003	Denmark 9,003; Norway 7,556; Finland 4,135.
Diamond:			
Gem, not set or strung—value, thousands	r $275	$108	Finland $56.
Industrial—do	r $33	$26	NA.
Feldspar and fluorspar	17,144	17,552	West Germany 4,507; East Germany 2,610; New Zealand 2,266.
Fertilizer materials, manufactured:			
Nitrogenous	57,439	54,255	East Germany 49,798.
Phosphatic, Thomas slag	58,881	29,616	Norway 19,684.
Other, including mixed	17,040	13,457	Norway 13,168.
Graphite, natural	112	192	NA.
Gypsum and plasters	1	45	NA.
Lime	981	2,000	NA.
Magnesite	52	50	NA.
Pyrite, gross weight	51,750	40,798	NA.
Salt and brines	341	546	NA.
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Granite, gneiss, sandstone, etc.	636,576	584,943	Netherlands 417,290; Denmark 89,000.
Marble and other calcareous	4,717	4,236	Denmark 3,117.
Slate	5,684	7,506	Norway 5,725; Netherlands 1,088.
Dolomite, chiefly refractory grade	r 4,553	4,146	Norway 1,899; Denmark 1,625.
Gravel and crushed stone	r 999,662	1,206,853	West Germany 587,409; Denmark 524,670.
Limestone	600,016	532,484	Finland 295,447; West Germany 171,646.
Quartz and quartzite	97,679	80,369	Norway 42,092; West Germany 19,143.
Sand, excluding metal bearing	50,243	43,974	Norway 30,215.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Sulfur:			
Elemental, all forms	20	(2)	NA.
Sulfuric acid, including oleum	186,495	215,408	United Kingdom 117,877; Norway 41,283; West Germany 26,723.
Talc and steatite	6,383	2,055	NA.
Other, nonmetals, n.e.s.:			
Crude	r 30,833	37,516	United Kingdom 27,420.
Slag dross and similar waste, not metal bearing	77,878	73,337	Norway 44,384; Liberia 25,714.
Oxides, hydroxides of magnesium, strontium and barium	55	34	NA.
Bromine, iodine, and fluorine	29,696	23,155	Poland 7,045; East Germany 3,457; Finland 2,074; Norway 2,029.
Building materials of asphalt, asbestos and fiber cement and unfired nonmetals, n.e.s	r 26,045	23,492	West Germany 20,395.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	r 177,889	10,824	East Germany 7,062.
Hydrogen, helium and rare gases	r 156	185	Norway 133.
Peat, including briquets and litter	23,288	24,713	Denmark 13,853.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	4,739	4,072	United Kingdom 1,990; Denmark 968; Norway 831.
Kerosine and jet fuel do	r 606	295	Denmark 105; United Kingdom 76.
Distillate fuel oil do	3,330	2,495	Denmark 1,691; Norway 743.
Residual fuel oil do	4,067	4,229	Denmark 3,045.
Lubricants do	r 439	465	Norway 132; Finland 129; Denmark 83.
Other, including liquefied petroleum gas do	504	483	Denmark 294; Norway 93.
Total refinery products do	r 13,685	12,039	
Mineral tar and other coal-, petroleum-, or gas-derived chemicals	r 29,426	33,145	Netherlands 15,392; Denmark 9,016; West Germany 4,023.

r Revised. NA Not available.
[1] Includes cast iron and shot, grit, sponge, etc., of iron and steel.
[2] Less than ½ unit.

Table 3.—Sweden: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrates	59,799	34,083	Greece 17,166; Guyana 6,493; Poland 5,507.
Oxide and hydroxide [1]	184,370	197,097	Jamaica 115,910; Guyana 42,200.
Metal, including alloys:			
Scrap	r 2,091	1,380	Norway 1,177.
Unwrought	r 40,397	33,528	Norway 19,416; Ghana 4,234; United States 2,797.
Semimanufactures	r 33,426	29,945	Norway 7,048; West Germany 3,090; United States 3,071; Switzerland 2,981.
Chromium:			
Chromite	196,903	187,656	U.S.S.R. 132,654.
Oxide and hydroxide	2,758	2,389	West Germany 1,334; Italy 577.
Cobalt oxide and hydroxide	6	5	NA.
Copper:			
Ore and concentrate	r 60,014	65,901	Norway 18,164; Ireland 13,056; Canada 10,637.
Matte	19,286	10,845	France 10,822.
Metal, including alloys:			
Scrap	8,207	8,277	United States 3,815; France 1,250; Denmark 1,162.
Unwrought	r 70,041	69,281	Chile 24,607; Zambia 15,411; Belgium-Luxembourg 13,671.
Semimanufactures	r 28,877	22,254	United Kingdom 6,088; Finland 4,688; West Germany 3,380.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Iron and steel:			
Ore and concentrate, except roasted pyrite	134,560	2,469	NA.
Roasted pyrite	3,282	5,945	All from Finland.
Metal:			
Scrap	r 480,908	184,115	U.S.S.R. 120,031; United States 20,532; Netherlands 10,025.
Pig iron, including cast iron [2]	r 368,957	358,875	Finland 163,712; East Germany 71,027; U.S.S.R. 56,389.
Ferroalloys	103,035	102,840	Norway 43,380; India 12,621; Republic of South Africa 10,410.
Steel, primary forms	r 56,209	53,862	Finland 22,898; West Germany 13,148.
Steel semimanufactures:			
Bars, rods, angles, shapes, sections	r 482,535	397,733	West Germany 77,773; Belgium-Luxembourg 75,086; France 58,420.
Universals, plates, sheets	r 860,801	854,613	West Germany 188,111; United Kingdom 128,180; France 100,863.
Hoop and strip	106,720	82,118	Belgium-Luxembourg 17,862; West Germany 16,795; Japan 11,631.
Rails and accessories	5,911	4,777	West Germany 2,211; Belgium-Luxembourg 1,840.
Wire	r 30,205	22,846	United Kingdom 8,114; Belgium-Luxembourg 4,163; Denmark 3,069.
Tubes, pipes and fittings	r 239,293	205,721	West Germany 65,178; United Kingdom 37,951.
Castings and forgings, rough	8,207	8,662	Poland 4,547; Norway 1,307; Belgium-Luxembourg 880.
Total semimanufactures	r 1,733,672	1,576,470	
Lead:			
Oxides	1,386	1,219	East Germany 560; United Kingdom 415.
Metal, including alloys:			
Unwrought	7,020	8,247	Peru 4,568; United Kingdom 2,322.
Semimanufactures	1,878	1,612	West Germany 988; Belgium-Luxembourg 277.
Magnesium metal, including alloys:			
Unwrought, including scrap	621	773	Norway 605.
Semimanufactures	104	130	United States 30; France 29.
Manganese:			
Ore and concentrate	114,791	150,058	Republic of South Africa 81,754; U.S.S.R. 45,818; Mexico 20,677.
Oxides	1,241	957	Japan 621.
Mercury, 76-pound flasks	1,624	1,566	Spain 725; Yugoslavia 522.
Molybdenum metal, including alloys, all forms	r 40	36	West Germany 15.
Nickel:			
Matte	2,139	1,254	U.S.S.R. 943.
Metal, including alloys:			
Scrap	r 1,266	408	United States 216.
Unwrought	r 18,719	15,110	Norway 4,837; United Kingdom 3,204; U.S.S.R. 1,858.
Semimanufactures	r 4,311	4,555	Netherlands 3,315.
Platinum-group metals and silver:			
Ore and concentrates, value, thousands	r $805	$2,024	All from Peru.
Waste and sweepings, do	r $636	$474	United States $325.
Metals, including alloys, unwrought or partly worked:			
Platinum group, do	r $2,216	$1,878	United Kingdom $1,103.
Silver, do	r $5,393	$5,341	United Kingdom $3,235.
Tin, metal, including alloys:			
Unwrought, including scrap, long tons	r 936	554	United Kingdom 247; Netherlands 174.
Semimanufactures, do	157	172	United Kingdom 109.
Titanium:			
Ore and concentrate	2,857	2,728	Australia 2,649.
Oxides	6,274	6,770	Japan 2,189; West Germany 1,049.
Tungsten:			
Ore and concentrate	r 3,535	2,792	Thailand 732; Canada 607; Brazil 415.
Metals, including alloys, all forms	115	35	West Germany 20.
Zinc:			
Oxide	2,159	2,246	Netherlands 926; Norway 367; East Germany 320.
Metals, including alloys:			
Blue powder (dust)	295	455	Norway 402.
Unwrought	39,749	37,805	Norway 19,227; Finland 9,008.
Semimanufactures	1,240	1,426	West Germany 918.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Other:			
Ores and concentrates:			
Molybdenum and zirconium	[3] 11,604	5,740	United States 1,386; Netherlands 1,226; Chile 1,097.
Unspecified	8	(4)	NA.
Ashes and residues containing nonferrous metal	r 58,032	50,031	West Germany 19,813; Norway 10,743; Poland 6,294.
Oxides, hydroxides and peroxides of metal, n.e.s	2,201	1,392	Finland 588; West Germany 313.
Metals, including alloys, all forms	5,913	5,204	Republic of South Africa 1,154; West Germany 998; France 883.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	3,352	448	NA.
Dust and powder of precious and semiprecious stones value, thousands	r $784	$787	United Kingdom $323; United States $249.
Grinding and polishing wheels and stones	r 3,812	3,423	United Kingdom 1,191; Austria 829; United States 632.
Asbestos	r 18,830	13,231	U.S.S.R. 6,600.
Barite and witherite	2,099	2,284	West Germany 1,844.
Boron materials:			
Crude natural borates	11,066	10,682	United States 6,110; Turkey 2,760.
Oxide and acid	657	914	France 374.
Cement	28,130	31,675	Denmark 20,547.
Chalk	10,905	10,195	Denmark 7,946.
Clay and clay products (including all refractory brick):			
Crude clays, n.e.s. (bentonite, kaolin, refractory)	299,769	275,348	United Kingdom 220,742.
Products, refractory (including nonclay brick)	126,980	124,808	United Kingdom 34,209; Austria 30,761; West Germany 26,024.
Cryolite and chiolite	1,585	2,081	All from Denmark.
Diamond:			
Gem, not set or strung value, thousands	r $1,783	$1,624	Belgium-Luxembourg $806; Israel $426.
Industrial do	r $1,168	$1,094	United Kingdom $575; Netherlands $254.
Diatomite and other infusorial earths	8,299	8,136	Denmark 4,393; United States 2,119.
Fertilizer material:			
Crude:			
Nitrogenous	26,292	25,246	All from Chile.
Phosphatic	508,574	476,114	Morocco 355,815.
Manufactured:			
Nitrogenous	r 445,047	477,378	Norway 420,271.
Phosphatic	32,226	13,769	Tunisia 13,746.
Potassic	238,766	207,991	East Germany 59,548; West Germany 57,312; France 38,752.
Other	r 81,537	103,401	Norway 91,245.
Ammonia	82,280	91,264	Norway 89,957.
Fluorspar, including feldspar	23,979	25,297	France 8,847; Republic of South Africa 4,386; Finland 3,835.
Graphite, natural	1,271	1,234	West Germany 831.
Gypsum and plasters	487,164	505,377	France 225,017; Poland 212,052.
Lime	7,756	4,569	Denmark 4,303.
Magnesite	12,772	10,989	U.S.S.R. 6,032; Austria 1,766.
Mica, all forms	1,305	1,197	Norway 364; United Kingdom 310.
Pigments, mineral:			
Natural, crude	184	94	NA.
Iron oxides, processed	6,452	6,475	West Germany 5,975.
Precious and semiprecious stones, except diamond value, thousands	r $449	$461	West Germany $198.
Pyrite	117,733	115,511	Norway 115,233.
Salt	r 1,102,412	959,583	Netherlands 508,347; West Germany 191,123; United Kingdom 147,121.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	66,555	75,945	Belgium-Luxembourg 47,092.
Caustic potash	697	370	West Germany 296.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous stone	2,206	1,601	Italy 894.
Slate	4,464	4,330	West Germany 2,356; Norway 1,874.
Other, including granite, gneiss, etc	11,216	5,663	Norway 2,701.
Worked, all types	r 26,842	17,107	Portugal 12,850.
Dolomite, chiefly refractory grade	20,379	18,347	Norway 17,680.
Gravel and crushed stone	64,562	71,557	Denmark 37,876; Norway 15,987.
Limestone (except dimension)	149,071	127,588	United Kingdom 72,543; Denmark 45,708.
Quartz and quartzite	17,831	24,305	Portugal 21,652.
Sand, excluding metal bearing	r 356,931	366,061	Denmark 253,922.
Sulfur:			
Elemental, all forms	134,640	126,585	Poland 59,918; Finland 31,081; France 24,168.
Dioxide, sulfuric acid and oleum	83,283	99,170	Finland 42,590; Norway 31,538.
Talc, steatite, soapstone, and pyrophyllite	22,121	20,462	Norway 11,601.
Other, nonmetals, n.e.s.:			
Crude	39,402	51,883	West Germany 26,574; Norway 18,743.
Slag dross, and similar waste, not metal bearing	227	171	NA.
Oxides and hydroxides of magnesium, strontium, and barium	13,284	15,254	Norway 8,438; United Kingdom 3,659.
Bromine, iodine, and fluorine	[5] 925	20	NA.
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s	r 15,690	18,884	West Germany 5,803; Denmark 4,846; Belgium-Luxembourg 3,295.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	702	991	United States 431.
Carbon black	17,444	17,288	Netherlands 6,457; United Kingdom 5,794.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,660	1,422	United States 583; Poland 338; U.S.S.R. 316.
Lignite and lignite briquets	14,627	8,285	East Germany 6,584.
Coke and semicoke thousand tons	1,208	1,220	West Germany 491; U.S.S.R. 144; United Kingdom 135.
Hydrogen, helium and rare gases	437	807	West Germany 777.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 86,668	87,110	Nigeria 25,498; Qatar 9,630; Venezuela 9,359.
Refinery products:			
Gasoline (including natural) do	r 22,053	23,964	United Kingdom 4,793; Italy 4,758; Trinidad and Tobago 4,342.
Kerosine and jet fuel do	r 3,962	3,252	United Kingdom 1,477; U.S.S.R. 483.
Distillate fuel oil do	r 52,848	50,239	Trinidad and Tobago 5,818; U.S.S.R. 5,278; Belgium-Luxembourg 4,050.
Residual fuel oil do	r 68,872	58,824	U.S.S.R. 23,410; United Kingdom 10,729.
Lubricants do	r 1,115	1,261	United Kingdom 458; Netherlands 360.
Mineral jelly and wax do	92	90	West Germany 51.
Other, including liquefied do	r 1,107	1,229	United States 752; West Germany 293.
Total refinery products do	r 150,049	138,859	
Mineral tar and other coal-, petroleum-, or gas-derived chemicals	18,749	29,389	West Germany 6,925; Denmark 6,024; Belgium-Luxembourg 5,536.

r Revised. NA Not available.
[1] Excluding artificial corundum.
[2] Includes spiegeleisen and sponge, powder and shot.
[3] May include vanadium and tantalum, as well as molybdenum and zirconium.
[4] Less than ½ unit.
[5] Mostly chlorine.

COMMODITY REVIEW

METALS

Aluminum.—Swedish demand for aluminum increased in the last half of 1972 and pushed production, trade, and consumption above the levels of 1971. Apparent consumption of metal, including alloys and semimanufactures, was about 98,000 tons in 1972 compared with 86,000 tons in the previous year. Output of primary aluminum at the Sundsvall smelter in 1972 (nearly 78,000 tons) was about 92% of productive capacity, and production was being increased at yearend. Shipments of aluminum semimanufactures by the Essem Aluminium Division of Gränges AB in 1972 rose to 70,000 tons, about 10% more than in 1971.

Imports of alumina and bauxite in 1972 were 209,000 tons and 46,000 tons, respectively. Net imports of unwrought metal and alloys in 1972 were nearly twice the quantity of 1971, while exports and imports of semimanufactures increased about 15%.

Consumption of aluminum semimanufactures in Sweden was reported as 83,500 tons in 1972, compared with 80,000 tons in 1971 and 87,400 tons in 1970. End uses, by field of consumption, were reported as follows, in percent:

	1970	1971	1972
Transport	5.1	5.4	5.6
Mechanical construction	3.4	3.6	3.6
Electrical construction	27.0	23.7	21.8
Building	36.0	36.8	38.1
Packaging	10.5	12.2	12.3
Household appliances	7.7	7.7	7.9
Miscellaneous	10.3	10.6	10.7
Total	100.0	100.0	100.0

Source: Aluminium, V. 49, No. 1, January 1973, p. 65.

Prospects for increased demand and higher prices for aluminum in Sweden in 1973 appeared to be favorable, although cutbacks in housing construction were expected to reduce consumption in the building sector.

Arsenic.—Boliden AB was planning to build a new plant at Rönnskär for production of arsenic metal. The plant will have a production capacity of 1,500 tons of arsenic per year and will cost approximately $2 million. The production process to be used, recently developed by the company and patented in 26 countries, was said to be virtually continuous and would cause no environmental pollution.

Swedish exports of elemental arsenic[2] increased nearly 20% in 1972, to 1,300 tons valued at approximately $2.7 million. The quantity of exports of arsenic oxides (12,669 tons in 1971) was not reported in 1972, but the total value of exports increased 13% compared with 1971 figures.

Copper.—Although Swedish production of copper concentrates decreased about 3% in 1972, the copper content was slightly higher than that in 1971. Imports of copper concentrates and matte declined sharply. Consumption of refined copper, reportedly increased to 97,500 tons,[3] about 6% more than in 1971. Imports of metal, including alloys, were little changed from 1971 levels but exports of unwrought metal declined to 27,000 tons and exports of semimanufactures increased to 45,000 tons. The Essem Copper division of Gränges reported shipments of 97,000 tons of copper and copper alloy semimanufactures in 1972, up 3% compared with 1971.

Boliden continued to increase production of low-grade (0.4 to 0.5% Cu) copper ore at the Aitik mine. Output of crude ore was 3.2 million tons in 1972. Expansion of production facilities at Aitik was completed by yearend, and the company expected to produce 5.7 million tons of ore in 1973.

Boliden planned to increase production capacity of its copper smelter at Rönnskär to about 80,000 tons annually, an increase of about one-third compared to the capacity available in 1972.

In mid-1972, a government study concluded that mining of state-owned deposits of copper and zinc at Stekenjokk, in Västerbotten county near the Norwegian border, would be desirable from a standpoint of national economic development even though profitability of the venture was uncertain. Shortly after yearend, it was announced that the Government would lease the deposits to Boliden company, whereby the Government had signed an agreement with the Boliden for 20 years, would contribute about $6 million toward construction costs, and would guarantee

[2] Selenium, tellurium, and boron are included with arsenic in Swedish trade statistics.
[3] World Metal Statistics (London). V. 26, No. 7, July 1973, p. 35.

a loan to the company of about $22 million. The agreement must be ratified by Parliament and by the Nature Conservancy Board, but approval was expected in 1973. The plan calls for annual production of about 400,000 tons of crude ore, 20,000 tons of copper concentrate, and 15,000 tons of zinc concentrate, beginning about 1978. Minable ore reserves were stated to be about 8 million tons averaging 1.6% Cu and 3.32% Zn.

Gränges continued discussions with the Peruvian state firm, Minero-Peru, concerning the establishment of a joint venture to exploit copper deposits in southern Peru. In Canada, Boliden was investing $2 million in a project to develop a low-grade copper-nickel deposit south of Thunder Bay, Ontario, in association with Great Lakes Nickel, Ltd.

Iron Ore.—With large stockpiles of ore at mines and ports, and relatively weak foreign demand in the first half of the year, production of iron ore in 1972 was less than that in 1971. Exports during the first 6 months also lagged behind the 1971 level, but a strong increase in foreign demand generated a 25% rise in exports during the last half of the year and pushed total exports for 1972 to 27.6 million tons, about 5% more than those in 1971. Shipments of ore to domestic consumers declined about 10% in 1972, and iron ore stocks at yearend rose to 8.8 million tons. The prospects for increased production and exports in 1973 appeared to be good.

Production and shipments of iron ore products by the largest Swedish producers in 1972 were as follows, in thousand metric tons:

Company	Production	Shipments		
		Domestic	Export	Total
Luossavaara-Kiirunavaara AB (LKAB)	25,840	[1] 639	24,266	24,905
Tuolluvaara Gruv AB [2]	NA	NA	NA	900
Granges AB	3,393	1,522	1,775	3,297
Stora Kopparberg Bergslags AB	900	921	--	921

NA Not available.
[1] Includes 537,000 tons delivered by rail and 102,000 tons delivered by ship.
[2] Shipments of ore from Tuolluvaara Gruv AB are reported by LKAB but are not included in shipments of LKAB ore.

Sources: LKAB. 1972 Annual Reports to Stockholders Granges AB. 1972 Annual Reports to Stockholders; Skillings' Mining Review. V. 62, No. 13, Mar. 31, 1973, p. 12.

Shipments of iron ore by LKAB from the port of Narvik in 1972 totaled 20.4 million tons, loaded on 606 vessels. Shipments from Luleå totaled 4.8 million tons, loaded on 216 vessels.[4] About 75% of LKAB exports and 67% of Gränges exports were destined for Common Market countries. LKAB also shipped 3.5 million tons to the United Kingdom. Exports by both companies to Poland totaled 855,000 tons.

Domestic shipments by Gränges included 572,000 tons to company-owned plants and 950,000 tons to other Swedish consumers. Domestic shipments by LKAB included about 520,000 tons to the state-owned iron and steel works at Luleå.

Production of iron ore pellets appeared to be about the same as in 1971. Shipments of pellets by LKAB totaled 5,014,000 tons of which all but 4,000 tons were exported. Shipments of pellets by Gränges totaled 983,000 tons of which 484,000 tons were exported. Cold-bonded ("Grangcold") pellets made up 57% of the pellet shipments by Gränges. Swedish production capacity for pellets, estimated at 7 million tons per year in 1972, was scheduled to increase by 2.5 million tons in late 1973 when a new plant is completed at Malmberget for LKAB.

Prices for Swedish iron ores in 1972 were essentially unchanged from 1971 levels. Prices for 1973 deliveries, however, were reduced by an average of 7% by Gränges and 9% by LKAB. These reductions were made because devaluation of the U.S. dollar in 1971 and lower ocean freight rates in 1972 had weakened the competitive position of Swedish ore. (Swedish ore prices are based on the krona, while most foreign ore prices are based on the dollar.) LKAB prices for high-phosphorus grades were reduced by as much as 15%.

Iron and Steel.—Although production of pig iron in 1972 was 8% less than that in 1971, production of raw steel was practically unchanged from the previous year. Output of each commodity represented

[4] These figures include 0.6 million tons of Tuolluvaara ore shipped from Narvik and 0.3 million tons from Luleå.

about 85% of the capacity of operating furnaces. Production of finished steel (semimanufactures, excluding crude forms) was also about the same as in 1971, but trade in steel semimanufactures increased by about 200,000 tons (14% and 18% respectively) in both exports and imports. Consumption of finished steel was 4.06 million in 1972, compared with 4.1 million tons in 1971.

Swedish producers reported that prices for some steel products were higher in 1972, and price increases for most items were expected in 1973. Producer-prices indices for 1972 indicated gains for most product groups by the end of the year, although the annual price index for the iron and steel sector as a whole was unchanged from 1971 figures. The annual index for stainless steel semimanufactures declined by 1.7%, and the index for pig iron (including ferroalloys) declined 12%. The increase in value of exports of steel semimanufactures in 1972 (10%) was less than the increase in volume (14%) compared with 1971, and a greater differential was evident in exports of specialty steels.

Investments in the iron and steel industry in 1972 were valued at approximately $178 million, of which 91% was in iron and steel works and the remainder was in iron and steel foundries and ferroalloy plants. Total investment planned for 1973 was equivalent to about $195 million.

Official forecasts of long-range economic growth for the 1972–77 period predicted an annual production growth rate for the iron and steel sector of 9%, and a 7% annual growth rate for exports. However, it was noted from a survey of firms, that planned growth in production capacity during the 1970–75 period averaged about 5.5% annually, and that a large part of this increase was attributed to the expansion underway at the state iron and steel works, Norrbottens Järnverk AB (NJA) at Luleå.

Under the free-trade agreement signed by Sweden with the European Community (EC) in 1972, the elimination of tariffs on certain specialty steels will take place over a 7-year period, compared with 5 years for other iron and steel products. EC tariffs on imports of Swedish specialty steel by the original six Common Market countries will still be at 85% of the 1972 level in 1975. Specialty steels comprised 28% of Sweden's crude steel output in 1972 and usually account for about 50% of the value of Swedish steel exports.

In plant developments, construction of the new blast furnace and steelmaking shop for NJA at Luleå was continued, with completion scheduled by late 1973. Construction of a coking plant was authorized in 1972; the plant will have an output capacity of 800,000 tons of coke per year, and will cost an estimated $75 million.

Sandvikens Jernverks AB was installing a new 60-ton electric arc furnace and a precision rolling mill for drill steel, with completion of both plants scheduled by mid-1973. The new furnace was expected to raise the company's production capacity for specialty steel by 30%, to 290,000 tons annually. The company recently completed a cold-finishing mill for production of tubes up to 200 millimeters in diameter.

Uddeholms AB was reported to have developed a new process for production of stainless steel. The process uses injection of steam through the bottom of a converter, and is claimed to reduce production costs by as much as $8 per ingot ton; the savings result from use of steam instead of argon, a lower temperature of refining, longer life of converter linings, and other factors. The company was installing a 70-ton converter at Degerfors, for completion by 1974.

Höganäs AB was building a new plant for production of iron powder. The plant was expected to be completed in October 1974, and will increase the company's production capacity by 60,000 tons per year. Shipments of iron powder by the company in 1972 totaled 78,000 tons (73,000 tons in 1971). The product was exported to about 30 countries including the United States and Japan. A former subsidiary of the company, the Hoeganaes Corp. of Riverton, N.J., (now owned 20% by Höganäs) is the largest producer of powdered iron in the United States.

Lead and Zinc.—Production and exports of lead increased substantially in 1972, compared with the previous year's output. A decline in exports of lead concentrates (to 55,000 tons in 1972) appeared to be related to increased output of refined lead and silver-bearing lead at the Rönnskär plant of Boliden. The company said that the previous decline in production of

metal had been due to marketing problems. Imports of unwrought lead, including alloys, in 1972 were 40% less than those in 1971.

In 1972, Boliden and the West German firm of Preussag A.G. formed a joint company known as Preussag-Boliden-Blei G.m.b.H. The new company was to take over operation of the Preussag lead smelter at Nordenhamn, West Germany, on January 1, 1973. Silver-bearing lead produced by Boliden at Rönnskär will be further refined at Nordenhamn.

Production of lead-zinc ore and concentrate at Ammeberg, Sweden, by the Belgian firm, Société des Mines et Fonderies de Zinc de la Vieille—Montagne, S.A., was expected to nearly double by 1977. The company planned to invest about $12 million in an expansion program, which will increase annual output of crude ore to about 600,000 tons, of zinc concentrate to 85,000 tons, and of lead concentrate to 12,000 tons. Output of silver will also increase. Current output of the mine (Zinkgruvan) is about 340,000 tons of crude ore per year. The ore reportedly contains about 9% Zn and 1.5% Pb.

Sweden exported 216,000 tons of zinc concentrate in 1972 and imported 43,000 tons of slab zinc and alloys. Most of the zinc concentrate was smelted at Eitrheim, Norway, by Det Norske Zinkkompani A/S, which is owned 50% by Boliden.

Consumption of refined lead and zinc in Sweden in 1972 was reported [5] to be 33,400 tons of refined lead (42,900 tons in 1971) and 38,000 tons of slab zinc (32,900 tons in 1971). The latest data on consumption of each metal, by end use, was as follows (in thousand metric tons):

Product	1969	1970
Lead: [1]		
Storage batteries	--	20.9
Cable sheathing	--	18.5
Alloys	--	2.0
Pigments and chemicals	--	1.9
Pipe and sheet	--	.5
Other	--	5.6
Zinc:		
Galvanizing	28.0	--
Brass	16.0	--
Alloys	4.0	--
Oxide	2.7	--
Total	[2] 50.7	49.4

[1] Including alloys.
[2] Of which 38.1 was slab zinc.

Source: World Metal Statistics (London). V. 26, No. 7, July 1973, pp. 72 and 89.

Silicon.—Production of silicon metal increased by 35% in 1972, compared with 1971. Exports in 1972 totaled 12,807 tons, more than 40% above the levels of 1970 and 1971.

Tungsten.—Production of scheelite concentrate was started in 1972 at the Yxsjöberg mine by AB Statsgruvor. Planned output of concentrate was 500 tons per year. Imports of tungsten concentrate (2,400 tons), oxides (104 tons), and metal (11 tons) in 1972 were substantially less than imports in 1971.

Uranium.—Experimental extraction of uranium from low-grade deposits in shale was continued at Ranstad by AB Atomenergi in 1972. The research will continue at least until 1974, when a decision will be made on whether to expand production facilities.

Exploration for uranium by the Swedish Geological Survey was reported to have located additional deposits in the Arjeplog area of Norrbotten County in 1972, but none was known to be economically exploitable. Discovery of uranium mineralization was also reported near Storsjö in West Central Sweden and a drilling program to explore the deposits was planned by Boliden.

NONMETALS

Cement and Other Construction Materials.—A general downturn in building construction was evident in 1972 and was reflected in a continuing decline in production of cement and other construction materials. In residential construction, the number of buildings under construction or completed has declined since 1970. Swedish investments in the quarrying and brick-and-cement sectors in 1972 (about $55 million) were higher than in 1971 but were expected to decline about 15% in 1973. Increased costs of building materials were indicated by a rise of about 9% in the price index for major groups of nonmetallic mineral products. Exports of cement rose sharply in 1972, to 221,000 tons, and a further increase was expected in 1973. The Euroc Group (formerly AB Cementa) was investing about $7 million in port installations at Malmö to facilitate exports of

[5] World Metal Statistics (London). V. 26, No. 7, July 1973, pp. 69 and 86.

cement.[6] Among the Euroc Group contracts for foreign sales was a contract to sell 400,000 tons of cement to a Florida firm.

Shipments of refractory-grade olivine by Handöls Täljstens AB rose to 50,000 tons in 1972 compared with 42,000 tons in 1971. The company was the only Swedish producer of olivine and was a wholly-owned subsidiary of Höganäs AB. Höganäs is an important Swedish producer and exporter of building materials and refractories.

Imports of gypsum in 1972 totaled 502,000 tons, about the same as in 1971. A substantial reduction in imports was expected in 1973, owing to production of gypsum as a byproduct from the manufacture of phosphoric acid at Hälsingborg. The Hälsingborg plant, operated by the Reymersholm division of Boliden, began production at the end of the year. The gypsum will be used to manufacture wallboard and cement.

Exports of stone in 1972 included 659,000 tons of limestone for industrial use and 634,000 tons of dimension stone, of which most was granite and gneiss. Exports of gravel and other crushed stone (1.18 million tons) were slightly less than exports in 1971, but imports of sand increased to more than 600,000 tons. The potential commercial importance of deposits of sand and gravel on the continental shelf area of Sweden was noted in a 1972 governmental report,[7] which recommended a 15-year program of geophysical and geological mapping of the seabed. The report estimated that the more promising areas for sand and gravel deposits could be defined within 6 or 7 years.

Fertilizer Materials.—Imports of fertilizer materials in 1972 were 10% to 20% more than those in 1971, and included 546,000 tons of crude phosphate, 248,000 tons of potassium salts, and 530,000 tons of manufactured nitrogenous materials. Exports of manufactured phosphate fertilizer increased to 139,000 tons.

The plant for production of phosphoric acid, which was brought onstream at Hälsingborg at the end of 1972, has a production capacity of 100,000 tons of acid per year.

Fluorspar.—Imports of fluorspar in 1972 (11,800 tons) were about 40% less than in 1971. The reduction in imports was in part due to the start-up of fluorspar production at the Ysxjöberg mine in mid-1972. Anticipated annual output of fluorspar at Ysxjöberg was about 5,500 tons of flotation concentrate, of which about 3,000 tons (of 95% grade) will probably be used in the manufacture of welding rods and 2,500 tons (of 85% grade) will be used in the manufacture of steel.

Sulfur.—Production of sulfuric acid by Boliden increased by 25% in 1972, to 837,000 tons. About 82% of this quantity was produced from roasting of pyrite, and the remainder was produced from smelter gases. In addition, the company produced 51,000 tons of liquid sulfur dioxide (47,600 tons in 1971).

With the increased domestic supply of sulfuric acid, imports of elemental sulfur declined by 34,000 tons, imports of sulfuric acid declined by 20,000 tons, and exports of acid increased by 130,000 tons, compared with 1971 levels.

MINERAL FUELS

On the basis of government studies in 1967 and 1970, the increase in energy consumption in Sweden was estimated at 4.6% annually for the 1965–75 period, and 3.2% annually during the 1975–85 period. En-

[6] American Embassy, Stockholm. Airgram A–105, March 23, 1973, p. 5.
[7] Industridepartmentet (Stockholm). Statens offentliga utredningar (SOU). V. 43, 1972, pp. 17, 18 (English summary).

ergy requirements and supply for 1955 and 1965, and forecasts for 1975 and 1985,[8] are shown in the following tabulation in million tons oil equivalent:

	1955		1965		1975		1985	
	Quantity	Percent	Quantity	Percent	Quantity	Percent	Quantity	Percent
Energy requirements:								
Industry	6.7	45	10.8	44	16.9	44	24.3	46
Transport	2.3	16	3.9	16	6.2	16	8.5	16
Domestic, etc	6.0	39	9.9	40	15.6	40	20.5	38
Total	15.0	100	24.6	100	38.7	100	53.3	100
Energy supply:								
Oil products [1]	7.5	46	16.6	64	30.7	69	38.8	54
Coal and coke	4.0	25	2.2	8	1.8	4	2.1	3
Hydropower	2.2	14	4.6	18	5.8	13	6.1	8
Nuclear power	--	--	--	--	3.4	8	22.1	31
Indigenous fuels	2.5	15	2.7	10	2.8	6	3.1	4
Total	16.2	100	26.1	100	44.5	100	72.2	100

[1] Not including products for foreign bunkering or oil for storage.

The forecasts indicate a rapid growth of nuclear energy in Sweden's supply by 1985, and that the share of energy supplies derived from oil and hydroelectric power is expected to decline although the quantity of energy supplied by both sources will continue to increase.

Coal and Coke.—Imports of coal declined by 30% in 1972, and imports of coke were relatively unchanged, compared with 1971 figures. Imports of gas and coking-coal were down by 250,000 tons, and imports of steam-grade coal were down by 150,000 tons.

Imports of coking coal may increase by more than 1 million tons annually by 1975, as a result of the authorization granted to Norsk Jernverks AB to build a coking facility at Luleå in north Sweden. Output capacity of the proposed plant would be 800,000 tons of coke per year. The coal was expected to be obtained from the United States, Poland, and the Soviet Union. The United States was the major supplier of coking coal in 1971 and 1972.

Consumption of coke in production of iron, steel, and ferroalloys in 1971 was approximately 1.57 million tons, including 1.4 million tons for pig iron, 105,000 tons for ferroalloys, 63,000 tons for sponge iron, and 5,000 for steel ingots and castings.

Natural Gas.—The Swedish Government was considering the possible importation of natural gas in the late 1970's, from the Soviet Union or Norway. Although imports of gas could reduce Sweden's dependence on oil, and would be desirable from an environmental standpoint, the Government said that conditions on the Swedish energy market were not particularly favorable for the introduction of natural gas but that it would continue to study the question.

Nuclear Energy.—The Oskarshamn powerplant completed its first full year of operation in 1972, producing about 1.4 billion kilowatt-hours of electricity. The output was about 8% of the power generated by thermal plants in 1972 and about 2% of total electricity production. A second plant, of 580-megawatts capacity, was scheduled to begin operation at Oskarshamn in 1974.

By the end of 1979, nine nuclear power-

[8] Organization for Economic Cooperation and Development (OECD), Paris. The Energy Policy of Sweden. Document DIE/E/EN/72.139 (1st Revision), Nov. 28, 1972, pp. 2–4.

plants with a total generating capacity of 6,460 megawatts were scheduled to be operating in Sweden, as indicated in the following tabulation:

Plant	Capacity (megawatts)	Reactor type [1]	In operation	Principal contractor	Owner [2]
Oskarshamn I	440	BWR	1971	ASEA-ATOM	OKG.
Ringhals I	760	do	1974	do	State Power Board.
Ringhals II	820	PWR	1974	Westinghouse	Do.
Oskarshamn II	580	BWR	1974	ASEA-ATOM	OKG.
Barseback I	580	do	1975	do	Sydkraft.
Ringhals III	900	PWR	1977	Westinghouse	State Power Board.
Barseback II	580	BWR	1977	ASEA-ATOM	Sydkraft.
Forsmark I	900	do	1978	do	State Power Board (and others).
Ringhals IV	900	PWR	1979	Westinghouse	State Power Board.
Total	6,460				

[1] BWR = boiling water reactor; PWR = pressurized water reactor.
[2] OKG = Oskarshamnverkets Kraftgrupp AB; Sydkraft = Sydsvenska Kraft AB.

Source: American Embassy, Stockholm, Airgram A–251, June 15, 1973, p. 16.

With annual Swedish requirements for natural uranium estimated at about 2,000 tons in 1980 and 4,000 tons by 1990, coordination of purchasing of uranium and enrichment services was needed. In 1972, a company (Svensk Kärnbränsleförsörjning AB) was formed for this purpose by the Swedish Power Board, Sydsvenska Kraft AB, and Oskarshamnverkets Kraftgrupp AB.

Petroleum.—Oljeprospektering AB (OPAB) continued exploration for oil and gas in southern Sweden in 1972, but without encouraging results. So far, drilling has been done in the province of Skåne and on the islands of Öland and Gotland. Offshore drilling in Baltic or North Sea areas of the Continental Shelf was planned in 1973.

In late 1972, the Government announced plans to establish a second prospecting company for oil and gas. The new company, OPAB II, will operate internationally but will contract out drilling to foreign firms. Ownership of the new company was similar to OPAB I, with the state holding 50% and the remainder by several private Swedish firms.

Imports of crude oil in 1972 totaled 11.2 million tons, about 6% less than in 1971. Imports of petroleum products were also down slightly, to 18.9 million tons, while exports rose by 9% to 1.8 million tons. Swedish refinery capacity remained at about 13 million tons annually, but was expected to increase to about 20 million tons when the new refinery at Lysekil is completed in 1974. Inland consumption of petroleum products in 1971 was reported as follows, in thousand metric tons:

Product	Inland consumption	
	1971	1972
Aviation fuels	(1)	(1)
Gasoline	2,886	3,003
Kerosine	158	137
Gas/diesel oil	8,744	8,961
Residual fuel oil	11,992	12,430
Other	1,459	1,600
Total	25,239	26,131

[1] Included in "Other."

Source: Organization for Economic Cooperation and Development (OECD), Paris. Provisional Oil Statistics by Quarters, 4th Quarter 1972, 1973, 22 pp.

The Mineral Industry of Taiwan

By K. P. Wang [1]

Because of the scarcity of local resources and the rising demand for minerals in an industrial economy, Taiwan's importation and processing activities in minerals and metals overshadow indigenous extraction. A comparison in output value shows that the mineral processing sector outweighed the mining sector by 15 to 1 in 1972, up from 12 to 1 only 2 years ago. In fact, the mineral processing sector accounted for 18.9% of the estimated 1972 gross national product (GNP), compared with 1.2% for the mining sector. In absolute values, the former made a gain of 23% during the year whereas the latter rose only 3.4%. Breakdown by value of output for specific mineral-related sectors was as follows, in million U.S. dollars:[2]

Sector	1971	1972
Overall mining	$85.8	$88.7
Coal	49.0	48.2
Metals	7.2	8.7
Oil and natural gas	20.5	24.1
Salt evaporation	5.3	3.4
Nonmetals and quarrying	3.8	4.2
Manufacturing of mineral and related products	1,102.0	1,356.0
Chemical products	429.0	522.0
Oil and coal products	270.0	344.0
Nonmetallic mineral products	180.0	210.0
Base metals	189.0	230.0
Metal products	34.0	40.0

GNP growth over 1971, at 15% in current prices and 11% in constant 1966 prices, was not quite as spectacular as mineral growth, although much above the goal of the fifth 4-year plan which began in 1969. Estimated GNP for 1972 was $7.18 billion at current prices and $5.66 billion at 1966 prices, compared with $6.23 billion and $5.10 billion, respectively, for 1971. The trend towards greater industrialization continued in 1972 with industrial production increasing to more than one-third of the GNP and agricultural production declining to below one-sixth for the first time. Rapid advances in industry and the economy have been made under fairly stable price conditions. In 1972, however, prices showed a sharp upturn of nearly 5%, presumably brought about by a 30% increase in money supply resulting from rapid influxes of foreign exchange holdings and higher international commodity prices.

Significant progress has been made during the last few years on expanding Taiwan's mineral industries, many of which are primarily based upon imported raw materials. The integrated steel complex of the China Iron and Steel Corp. Ltd. was in the initial stages of construction and, when the first phase is completed in 1975–76, Taiwan's steel capacity will have been doubled and will reach close to 3 million tons per year. Taiwan Aluminium Corp. (TALCO), which just recently raised annual ingot capacity to 38,000 tons, was embarking on a program to expand further to 70,000 tons by about 1976. China Petroleum Corp. (CPC) roughly doubled refining capacity to 220,000 barrels per day. All three firms mentioned above have their principal facilities located at Kaohsiung in the south. CPC was also planning to build a large oil refining complex in the north near Keelung as part of an overall expansion program embracing tankers, pipelines, and moorings. In late 1972, Taiwan Metal Mining Corp. was considering the construction of a 30,000-ton-per-year integrated copper smelter.

Taiwan's output of electric power was about 17.5 billion kilowatt-hours in 1972, 15% higher than that of 1971. The bulk of Taiwan's power was produced by Taiwan Power Co. (TPC). Taiwan's installed power capacity was 3.5 million kilowatts at yearend 1972, compared with 2.7 million a

[1] Physical scientist, Division of Nonmetallic Minerals.

[2] Where necessary, values have been converted from New Taiwan dollars (NT$) to U.S. dollars at the rate of NT$40=US$1.00.

year earlier. About 3 million kilowatts are expected to be added by 1976, and construction was already underway for various new facilities. Two nuclear plants with a combined annual capacity of 1.6 million kilowatts and costing nearly $300 million were in the process of being built, and two others are planned by the late 1970's.

Taiwan's industries consumed 12.26 billion kilowatt-hours of electricity in 1972, including 6.2 billion kilowatt-hours in the minerals and related fields. Estimated breakdown within the minerals and related industries was as follows, in million kilowatt-hours: iron and steel, 1,180; basic industrial chemicals, 949; cement, 747; chemical fertilizers, 572; aluminum, 518; other chemical products, 1,338; mining and quarrying, 480; metal products, 253; and ceramics, 150.

The revised Statute for the Encouragement of Investment of January 1, 1971, which permits 100% foreign investment among other things, has been described in the chapter on Taiwan in the 1971 Minerals Yearbook. No basic changes were made in 1972. Rather, government efforts were directed mainly towards simplification of application procedures and streamlining of foreign investment screening under the Overseas Chinese and Alien Investment Screening Committee. Screening criteria and minimum investment requirements were also made more flexible during the year. In 1972 investment by overseas Chinese and foreign investors totaled $126 million, with Ford Motor Co. leading the investors. This compares with foreign investments of $163 million in 1971, when the Voest Steel Corp. of Austria made most of its investments.

Most new trade regulations were aimed at reducing import controls and tariffs and imposing stricter export procedures in order to slow down foreign exchange accumulation. Efforts were made to simplify appraisal procedures on import cargo, so as to reduce warehouse expenses. The exchange rate held firm at NT$40 to US$1.00 for all of 1972. On February 16, 1973, however, the rate was changed upwards 5% or NT$38 to US$1.00. As a result of the two devaluations of the U.S. dollar, Japanese and Europeans were placed at a slight disadvantage compared with Americans. Premier Tanaka's visit to the People's Republic of China (PRC) signaled a slight deterioration of Japan-Taiwan trade relations. The U.S. agreement with the PRC in early 1973 to exchange liaison offices with the PRC, however, probably will not greatly affect future U.S.-Taiwan trade and investments. Despite these two adverse developments, Taiwan's economy and trade seem destined to continue expansion at a fast pace.

PRODUCTION

Coal output declined 5%, although value showed little change. Crude oil and natural gas production each gained nearly one-sixth in quantity. Neither was of consequence by world standards, but natural gas was important to the domestic economy. The real significance in oil was in the production and consumption of refinery products derived from imported crude, which far overshadowed domestic crude in overall oil supply. Production of gasoline, diesel oil, and fuel oil in 1972 went up 9.3%, 15.8%, and 40.6%, respectively, over that of 1971.

Steel ingot output rose by one-sixth during 1972. Aluminum production showed an increase of 21% as a result of partial operation of newly added capacity. Copper showed a decline in mine output, despite more leaching operations, and a gain in refinery output.

The chemical fertilizer industry showed a sharp gain in compound fertilizers and urea, and only minor changes in other ammonium fertilizers and superphosphates. Salt output declined sharply despite plans to expand output. Increased domestic demand for cement absorbed the 13% growth in output. The marble industry made a significant increase of 17%, the same growth as the year before.

Table 1.—Taiwan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
METALS				
Aluminum:				
Alumina, gross weight		41,817	43,011	52,602
Metal, primary		r 26,992	26,546	32,104
Sheet		14,692	1 14,635	18,593
Copper:				
Mine output, metal content e		2,500	2,400	2,000
Metal, refined, secondary		3,752	3,670	4,677
Gold metal, primary	troy ounces	r 22,602	19,496	17,882
Iron and steel:				
Iron ore and concentrate		5,870	--	28,291
Pig iron		55,697	76,622	81,022
Ferroalloys (ferrosilicon)		5,039	7,675	7,003
Crude steel		293,859	391,882	456,914
Silver metal, primary	thousand troy ounces	r 96	73	74
NONMETALS				
Asbestos		2,842	2,327	2,687
Cement, hydraulic	thousand tons	4,305	5,043	5,690
Fertilizer materials, manufactured:				
Urea (46%N)	do	180	140	201
Ammonium sulfate (21%N)	do	398	401	392
Ammonia, anhydrous	do	156	142	159
Nitrochalk (20%N)		46	18	11
Compound fertilizer (20%N, 5% P_2O_5, 10% K_2O)	do	118	141	199
Calcium superphosphate (18% P_2O_5)	do	190	195	205
Gypsum:				
Precipitated		3,912	3,662	2,541
Other		7,413	12,676	3,459
Lime	thousand tons	128	171	177
Pyrite and pyrrhotite (including cupreous): 2				
Gross weight		39,586	45,229	30,326
Sulfur content e		15,000	17,100	11,500
Salt, marine	do	535	670	440
Stone:				
Dolomite	do	64	91	98
Limestone	do	NA	7,564	8,534
Marble		1,286	1,510	1,773
Sulfur, elemental, native other than Frasch 3		6,060	5,191	3,663
Talc and related materials, soapstone		38,717	39,042	24,792
MINERAL FUELS AND RELATED MATERIALS				
Carbon black		265	146	197
Coal, bituminous	thousand tons	4,473	4,097	3,913
Coke		279	254	249
Gas, natural: 4				
Gross production	million cubic feet	r 32,420	38,520	44,632
Marketed	do	32,173	38,427	44,186
Natural gas liquids:				
Condensate	thousand 42-gallon barrels	NA	792	910
Liquefied petroleum gas from natural gas	do	242	419	614
Natural gasoline	do	103	127	163
Petroleum:				
Crude	do	638	792	910
Refinery products:				
Gasoline	do	4,519	5,097	5,567
Jet fuel	do	4,496	e 4,600	e 5,000
Kerosine	do	158	291	258
Distillate fuel oil	do	7,243	7,676	8,888
Residual fuel oil	do	16,812	17,759	24,965
Liquefied petroleum gas	do	1,370	1,581	2,418
Asphalt	do	945	951	913
Lubricants	do	231	260	329
Other 5	do	1,025	1,018	1,044

e Estimate. p Preliminary. r Revised. NA Not available.

1 Taiwan Aluminum Corp. production only, does not include small quantities that may have been produced by independent producers.

2 From Chinkuashih only.

3 Excludes sulfur produced by oil refineries.

4 Largely processed into natural gas liquids.

5 Includes only solvents and base oils according to Chinese definitions.

TRADE

Taiwan's total foreign trade rose by a phenominal 44.4%, with exports reaching 43% of GNP, one of the highest in the world. Taiwan has now become a major trading nation, ranking within the first 20 in the world, and an important U.S. trad-

ing partner—about 11th in U.S. trade. Exports totaled $3.11 billion and imports $2.84 billion, making gains of 46% and 43%, respectively, over 1971. Textiles held the leading position in exports, but electronics made the most spectacular gain and occupied second place.

In 1972 mineral and metal products represented approximately 4% of all exports and more than 15% of all imports, reflecting Taiwan's reliance on imported raw materials. During the year, mineral exports rose by about 30% to $120 million, with the increase mainly accounted for by base metals and products. Mineral imports increased even more—by nearly one-half to approximately $433 million; fuels and metals spearheaded the gain. All these indicators point to increased industrialization in a healthy economy. Table 2 shows the breakdown of mineral items traded during the last 3 years, in terms of value.

Table 2.—Value of principal mineral exports and imports
(Million dollars)

Commodity	1970	1971	1972 [1]
EXPORTS			
Iron and steel products	51.7	46.4	65.0
Nonferrous metals	12.2	10.5	21.0
Copper, primary materials	4.7	3.0	3.7
Cement	r 10.3	14.0	14.0
Glass products	10.3	10.8	13.5
Refined oil products	7.0	8.5	12.0
IMPORTS			
Iron and steel products	117.5	124.7	160.0
Scrap iron	11.6	29.3	26.3
Nonferrous metals	33.9	43.0	62.0
Natural phosphates	3.0	2.8	3.2
Chemical fertilizers	r 5.7	4.6	5.0
Crude oil [2]	59.7	81.3	167.0
Lubricants	4.1	4.5	4.0
Bauxite	1.4	1.5	1.4

[1] Estimated mainly on the basis of 10-month figures.
[2] Includes fuel oil which amounts to $20 to $25 million annually.

Source: Industry of Free China (Taipei, Taiwan). February 1973, 193 pp.

Table 3.—Taiwan: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms	7,165	3,954	Indonesia 735; Hong Kong 690; South Vietnam 551.
Copper:			
Ore and concentrate	9,023	2,462	All to Japan.
Metals, including alloys, all forms	3,358	3,419	Japan 1,419; Hong Kong 1,284.
Iron and steel:			
Metal:			
Scrap	33,837	11,710	Japan 7,432; Hong Kong 2,107; Indonesia 2,000.
Pig iron, ferroalloys and other similar materials	6,844	10,820	Thailand 3,111; Malaysia 1,201; India 1,000.
Steel, primary forms	17,001	5,411	Hong Kong 2,500; Malaysia 1,000; Ryuku 940.
Semimanufactures:			
Bars, rods, angles, shapes, sections—thousand tons	212	222	Indonesia 103; Saudi Arabia 32; Hong Kong 29.
Universals, plates and sheets do	50	17	Hong Kong 5; Indonesia 5.
Other do	65	101	United States 39; Indonesia 10.
Lead metal, including alloys, all forms	NA	(1)	NA.
Tin metal, including alloys, all forms long tons	20	16	Singapore 9; Hong Kong 6.
Titanium oxide	NA	(1)	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	NA	64	Philippines 36; Japan 28.
Asbestos	151	21	Hong Kong 19; Singapore 2.
Cement—thousand tons	750	977	Hong Kong 179.
Clays and clay products (including all refractory bricks):			
Crude clays, n.e.s	NA	75	Thailand 47; South Vietnam 15; Philippines 10.
Products	34,656	41,229	Hong Kong 18,903; United States 4,130.
Fertilizer materials:			
Manufactured:			
Nitrogenous	17,278	5,630	Thailand 5,550.
Potassic	NA	--	
Others, including alloys, all forms	64,093	18,278	Philippines 10,000; New Zealand 5,200; Thailand 26.
Ammonia	NA	374	South Vietnam 349.
Graphite, natural	NA	10	All to Indonesia.
Sodium and potassium compounds, n.e.s.	NA	8,075	Hong Kong 4,045; Khmer Republic 1,297; Indonesia 945.
Other nonmetals, n.e.s.:			
Crude	240,332	226,175	Hong Kong 107,356; Singapore 79,739.
Slag, dross and similar waste, not metal bearing	1,852	3,591	All to Japan.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s.	r 178	332	Japan 330.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	26,722	14,142	Singapore 4,646; Thailand 3,892; Indonesia 2,150.
Petroleum refinery products:			
Gasoline (including natural) thousand 42-gallon barrels	16	205	Ryukyu 199.
Kerosine do	28	75	All to Hong Kong.
Distillate fuel oil do	997	452	Hong Kong 301; Malaysia 128.
Lubricants do	347	316	Japan 206; Philippines 57; Republic of Korea 37.
Other do	336	309	Indonesia 153; South Vietnam 116.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	6,764	43,008	Japan 35,902; Philippines 6,943.

r Revised. NA Not available.
1 Less than ½ unit.

Table 4.—Taiwan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Bauxite and concentrate—thousand tons	126	132
Metal, including alloys:		
Scrap	3,131	3,223
Unwrought and semimanufactures	10,249	5,415
Arsenic, natural sulfides	NA	6
Cobalt oxide and hydroxide	NA	9
Copper:		
Ore and concentrate	NA	4
Metal, including alloys, all forms	10,938	13,798
Iron and steel:		
Ore and concentrate—thousand tons	73	100
Metal:		
Scrap—do	210	506
Pig iron, ferroalloys and other similar materials—do	38	70
Steel, primary forms—do	32	57
Semimanufactures—do	609	739
Lead metal, including alloys, all forms	4,156	5,787
Manganese oxide	NA	2,312
Mercury—76-pound flasks	NA	3,741
Nickel metal, including alloys, all forms	310	685
Tin metal, including alloys, all forms—long tons	r 542	739
Titanium dioxide	NA	7,110
Zinc metal, including alloys, all forms	15,200	17,949
Other:		
Ore and concentrate	11,852	23,831
Ash and residue containing nonferrous metals	2,758	5,427
Base metals, including alloys, all forms, n.e.s	r 217	403
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	2,785	3,474
Asbestos	6,589	4,961
Cement	8,477	2,901
Clays, and clay products (including all refractory brick):		
Crude clays, n.e.s	NA	1,248
Products	4,318	4,703
Fertilizer materials:		
Manufactured:		
Nitrogenous	12,282	1,140
Potassic	117,989	99,133
Other, including mixed	NA	260
Graphite, natural	NA	5,813
Gypsum—thousand tons	[1] 125	102
Mica, crude, including splittings and waste	NA	58
Sodium and potassium compounds, n.e.s.:		
Caustic soda	NA	3,041
Caustic potash, sodic and potassic peroxides	NA	263
Sulfur, elemental, all forms—thousand tons	NA	148
Other:		
Crude	229	209
Slag, dross, and similar materials not metal bearing	10,675	34,735
Building materials of asphalt, asbestos and fibre cement, and unfired nonmetals, n.e.s	470	418
MINERAL FUELS AND RELATED MATERIALS		
Carbon black and gas carbon—thousand tons	NA	6
Coal and coke, including briquets—do	76	11
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	26,038	25,691
Refinery products:		
Distillate fuel oil—do	6,620	11,955
Lubricants—do	283	297
Mineral jelly and wax—do	42	55
Other—do	185	112
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	6,917	20,961

r Revised. NA Not available.
[1] Includes crude stone, sand, gravel, and plasters.

COMMODITY REVIEW

METALS

Aluminum.—Beginning in mid-1972, the Government-owned TALCO, sole producer of primary aluminum in Taiwan, started full-scale operations at its newly expanded facilities at Kaohsiung rated at 76,000 metric tons of alumina and 38,000 tons of aluminum annually. A program was underway to increase capacity further to 140,000 tons of alumina and 70,000 tons of aluminum annually by about 1976. The French company Péchiney had been intimately involved in the recently completed first-stage expansion, and will also give help in the second-stage expansion now being implemented. The cost of U.S. goods and services in the latest expansion will total about $22 million; the Export-Import Bank of the United States has agreed to provide 45% of this sum as a 6% loan payable in 20 semiannual installments beginning in mid-1976 and guarantee another 45% in the form of loans from private banks.

In 1972 TALCO produced 32,104 metric tons of aluminum ingot (a gain of 21% over 1971), 18,593 tons of aluminum sheet, 11,665 tons of aluminum products, and 1,731 tons of aluminum foil. Its hot-rolling capacity of 50,000 tons and cold-rolling capacity of 23,000 tons per year were being greatly expanded. By yearend 1972 the sheet rolling mill was being enlarged to 2,200 tons monthly. Extrusion capacity in Taiwan stood at about 600 tons annually, and there was a need to develop a secondary aluminum industry. In addition to TALCO, there were two other important producers of aluminum extrusions and rolled products—the China Wire & Cable Co. and the Walsin Electric Wire & Cable Co.

New manufacturing facilities in Taiwan readied for operation by yearend 1972 included TALCO's 1,500-ton-per-year aluminum rod and wire mill, which will supply bars to manufacture zippers, and its roll-bond product line which will supply aluminum freezers. Additional facilities scheduled for startup by mid-1973 included an aluminum can plant, a shipping container and truckbody-kit plant, and a 36-inch coating line, all belonging to TALCO. It can be expected that the availability of coated coils and sheets in Taiwan will trigger many new aluminum uses.[3]

Taiwan's 1972 consumption of aluminum has been estimated by TALCO at 28,000 tons, up about 5% from 1971. The restricted consumption growth was attributed to limited capacity to produce semimanufactures rather than low market demand. Breakdown of 1972 consumption was roughly as follows: building and construction, 7,000 tons; transportation, 2,000 tons; electrical goods, 4,000 tons; containers and packaging, 2,000 tons; consumer durables 6,000 tons; machinery and equipment, 6,000 tons; and others, 1,000 tons.

In 1972 Taiwan exported about 8,000 tons of aluminum semimanufactures, including about 6,000 tons of sheet, 1,000 tons of wire, and 500 tons of extrusions. Imports totaled about 2,000 tons of metal and semimanufactures. Households utensils were the only important end products exported; such exports were believed to be much larger than the 2,691 tons registered for 1971.

As usual Taiwan imported all its bauxite requirements (105,646 metric tons during January–November 1972), mainly from two adjoining mines in Johore, Malaysia and from Australia. The bauxite was converted to alumina by TALCO, requiring about 16,000 to 18,000 tons of caustic soda in the processing. There was still no serious effort to consider importing alumina, and expansion plans underway for making alumina indicate that foreign bauxite will continue to be the principal raw material for at least 3 to 5 more years. Power shortages have been a problem at reduction plants, and these occur when the Taiwan grid is short of hydropower because of inadequate rainfall. To compensate for this TALCO was in the process of building its own diesel plant for generating needed electricity. In 1972 TALCO used 518 million kilowatt-hours of electricity or 16,200 kilowatt-hours per ton of aluminum.

Copper.—The Government-owned Taiwan Metal Mining Corp. controlled most of the copper business in Taiwan. Output of mine copper (all from the Chinkuashih mine) decreased, and most of the product was in the form of cement copper (25% to 30% copper) and copper matte (40% to

[3] Wang, C. Taiwan. Aluminium. V. 49, No. 1, January 1973, pp. 80–81.

45% copper) rather than concentrate (15% to 20% copper) as in previous years. One reason for the change was the in-place leaching program introduced. The entire production was sent to Japan for custom smelting; Japanese official trade returns show that 701 metric tons of copper concentrate and 6,510 tons of cement copper and copper matte were imported from Taiwan in 1972. Chinkuashih also provided small amounts of precious metals and considerable byproduct pyrite.

Taiwan Metal's existing refinery uses copper and brass scrap for raw materials and production of refined copper in 1972 was about 1,000 tons or 27.4% more than in 1971. The company does not produce wire and other rolled products, and its bid to erect a small fabrication plant with loans from the Asian Development Bank fell through. At the turn of the year 1972–73, however, Taiwan Metal was making plans to build an integrated copper plant of possibly 30,000 tons per year (preliminary and awaiting feasibility study) at a cost of more than $40 million to be mainly financed by the Government. If this proposal goes through, much of the raw material would have to be imported. Copper requirements in Taiwan have been increasing at about 15% a year.

Iron and Steel.—The principal news on the steel scene dealt with the integrated steelworks being built by China Iron and Steel Corp., at Kaohsiung which will use imported raw materials primarily. Details on this project were given in the chapter on Taiwan in the 1971 Minerals Yearbook. Design and construction have been on schedule, with startup planned for late 1975 or early 1976. The $322 million steelworks is to be built in two stages. For the first stage, the plan is to produce 1.4 million metric tons of crude steel annually from two 165-ton "Voest" basic oxygen furnaces (BOF's) and corresponding blast furnaces and byproduct coke ovens. This will be converted to roughly 1.1 million tons of steel products, consisting primarily of flat-rolled products, billets, reinforcing bars, and wires. Ultimately, the new Kaohsiung steelworks can be expanded to as much as 5 million tons per year, as internal steel demand increases.

Steel consumption has risen sharply in recent years, with production of steel products attaining the annual level of possibly 1.4 million tons; imports were more than 0.3 million tons. Taiwan's existing steel industry is comprised of more than 200 small companies, headed by the Taiwan Iron Manufacturing Corp. and the Tang Eng Iron Works. More than half of the raw material consisted of scrap from ships. Taiwan's ship scrapping business is big by world standards and during 1972 a total of 1.6 million tons of ships (220 vessels) were scrapped. The rest of the raw materials were imported as iron and steel scrap (about $26 millon worth in 1972) and semimanufactures for further processing. Pig iron was a minor factor. Approximately $150 million dollars worth of iron and steel products were imported by Taiwan in 1972, as compared with $65 million exported.

NONMETALS

Cement.—The Taiwan cement industry had another good year, with production gaining 647,000 tons or 12.8% over 1971. The surplus of cement was approximately 1 million tons, valued at some $14 million and mainly exported to South Vietnam. There was concern over long-term prospects for exports to this and other Asian markets, particularly in view of the competition by other cement exporting countries like South Korea, the Philippines, and rising sharply, which justified the increase Thailand. However, domestic demand was of national capacity to more than 7.5 million metric tons at yearend.

Taiwan Cement Corp. (TCC), sold by the Government to private industry a few years ago, was rated at 2.7 million tons at yearend 1972. Its three large plants showed no change in annual capacity—Kaohsiung at 1,195,000 tons, Suao at 522,000 tons, and Chutung at 797,000 tons. However, capacity of the fourth and smallest plant at Hualien was raised from 79,000 tons to 165,000 tons. The company has three large suspension preheater type of kilns at various plants.

Asia Cement Corp.'s plant at Tatu was rated at 1,700,000 tons annually; Universal Cement Co.'s Tahu plant, 550,000 tons; Chiahsin Cement Co.'s Kangshan plant, 500,000 tons; and Chientai Cement Co.'s Panpingshan plant, 400,000 tons. These four companies were not contemplating expansion. Three plants contributed mostly to the increase of Taiwan's cement output

during 1972: Southeast Cement Co.'s Panpingshan plant which raised capacity from 380,000 tons to 420,000 tons; Chengtai Cement Co.'s Panpingshan plant which raised capacity from 100,000 tons to 300,000 tons (scheduled to expand further to 500,000 tons by yearend 1973); and Yungkang Cement Co.'s Yangmei plant which raised capacity from 100,000 tons to 185,000 tons. Kuanhua Cement Co.'s Kuanhsi plant was scheduled to be expanded from 60,000 tons in 1972 to 400,000 tons in 1973.

Fertilizers.—Taiwan's three nitrogen producers, headed by the Government-owned Taiwan Fertilizer Co. (TFC), had a combined annual capacity in excess of 300,000 tons of contained nitrogen. Existing capacity in nitrogenous fertilizers, source of more than 60% of all plant nutrients in Taiwan, appeared to be adequate for the next few years. Hence, the buildup in plant capacity was expected to be in compound fertilizers, phosphates, and potash. Nitrogen fertilizer production increased slightly, mainly urea. Taiwan's 1972 output of ammonium sulfate was close to 400,000 tons, about twice the tonnage of urea.

TFC's new 300-ton-per-day compound fertilizer plant at Kaohsiung went onstream and this helped raise Taiwan's overall output over 1971 by slightly more than 40% to nearly 200,000 tons. This tonnage approximates the output of superphosphates.

China Phosphate Industries Corp., a new government enterprise, made firm plans to construct a phosphate complex in Kaohsiung. Major components would include a 100-ton-per-day contact process phosphoric acid plant, a 350-ton-per-day wet process sulfuric acid plant, and two other related plants for making products used in detergents and animal feed. The sulfur is local, but Taiwan must import phosphate rock, mainly Florida pebble from the United States.

Lee Chang Yung Chemical Co. has awarded a contract to construct a 43,000-ton-per-year methonel plant utilizing natural gas feedstock and incorporating the Lurgi Process. The plan was to complete the plant by about yearend 1972.

Salt.—Taiwan's salt output declined by 230,000 tons or one-third of the 1971 production, after several years of rapid expansion. Consumption continued to increase, however, mainly in the soda-chlorine industry which produced 151,906 tons of caustic soda and 54,207 tons of soda ash in 1972. Construction of a 100,000-ton-per-year ion-exchange membrane salt plant furnished by the Japanese firms Marubeni Corp. and Asahi Chemical Industry Co. was well underway; and this should help to relieve the salt shortage.

Stone.—*Marble.*—Taiwan's new marble industry, located on the east coast near Hualien and started by the Retired Servicemen's Engineering Agency, continued to expand at a rapid pace. Output increased by 263,000 tons or 17% over 1971. Taiwan's marble reserves are extensive, quality good and varied, and annual sales may have reached $3 million to $5 million. Marblecraft used to be the mainstay of the business, but future growth will be in structural marble. Exports are becoming increasingly important, mainly to Australia and the United States.

MINERAL FUELS

Coal.—Coal production continued its downward trend with national output dropping below the 4-million ton level for the first time in many years. The industry had not yet recovered from the severe flood damage sustained during the typhoon of late 1971. Fundamental obstacles prevent Taiwan from achieving a 4- to 5-million-ton annual output again during the 1970's. In fact the Government's objective is modest a 3.8 to 3.9 tons per annum in the next 4 years.

Taiwan's essentially private-enterprise coal industry suffers from the long-standing problems of high production cost and declining demand in competition with other energy sources. New investments were not forthcoming in coal, and government loans aimed at modernization of facilities seemed too small to be of great help. Easily workable coal reserves were dwindling, and mine safety became increasingly difficult to control. Meanwhile, natural gas and fuel oil were cutting into traditional coal markets in both households and factories. Coal prices were rising, but so were oil prices. This gives coal producers some hope. When the integrated steel complex is eventually completed, some of Taiwan's good coking coal might find a new market.

The Government has worked out some guiding principles to aid the coal industry,

hoping to preserve at least a 3-million-ton annual production capability. A coal industry development fund will be established, with money coming from an assessment on natural gas utilization; $1 million to $1.3 million might be collected annually in this manner, beginning in 1975. Coal firms were urged to sign long-term contracts with major consumers. Better mines will be further mechanized, and small noneconomic mines shut down.

Petroleum.—Output of indigenous crude oil increased by nearly 15%, but this represented a mere fraction (less than 1.5%) of all oil imports. During January to October 1972, Taiwan imported about 67 million barrels of crude oil and diesel fuel with a total value of about $140 million; this compares with 33 million barrels (two-thirds crude and one-third diesel fuel) valued at $75 million in all of 1971. The reason for this large increase in imports was not clear, but Taiwan has a large refining capacity. Most of the crude came from the Middle East, headed by Iraq. A program to expand the tanker fleet so as to reduce delivery cost was being implemented. Oil consumption has been increasing at an annual rate of 10% to 15% annually.

CPC dominates every major aspect of Taiwan's oil and gas activities. Annual gross has surpassed $300 million, with very high profits. In 1971 CPC revenues were approximately $285 million, capital expenditures $58 million, and exploration more than $8 million. Completion of a new crude topping unit raised refining capacity of CPC (mainly at Kaohsiung in southern Taiwan) to 220,000 barrels daily, more than enough to meet domestic requirements. Five supertankers of 100,000 deadweight tons (dwt) carry CPC's crude from the Middle East to Taiwan. Mooring buoys and submarine pipelines have been installed a Kaohsiung and similar facilities are planned for the Keelung area in the north to serve a new 100,000-barrel-per-day refinery to be completed there by about 1975. The new refinery will be able to handle 150,000-dwt or larger tankers.

CPC has an ambitious 12-year development program starting in 1973 that may eventually cost $3.2 billion.[4] Goals of the program include an increase in natural gas output to 3.6 billion cubic meters (126 billion cubic feet); an increase of refining capacity by 350%; an extensive oil and gas exploration program; purchase of new equipment; and construction of additional tankers.

CPC's activities in petrochemicals are partly under its subsidiary the China Petrochemical Development Corp. (CPDC).[5] CPC's initial activities were in Kaohsiung or the Southern Petrochemical Complex. The first naphtha cracking unit produced about 55,000 tons of ethylene, 40,000 tons of polyethylene, and 28,000 tons of vinyl chloride in 1972. A second naphtha cracking unit was being built in the southern complex with the following annual capacities, in tons: Ethylene 230,000, propylene 95,000, butadiene 32,000, benzene 94,000, and xylene 24,000. Downstream products will be made by about eight companies, including CPDC. Hercules Co. reached an agreement with CPC near yearend to jointly build a 50,000 ton-per-year polypropylene plant near Kaohsiung. A northern petrochemical complex centered around Toufen to use ethane from CPC's natural gas came into production in the fall of 1972. This complex is rated at about 54,000 tons of ethylene annually. Additional expansion has been planned for the northern complex, but competition from South Korean petrochemical plants may influence its eventual size.

On offshore matters regarding Senkaku Islands (Tiao-yu-t'ai), little progress was made on additional exploration work because of jurisdictional problems vis-a-vis the PRC and Japan. About five concessions had previously been granted to various international oil companies.

[4] Petroleum Intelligence Weekly (New York). Oct. 16, 1972, p. 8.

[5] Industry of Free China (Taipei). Development of Man-made Fiber Industry and Petrochemical Industry in Taiwan. V. 39, No. 2, February 1973, pp. 18–34.

The Mineral Industry of Thailand

By H. B. Wood [1]

The mineral industry of Thailand continued strong in spite of an industrial recession in some major export markets and within Thailand. The total value of the 1972 mineral production represented nearly 3% of the gross national product (GNP). The GNP value increased 6% from $6,951 million in 1971 to $7,369 million [2] in 1972, but when measured in terms of 1962 constant prices, the 1972 GNP growth was up by only 3.5%. Increased foreign demand for most of Thailand's basic agricultural products brought unexpected additional earnings in 1972 that improved Thailand's balance of payments by about 20%. The unit value for all of the top seven agricultural commodities exported increased during 1972, whereas only two of the seven major export minerals made gains. Specifically, tin and barite showed increases, but cement, tungsten, fluorspar, antimony, and manganese decreased in value per ton.

Inflation continued throughout 1972 as world demand for Thailand's agricultural products increased food costs 11% and brought about a 6.4% increase in the consumer price index. Steep increases have also been reported for textiles and reinforcing steel. The growth in money supply was up almost 12%, but growth of production in real terms was up only 3.5%. The inflation trend was further accelerated by a 10% devaluation of the baht on February 13, 1973, in order to hold the baht-to-U.S. dollar ratio at 20.8 to 1.00.[3]

The fiscal 1973 budget of the Thailand Government enacted on September 29, 1972, was 9% higher than the fiscal 1972 budget. No increase in funds for mineral exploration or development projects was noted. The Mineral Resource Department and the Office of Atomic Energy for Peace were transferred from the Ministry of National Development to the Ministry of Industry. A 30% increase in the budget for the Land Department was specifically allocated to perform aerial mapping and land title clarification.[4]

In the tin industry one large floating suction dredge was operating in the Andaman Sea during most of 1972 and, following a successful exploration program, a second company was making plans to work another such dredge. Of course, Thailand has many conventional bucket dredges. By yearend 1972 a plant to produce acid-grade fluorspar, and the first modern fluorspar heavy-media separating plant known to exist in southeast Asia were in full operation. Tungsten, antimony, and manganese production remained erratic and will probably continue to behave in this manner until large companies become involved, particularly companies with more dependable systematic mining methods and with long-term market contracts. The 1972 cement capacity was much larger than demand, and probably will continue to provide a surplus for the next 2 or 3 years; however, cement consumption by the internal market and the export market is expected to grow steadily.

In October Canadian-Siam Resources, registered in Ontario, Canada, started an exploration program, consisting of magnetic and induced polarization surveys and drilling on a gosson area in the district of Yaha-Bannang Sata, Province of Yala near the Malaysia border. McPhar (Asia) Pte. of Singapore agreed to perform the geophysical surveys.[5]

In the report by the Institute of Geological Sciences on a mineral survey in Thai-

[1] Mining geologist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Where necessary values have been converted from Thailand bahts (B) to U.S. dollars at the rate of B20.8=US$1.00.

[3] U.S. Embassy, Bangkok, Thailand. Economic Trends in Thailand. State Department Airgram A–77, Mar. 20, 1973, pp. 8–9.

[4] U.S. Embassy, Bangkok, Thailand. Thai Government Budget for Fiscal Year 1973. State Department Airgram A–464, Nov. 21, 1972, pp. 1–8.

[5] Northern Miner. Canadian-Siam Resources Starts Exploration Program in Thailand. Nov. 16, 1972, p. 15.

land,[6] a detailed exploration program was outlined. This survey was instigated in 1963. The field work was performed during the 1964 and 1965 dry seasons. Aerial photography and geologic mapping were performed first, then geophysical and geochemical surveys were performed, and finally followed by detailed prospecting including some trenching and drilling. The results delineated favorable mineralized areas, which in the near future probably will be put up for leasing by the Royal Thai Government.

[6] Pallister, J. W. Integrated Mineral Surveys Overseas. Survey in Thailand. Min. Mag., v. 128, No. 3, March 1973, pp. 169–171.

Table 1.—Thailand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Antimony:			
Ore:			
Gross weight	5,545	5,397	11,172
Metal content	2,357	2,294	4,725
Metal	155	86	19
Chromite, gross weight	--	1,000	--
Columbite-tantalite concentrates, gross weight	[r] 56	42	13
Copper, mine output, metal content	NA	NA	[e] 6
Iron and steel:			
Iron ore, 55% iron, gross weight	22,523	39,531	27,818
Pig iron	10,812	13,552	12,678
Crude steel	[r] 5,784	119,994	181,943
Steel billets	--	51,931	100,800
Lead, mine output, metal content	1,289	2,348	1,819
Manganese ore:			
Battery grade 75% MnO_2	6,474	5,097	5,413
Metallurgical grade 46% to 50% MnO_2	17,391	8,885	[2] 14,439
Total	23,865	13,982	19,852
Monazite, gross weight	108	112	171
Tin:			
Mine output, metal content—long tons	21,435	21,346	22,072
Metal—do	21,692	21,336	21,929
Tungsten concentrate:			
Gross weight	1,378	[r] 3,517	6,485
Metal content	710	1,813	3,343
Zinc, mine output, metal content [e]	500	900	700
Zircon, gross weight	865	1,526	366
NONMETALS			
Asbestos	NA	NA	22
Barite	16,490	63,539	97,091
Cement, hydraulic—thousand tons	[r] 2,627	2,786	3,392
Clays, kaolin	[r] 3,188	10,133	15,290
Feldspar	NA	NA	1,500
Fluorspar, 80% to 85% CaF_2	318,227	427,298	395,070
Gypsum	144,250	167,903	89,805
Salt [e]—thousand tons	[r] 160	160	160
Sand, silica	43,720	27,440	48,080
Stone:			
Marl (used for cement)—thousand tons	623	490	372
Quartz, not further described	NA	NA	2,248
Talc and related materials:			
Pyrophyllite	--	50	1,550
Talc	NA	NA	75
MINERAL FUELS AND RELATED MATERIALS			
Coal, lignite—thousand tons	400	445	345
Petroleum:			
Crude—thousand 42-gallon barrels	70	95	[e] 100
Refinery products:			
Gssoline—do	4,342	12,521	8,160
Jet fuel—do	2,092	3,237	4,937
Kerosine—do	1,071	1,139	1,804
Distillate fuel oil—do	7,196	11,972	13,474
Residual fuel oil—do	8,083	11,488	15,753
Naphtha—do	651	219	2,072
Liquefied petroleum gas—do	709	1,100	1,903
Asphalt—do	NA	713	854
Other—do	NA	2,816	6,620

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

[1] In addition to the commodities listed, Thailand produces other varieties of crude construction materials (clays, sand and gravel, stone, etc.) but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Includes 24 tons of chemical grade ore.

PRODUCTION

In general, production of Thai minerals was steady, recording some gains and some losses. Estimated value of mineral production increased 14% from $175.5 million in 1971 to $200.3 million in 1972. Tin concentrate continued to be the leading mineral product with a 1972 value of $81 million, followed by cement at $76 million, tungsten at $20 million, and fluorspar at $15 million.

Because tin metal is the most valuable mineral product exported from Thailand, production trends are watched closely. Tin export value totaled about 68% of the total value of all minerals exported ($118.5 million) and is an important product in keeping the trade deficit low. Tin mining is undergoing a transitional stage during which the number of small mines is expected to decrease slowly, the number of tin dredges is expected to increase, and large companies with advanced techniques and investment capital are expected to become increasingly involved. Historically, production of tin concentrate (about 73% tin grade in recent years) has since 1967 ranged from 28,000 to 32,000 long tons per year. World demand for tin has been steady and unless the U.S. market, which is the largest buyer (58% in 1972) of Thailand tin, fails to buy as much, there is no reason to anticipate any change in the trend of Thai tin production and exports.

The 7.5% decrease in production of fluorspar was probably a reflection of the industrial recession in Japan, where 90% of the fluorspar is sold. The 22% increase in cement production was a reflection of the large expansion in capacity carried out in 1971 and 1972. The Thai Government encouraged such an expansion in anticipation of new markets in The Republic of Khmer (Cambodia), Laos, and South Vietnam, where new demands for cement are expected for rebuilding the war-torn country.

Continued growth in overall mineral production is anticipated for Thailand. Except for tin, most of the new deposits are shallow and cheap to work. All the industry needs are steady markets to permit long-range planning and sufficient capital investment. It is reasonable to assume that extraction of zinc and copper will be started in the future, and to anticipate notable increases in the production of tungsten, antimony, iron ore, barite, fluorspar, and cement.

Dependency of Thailand on imported crude oil and petroleum products, particularly from Middle East countries, emphasizes the urgency for encouraging oil exploration on Thai land and water areas. Most of the offshore oil blocks have been leased to major foreign (mostly U.S.) oil companies, and exploration drilling has started in various concessions. Some drilling was also done onshore in northern Thailand. To date, no conclusive results have been obtained from either the onshore or offshore drilling.

TRADE

Thailand's overall trade balance improved 20% with the trade deficit decreasing from $449 in 1971 to $366 million in 1972. Preliminary estimates of overall exports were up 31%, reaching a total value of $1,089 million in 1972. Mineral exports totaled $118.5 million, representing about 11% of all exports. The export values of four minerals—tin $79 million, cement $8.4 million, tungsten $18 million, and fluorspar $10.2 million—totaled $115.6 million. Thailand's largest tin market is in the United States, and the largest fluorspar market is in Japan. Markets for the other minerals are scattered throughout the world.

Preliminary estimates of Thailand's overall imports indicated that the value increased 13% to $1,455 million. The leading mineral import was petroleum and petroleum products valued at about $131 million, an increase of about 15% over 1971 imports.[7]

Crude oil imports alone totaled 39.6 million barrels, up 28% from 1971 imports. Petroleum imports were the largest contributor to the trade deficit, followed closely by fertilizer materials and iron and steel products. Imports of iron and steel products decreased in 1970 and 1971 and

[7] Work cited in footnote 3.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys:		
Scrap	403	--
Semimanufactures	36	64
Antimony:		
Ore and concentrate	r 3,298	4,702
Metal [2]	108	22
Chromium, chromite	200	--
Columbite-tantalite [2]	--	2
Copper:		
Ore and concentrate	25	--
Metal, including alloys, scrap	240	30
Iron and steel:		
Ore and concentrate	52,335	4,500
Metal:		
Pig iron, including cast iron	800	304
Semimanufactures	r 10,784	12,403
Lead:		
Ore and concentrate [2]	r 2,886	5,180
Metal, including alloys:		
Scrap	844	--
Unwrought	169	1,200
Semimanufactures	101	--
Magnesium metal, including alloys, scrap	10	--
Manganese, ore and concentrate [2]	r 7,860	8,279
Silver metal, including alloys, troy ounces	643	--
Tin metal, including alloys, unwrought, long tons	21,502	21,528
Tungsten, ore and concentrate [2]	r 1,536	4,384
Zinc metal, including alloys, semimanufactures	737	67
Zirconium, ore and concentrate	1,960	--
Other, metallic ores and concentrates	11,269	32,958
NONMETALS		
Barite [2]	2,700	37,700
Cement	r 157,539	252,361
Chalk	--	100
Clays and clay products:		
Kaolin	--	4,440
Fuller's earth, dinas, chamotte, and others	5	200
Diatomite and other infusorial earths	--	3,500
Fertilizer materials:		
Potassic	191	186
Other and mixed	85	10
Fluorspar	349,257	335,774
Gypsum	37,904	22,513
Precious and semiprecious stones, except diamond:		
Natural, thousand carats	7,486	7,052
Manufactured, do	2,417	11,870
Salt	96,272	39,870
Stone, sand and gravel:		
Dimension stone, crude and partly worked:		
Calcareous	r 1	--
Other	--	6
Gravel and crushed rock	46	169
Limestone	194	266
Talc and related materials, pyrophyllite [2]	--	15
Other:		
Slag, dross and similar waste, not metal bearing:		
From iron and steel manufacture	935	--
Slag and ash, n.e.s	1,574	3,465
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products: [3]		
Gasoline, motor, thousand 42-gallon barrels	558	654
Kerosine, do	334	142
Jet fuel, do	3	24
Distillate fuel oil, do	157	582
Lubricants, do	12	12
Other, do	r 7	130

r Revised.

[1] Source (unless otherwise specified): Thailand Department of Customs. Foreign Trade Statistics of Thailand, December 1970 and December 1971. Bangkok, 1972 and 1973.

[2] Source: Various State Department Airgrams released during 1972 and 1973.

[3] Includes bunker.

Table 3.—Thailand: Preliminary data on exports of selected mineral commodities in 1972 [1]

(Metric tons unless otherwise specified)

Commodity [2]	Quantity	Value [3] (thousands)
Antimony:		
Ore and concentrate, gross weight	5,213	$ 812
Metal	64	48
Barite	40,050	1,005
Cement	531,652	8,435
Clays (kaolin only)	3,913	62
Columbite-tantalite concentrates, gross weight	15	53
Fluorspar	257,708	10,183
Gypsum	7,156	77
Manganese ore, gross weight	3,298	115
Monazite	100	10
Salt	48,665	736
Talc and related materials, pyrophyllite	200	(4)
Tin, metal long tons	21,014	78,971
Tungsten, ore and concentrate, gross weight	5,843	17,966

[1] Source: United States Department of State, Airgram A-134, Bangkok, May 18, 1973. Enclosure 3; except for cement data, which are from Airgram A-50 Bangkok, February 23, 1973.
[2] Source indicate that exports of iron ore and lead ore (both reported in 1971) were nil in 1972.
[3] Converted from reported figures in bahts at the rate of B20.8 = US$1.00.
[4] Less than $5,000.

the downward trend probably continued into 1972.

The export of Thailand's agriculture products is growing rapidly, as the Thai's can sell almost any food product that they can get to the market. It is their need to import industrial products that caused the trade deficit of about $366 million in 1972.

Although Thailand had no significant trade with the People's Republic of China (PRC) after World War II, an official embargo was not defined and enforced until 1957. An official agreement to open trade relations with the PRC has not been consumated, but talks are currently underway. Thailand will probably establish a government-owned trading company to make trade agreements with the PRC, particularly for exportable commodities.[8]

[8] U.S. Embassy, Bangkok, Thailand. Thailand Moves Toward Trade With the People's Republic of China. State Department Airgram A-461, Nov. 17, 1972, pp. 1-3.

Table 4.—Thailand: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Bauxite and concentrate	2,992	3,374
Metal, including alloys:		
Scrap	1,081	549
Unwrought	8,423	9,358
Semimanufactures	4,581	3,817
Antimony:		
Ore and concentrate	2	6
Metal, including alloys, all forms	14	--
Arsenic trioxide, pentoxide, and acids	109	124
Chromite	20	5
Cobalt, oxides and hydroxides	105	28
Copper:		
Matte	12	3
Copper sulfate	50	52
Metal, including alloys:		
Scrap	133	541
Unwrought	10	48
Master alloys	94	2
Semimanufactures	4,255	4,669
Gold metal, unworked or partly worked troy ounces	146,223	135,532
Iron and steel:		
Ore and concentrate	244	--
Metal:		
Scrap	168,996	200,730
Pig iron, ferroalloys, and similar materials	4,941	6,313
Sponge iron, powder, and shot	1,329	90
Steel primary forms	r 7,090	33,388
Semimanufactures	r 537,054	442,688
Ingots	171	1,532

Table 4.—Thailand: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Lead:		
Ore and concentrate	--	10
Oxide	628	548
Metal, including alloys:		
Scrap	87	49
Unwrought	2,770	4,628
Semimanufactures	213	232
Magnesium metal, including alloys:		
Scrap	(1)	--
Unwrought	r 7	1
Manganese:		
Ore and concentrate	370	314
Oxides	464	361
Mercury, 76-pound flasks	128	148
Molybdenum metal, including alloys, all forms	5	--
Nickel:		
Ore and concentrate	2	--
Matte, speiss, and similar materials	2	6
Metal, including alloys:		
Scrap	1	7
Unwrought	6	2
Semimanufactures	540	225
Platinum-group metals:		
Ore and concentrate, metric tons	24	--
Metals, including alloys, all forms, troy ounces	r 3,054	2,186
Silver metal, including alloys, do	16,590	394,811
Tin:		
Oxides, long tons	r 8	6
Unwrought and semimanufactures, do	r 3	3
Titanium:		
Ore and concentrate	148	181
Oxides	r 1,528	1,868
Tungsten metal, including alloys, all forms	r 1	--
Zinc:		
Ore and concentrate	4	--
Oxide	1,331	1,423
Metal, including alloys:		
Scrap	370	55
Blue powder	20	9
Unwrought	16,361	18,870
Semimanufactures	r 1,828	1,269
Zirconium, ore and concentrate	102	--
Other:		
Ore and concentrate of base metals, n.e.s	392	1,952
Ash and residue containing nonferrous metals	73	97
Oxides, hydroxides and peroxides of metals, n.e.s	64	69
Metals, including alloys, all forms:		
Alkali, alkaline earth, and rare-earth metals	7	5
Pyrophoric alloys	16	7
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	1,717	1,730
Dust and powder of precious and semiprecious stones, kilograms	r 57	3
Grinding and polishing wheels and stones	1,179	817
Asbestos	21,271	33,423
Barite and witherite	84	39
Bromine:		
Elemental, kilograms	909	20
Compounds, n.e.s, do	29,876	53,603
Cement	r 22,508	4,860
Chalk	52	239
Clays and clay products:		
Crude clays, n.e.s.:		
Fuller's earth, dinas, and chamotte	1,715	17,213
Kaolin	6,026	6,185
Products:		
Refractory (including nonclay bricks)	8,782	14,713
Nonrefractory	13,042	13,215
Cryolite and chiolite	10	(3)
Diamond:		
Gem, not set or strung, carats	r 14,741	10,200
Industrial, do	38,093	109,736
Diatomite and other infusorial earths	47	--
Feldspar, leucite, nepheline, and nepheline syenite	1,455	2,531
Fertilizer materials:		
Crude and manufactured:		
Nitrogenous	11,812	53,414
Phosphatic	6,351	5,014
Potassic	3,760	3,906
Other and mixed	r 227,696	171,070
Ammonia, anhydrous	r 349	357

Table 4.—Thailand: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
NONMETALS—Continued			
Fluorspar		35	89
Graphite, natural		774	1,014
Gypsum, anhydrite, and plasters		647	1,060
Lime		429	267
Magnesite		339	297
Mica		r 44	91
Pigments, mineral, including processed iron oxides		r 747	682
Precious and semiprecious stones except diamond	thousand carats	r 62,232	89,016
Pyrite, gross weight		120	--
Salt		r 147	18,207
Sodium and potassium compounds, n.e.s		5,645	4,385
Stone, sand and gravel:			
Dimension stone:			
Crude:			
Calcareous (marble)		99	660
Slate		3	--
Other		3,753	530
Worked:			
Calcareous (marble)		1,108	1,072
Slate		65	62
Paving and flagstone		18	--
Other		345	962
Dolomite, chiefly refractory grade		1	4
Gravel and crushed rock		5,542	11,490
Limestone (except dimension)		147	93
Quartz and quartzite		1,274	1,057
Sand, excluding metal bearing		191	444
Sulfur:			
Elemental:			
Other than colloidal		23,470	21,789
Colloidal		1,392	6,190
Sulfur dioxide		15	1
Sulfuric acid		20	55
Talc and steatite		3,196	3,179
Other nonmetals, n.e.s.:			
Crude		--	9
Slag, dross, and similar waste, not metal bearing		1,898	1,599
Oxides and hydroxides of magnesium, strontium, and barium		41	28
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		29	8
Carbon black		6,801	7,040
Coal, all grades, including briquets		287	535
Coke and semicoke		9,783	17,438
Peat		3	50
Petroleum:			
Crude and partly refined:			
Crude	thousand 42-gallon barrels	r 3,719	7,543
Partly refined	do	24,080	32,044
Refined products: [4]			
Gasoline, aviation	do	43	116
Gasoline, motor	do	1,320	473
Kerosine	do	337	117
Jet fuel	do	453	87
Distillate fuel oil	do	r 6,963	5,049
Residual fuel oil	do	r 173	38
Lubricants	do	755	511
Mineral jelly and wax	do	50	57
Other:			
Nonlubricating oils, n.e.s	do	148	277
Liquefied petroleum gas	do	2	[3]
Pitch, pitch coke, and petroleum coke	do	2	39
Bitumen and other	do	5	7
Bituminous mixtures, n.e.s	do	10	6
Other	do	325	828
Total	do	10,586	7,605
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		1,816	307

r Revised.
[1] Revised to none.
[2] Erroneously reported as metric tons in previous edition.
[3] Less than ½ unit.
[4] Includes bunker.

COMMODITY REVIEW

METALS

Antimony.—Antimony output more than doubled in 1972, increasing to 11,172 tons. This was due to increased market demand and subsequent higher prices which encouraged expanded production.

Iron and Steel.—During 1972, production of iron ore and pig iron decreased 30% and 6%, respectively, below the 1971 production level. Thailand's exports of such materials have been very nominal by world standards.

No imports of iron ore (50% Fe) were reported in 1971 or 1972. Thailand's average annual imports of iron and steel products were roughly 720,000 and 685,000 tons during 1970 and 1971. The 1971 imports comprised about 443,000 tons of semimanufactures and 201,000 tons of scrap. In 1972, iron and steel imports probably were a little lower than in 1971 because Thailand was undergoing an industrial recession.

Effective January 1972, the Thai Government restricted imports of specific grades of steel bars and rods without a license from the Ministry of Economic Affairs. This act was probably initiated to bolster the domestic steel industry and may account for some of the anticipated 1972 reduction in imports.[9]

Siam Iron and Steel Co. (SISCO) completed installation of its second electric arc furnace, which will increase capacity to 130,000 tons per year.[10] Added production was actually not needed in 1972 because of sluggish markets.

Thai mining companies were reported to be seeking U.S. partners in new iron ore mining ventures. Also, the Government reportedly was trying to promote the establishment of an integrated steel industry in Thailand with the help of the United States and British and other European companies. To date, most of the Thai steel industry has been financed by Japanese money.

Lead and Zinc.—Lead ore production, all from the Kanchanaburi District in northwest Thailand, decreased from 5,525 tons in 1971 to 4,279 tons (grade 40% to 45% Pb) in 1972. Exports of lead ore and metal increased from 4,000 tons in 1970 to 6,380 tons in 1971, but it was reported that exports declined in 1972. Imports of lead metal in 1971 were 4,628 tons, up 67% from 1970.

No zinc metal production was reported for 1972. Imports of zinc oxide and zinc metal were 1,423 tons and 18,870 tons, respectively, in 1971. Most likely, slight increases in imports were registered in 1972.

Thai Zinc Ltd. started to develop the 3 million-ton (35% Zn) calamine-smithsonite zinc deposit at Pa Daeng in Mae Sot. This deposit was discovered in 1956 by the Royal Department of Mines. Thai Zinc leased the deposit at the end of 1971 and in April 1972 announced that Davy-Ashmore Pty. Ltd. of Melbourne, Australia, had been retained to build a $20 million zinc processing plant of 50,000 ton-per-year slab zinc capacity, which is to be completed within 3 years. During the interim, Thai Zinc expects to produce and export some zinc ore.[11]

Manganese.—Combined production of metallurgical-grade and battery grade manganese ore increased 42% from 13,982 tons in 1971 to 19,852 tons in 1972, but these tonnages were far below the 1969 and 1970 levels. Exports of all grades dropped 60% from 8,279 tons in 1971 to 3,298 tons (preliminary estimate) in 1972, table 3. The average value per ton for all grades of ore shipped decreased from $38.62 per ton in 1971 to $33.67 per ton in 1972.[12]

In 1972 exports decreased notably with the decline in prices, but production continued unabated. Domestic consumption of metallurgical-grade manganese may have increased slightly in 1972, but more likely large stockpiles occurred in Thailand at yearend. Only a small market exists in Thailand for battery-grade ore. Japanese steel companies, normally the largest buyers of Thai manganese, reduced purchases drastically and no doubt caused the oversupply situation in Thailand.

Tin.—Tin concentrate (73.25% Sn) production increased slightly, with total value

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[9] U.S. Embassy, Bangkok, Thailand. Thai Government Restricts Imports of Hot Rolled Steel Bars and Rods. State Department Airgram A-24, Jan. 14, 1972, pp. 1-2.

[10] Investor. Siam Iron and Steel looks to a Good Year. V. 4, No. 3, March 1972, p. 172.

[11] Engineering and Mining Journal. AUS-Thai Consortium. V. 173, No. 5, May 1972, p. 124.
World Mining. Asia-Thailand, Thai Zinc Will Use EZ Silicate Leach at Mal Sot Zn Mine. V. 8, No. 8, July 1972, p. 47.

[12] U.S. Embassy, Bangkok, Thailand. Mineral Questionnaire 1972. State Department Airgram, A-126, May 11, 1973, p. 2.

rising about 9% from $74 million in 1971 to $81 million in 1972. Output of tin metal in concentrate (73.25% Sn) increased about 3% from 21,346 long tons in 1971 to 22,072 long tons in 1972, and smelter tin output increased 2.8% from 21,331 long tons in 1971 to 21,925 long tons in 1972. In concentrate production, Thailand maintained its position as the fourth largest producer in the world; in smelter metal production, Thailand moved up from fourth to third place. In 1972 tin concentrate comprised 40% of the total value of all mineral production and 68% of total mineral exports. Tin metal exports decreased about 2% from 21,358 long tons in 1971 (table 3) to 21,014 long tons in 1972, but total value increased from about $75 million or $3,516 per long ton in 1971 to about $79 million or $3,760 per long ton in 1972.[13]

Because of the price fluctuations in the middle of the year, the International Tin Council, under authority of the Fourth International Tin Agreement, which Thailand signed in 1971, placed export quotas on producers. During the last quarter of 1972, the tin price (c.i.f. New York) averaged $3,917 per ton, and prices closed firm at yearend. In December, the London Metal Exchange prices ranged from £1,606 to £1,610 per ton, (over $4,000 per ton).[14]

During the year, the number of mines in operation ranged from 581 to 657 and, on the average, they employed about 38,000 men. Associated Mines of Thailand completed its tin exploration off the West Coast of Thailand in the Andaman Sea, and reported favorable tin dredging conditions. Except for shutdowns to make design adjustments and trips to the dock to avoid the monsoons, the new TEMCO II dredge of Thailand Exploration and Mining Co. Ltd. and Thailand Smelting and Refining Co. Ltd. operated most of the year in the vicinity of Phuket Island.

Byproduct minerals from tin dredging have promise of developing into a secondary industry. Associated with the cassiterite in the alluvial deposits of granite origin are minerals such as columbite-tantalite, monazite, xenotime, zircon, ilmenite, leucoxene, anatase, and brookite. For lack of demand, these minerals are normally stockpiled as waste near the tin dressing sheds after extraction of the tin concentrate. The mineralized waste locally called "amang" is now being treated principally by Boonsoong Tin Dredging Ltd. in Takuapa District, Phang-nga Province, which is capable of treating 900 tons per day. This company's modern plant is recovering some cassiterite along with a concentrate of monazite, zenotime, columbite, zircon, ilmenite, and garnet.[15]

Tungsten.—Tungsten production and exports continued their upward trend and in dollar value, tungsten took over third position and cement second from fluorspar in terms of export value. Tungsten concentrate production (65% WO_3) increased 84% from 3,517 tons in 1971 to 6,485 tons in 1972, and exports increased 33% from 4,384 tons to 5,843 tons. Although the 1972 increases were substantial, these were far below the 1971 growth rates for tungsten production and exports. In 1971 the value of the concentrate produced averaged $3,498 per ton and in 1972 averaged $3,066 per ton, indicating a decrease in value of about 12%. In 1972 Thailand moved from seventh position in tungsten production to fourth, almost equaling U.S. production.

As world prices dropped, Thailand's tungsten production slowed down. Also, as prospects for world trade with the PRC improved, the possibility of the PRC huge tungsten reserves becoming available may have softened the world market.

Much of Thailand's tungsten is mined in the Kanchanaburi District in the northwest and in the Nakhom Si-Thammarat District in southern Thailand, mostly in conjunction with tin. From five to 10 different tungsten mines operated off and on during 1972, employing 460 men on the average.[16] The Siamerican Mining Enterprise Co., Ltd. owns the Khao Soon mine in Nakhom Si-Thammarat described as the largest tungsten mine in Asia outside the PRC. Khao Soon District has been plagued by poachers (as many as 23,000) and has even had to buy its own ore back from these illegal diggers. Approximately 90% of Thailand's tungsten mines are harassed

[13] U.S. Embassy, Bangkok, Thailand. Industrial Outlook Report: Minerals. State Department Airgram A–134, May 18, 1973, pp. 1–3.
[14] American Metal Market. Tin Report. Prices Expected to Soften During Seasonal Slowdown. Dec. 15, 1972, p. 15.
[15] Industrial Minerals. Thailand. Byproduct Minerals from Tin Mining. No. 57, June 1972, p. 35.
[16] Department of Mineral Resources, Bangkok, Thailand. Mineral Production of Thailand. Mineral Resource Gazette. V. 17. 1972, appendix.

by illegal diggers within the concessions. The mines in the south are further handicapped by general lawlessness, including large-scale smuggling across the Malaysian border. Under the circumstances, foreign investors are unlikely to venture into tungsten mining in Thailand. [17]

NONMETALS

Barite.—Barite demand continued to increase owing to the oil well drilling boom in Southeast Asia, particularly offshore. Barite (93% $BaSO_4$) production increased 53% from 63,539 tons in 1971 to 97,091 tons in 1972, but barite exports increased only 6% from 37,700 tons in 1971 to 40,050 tons in 1972. The average value of exports increased only slightly to $25.09 per ton in 1972.

The fact that twice as much barite was produced in 1972 as was exported indicates that either the producers overestimated demand and accumulated a stockpile of over 40,000 tons at yearend, or that Barite Thailand Co., Ltd., had put into operation a new processing plant in Songkhla Province to make oil well drilling mud primarily for the domestic market.[18] From four to nine barite mines were in operation during the year employing an average of 300 men annually. Most of the barite mines are in the southern Province of Songkhla.

Cement.—Cement production and exports increased sharply in 1972, and total sales value increased from $61.7 million in 1971 to $68.6 million in 1972. As a result, the cement industry maintained its position in value as the second largest mineral industry in Thailand following tin. Cement production increased about 22%, from 2.8 million tons in 1971 to 3.4 million tons in 1972; capacity rose about 38%, from 2.9 million tons in 1971 to 4 million tons in 1972. Exports more than doubled, rising from 258,000 tons in 1971 to 532,000 tons in 1972. Export value rose to $8.4 million. There were no imports reported in 1972.[19]

Siam Cement Co. Ltd. completed the first full year of production at its new Kaeng-Khoi plant in Sarabui Province. Kaeng-Khoi's reported capacity is 750,000 tons annually, and this new addition increased the company's overall capacity to 2,800,000 tons annually. During 1972, Siam City Cement Co. started to produce cement at its new plant, also in Kaeng-Khoi, which has a reported capacity of 600,000 tons annually. Siam City Cement also had a second new plant of 425,000-ton-per-year capacities scheduled to go onstream in the fall of 1972. Jalaprathan Cement Co. has two cement plants in Thailand; the plant at Cha-Am of about 500,000 tons annually went onstream in 1972. These new plants are expected to increase Thailand's cement production by more than 1 million tons. The Thai Government has encouraged the cement companies to increase capacity and to export all surplus.

Although Thailand is faced with an overproduction situation, prices are listed f.o.b. Bangkok instead of c.i.f. at the port of delivery. This puts the buyer in an uncertain supply position, particularly since shipping service needs improving. The country is strategically located to potential markets and producers turn out a good product, which is desired by customers.

The average domestic price for cement is quoted at $22 per ton, a slight decrease from $23.50 in 1971, but the export price was normally less than $16 per ton.

Fluorspar.—Thailand fluorspar miners struggled through 1972, with the result that the country was the third largest producer in the free world. The slump in world demand resulted in a production drop of 7.5%, from 427,298 to 395,070 tons (70% CaF_2) and a value decline from $42.83 per ton in 1971 to $38.09 per ton in 1972, f.o.b. Bangkok. The reported fluorspar price at the mine (loaded on truck or railroad car) averaged $35.70 per ton. Exported tonnage decreased 23% from 336,000 in 1971 to 258,000 tons in 1972.[20] Fluorspar in value was Thailand's fourth largest mineral export commodity in 1972, but the export value decreased to 10.2 million in 1972, f.o.b. Bangkok. There was very little difference between reported production values and export values of fluorspar, f.o.b. Bangkok. Japan continued to be the largest buyer, receiving 229,014 tons at an average cost of $41.51 per ton c.i.f. Japanese ports. The number of fluorspar mines in operation ranged from 50 to 81, but on the average there were 69 mines employing about 7,000 men.

[17] Work cited in footnote 13.
[18] Work cited in footnote 13.
[19] U.S. Embassy, Bangkok, Thailand. Cement: Production and Sales in 1972. State Department Airgram A-50, Feb. 23, 1973, pp. 1–5.
[20] Work cited in footnote 13, pp. 1–3.

Consumption of metallurgical fluorspar by the Thai steel industry was not reported for 1971 or 1972. Because Thailand has no significant consuming industry no major domestic market exists. Total domestic consumption is probably less than 10,000 tons of fluorspar per year. Thailand's stocks of fluorspar at yearend 1972 were probably close to 100,000 tons.

Thai Fluorite Processing Co. Ltd.'s concentrating plant located in Petchaburi Province went onstream in July 1972, and was officially dedicated in September 1972. The annual rated output capacity is 50,000 tons of fluorspar concentrate containing more than 97% CaF_2. Reportedly, Thai Fluorite had a contract with Ataka Trading Co. of Japan to deliver up to 30,000 tons of acid-grade fluorspar before March 31, 1973, and an additional 30,000 tons before March 31, 1974.[21]

In March 1972, Universal Mining Co. completed a heavy-media separating (HMS) plant near Chiengmai, Lamphun Province, about 540 kilometers north of Bangkok in the Ban Hong District. The HMS plant was designed and built by Head Wrightson Process Engineering Ltd. of the United Kingdom. Full production was not achieved until December. The feed is reported to come from piles of hand sorted waste material that have accumulated in the area during the past 10 years. Reportedly the plant is expected to produce 60,000 tons of 80%-grade fluorspar annually.[22] Crude ore from nearby mines will also be available for processing.

Leighton Mining N.L. of Australia, obtained a 49% interest in Petchaburi Mining and Processing Ltd., which has been operating fluorspar mines in south-central Thailand. Historically, the company has produced 30,000 tons of hand-sorted metallurgical fluorspar annually.[23] This acquisition is an indication that Australian companies are interested in obtaining a source of fluorspar for the growing steel industry in Australia.

Toyoda Tsusho Co. of Nagoya, Japan, has obtained an interest in some fluorspar mines in Lamphun Province about 700 kilometers north of Bangkok. The reserves are reported to be 150,000 tons, which may be mined by crude hand methods to produce metallurgical fluorspar at the rate of 3,000 tons per month.[24]

Thai fluorspar producers are aware that the PRC has made trade agreements to ship 50,000 tons of metallurgical fluorspar annually to Japan. Thai producers hope to make up this market loss by selling at least twice that amount to the Soviet Union.

Soviet trade may have transportation problems, due to a dearth of Soviet ships stopping at Bangkok.

Other Minerals.—Preliminary reports on gypsum, indicate that production decreased 47%. A notable increase was reported on some minor minerals such as pyrophyllite, monazite, kaolin, and silica sand, but a decrease was noted in zircon, and in the concentrates of columbite-tantalite.

MINERAL FUELS

Coal.—Lignite production decreased 22% from 445,000 tons in 1971, valued at $1.76 million, to 345,000 tons in 1972, valued at $1.33 million. The 1972 production was even lower than the 1970 production. During 1972, three lignite mines were in operation, employing an average of 380 men. All of the lignite was consumed by domestic powerplants or fertilizer plants, or to make wood charcoal for ironmaking.

In July the Thai National Energy Authority announced that a West German engineering firm had been retained to design a pilot plant to make coke from lignite. The proposal is to use lignite from the Li area in Lamphun Province where a lignite reserve of 36 million tons has been reported.

Petroleum.—Only a fraction of Thailand's oil needs were met by domestic production. However, considerable exploration was being done, particularly offshore by international oil companies. High-grade reserves of shale oil occur in the Mae Sot area of Tak bordering Burma, but no serious efforts were made to develop them.

Meanwhile, large quantities of crude petroleum and secondarily, refined petroleum were imported. In 1972, preliminary reports on crude oil imports totaled 39.6 million barrels valued at $97 million; a

[21] U.S. Embassy, Bangkok, Thailand. Mining and Minerals. State Department Airgram A-398, Oct. 7, 1972, p. 1.
U.S. Embassy, Bangkok, Thailand. Foreign Service Despatch A-170, May 9, 1972, p. 2.
[22] Industrial Minerals. Progress in Modernising Thailand's Fluorspar Industry. No. 56, May 1972, pp. 31-33.
[23] Industrial Minerals. No. 58, July 1972, p. 37.
[24] Industrial Minerals. New Fluorspar Mine in North. No. 60, September 1972, p. 37.

notable increase from 1971. Refined oil imports (mainly diesel fuel oil) totaled 4.6 million barrels, down 3 million barrels from 1971. These figures reflect overall growth in petroleum consumption and an increase in refinery production.

The oldest and smallest refinery (only 1,000 barrels per day) at Fang is owned by the Government and located in northeastern Thailand. The Bangkok Oil Refinery, also owned by the Thai Government but operated by the Summit Industrial Corp., was expanded 65,000 barrels per day from the original capacity of 25,000 barrels. At yearend 1972, the Thai Oil Refinery Co., Ltd., refinery was capable of producing 65,000 barrels per day and the Esso Standard Thailand Ltd. refinery,[25] 35,000 barrels per day. All three refineries are located in Sri Racha, Chon Buri, 110 kilometers southeast of Bangkok. Summit was making plans to build a 14-inch, 13-kilometer pipeline from its refinery to an electric powerplant in south Bangkok.

A $15 million project to construct offshore sea-berthing facilities to serve the Sri Racha refineries was proposed by the National Energy Authority during the year. The new facilities will increase handling capacity from 80,000 deadweight tons to 200,000 deadweight tons and allow berthing of two supertankers simultaneously. Shares will be owned by the Government and the three oil refiners, Esso, Summit, and Thai Oil Refinery (in which Shell participates).

Thai International Petroleum Co.'s (TIPC) proposal to build a 80,000 barrel per day refinery and a 1,360-kilometer (845-mile) pipeline network was agreed upon by the Government around midyear. The combined project would be owned by the Government and operated by TIPC at 40% of the profits. Cost of the refinery would be about $71 million, and cost of pipeline network, about $51 million. Pipelines would be built to serve areas to the north and southeast from Bangkok. Many international companies have expressed interest in jointly working with TIPC.[26] A larger capacity was not considered because of the Thai Government limitation of refinery size to 100,000 barrels per day.

In April, the Government took into consideration a Japanese plan for a 100-mile (160-kilometer), 50- to 56-inch pipeline across the Isthmus of Kra to provide an alternative route for crude oil from tankers, which at present use the Straits of Malacca. However, a later suggestion of a canal across the isthmus was also considered and became a subject of a government feasibility study.[27]

A plan to build a petrochemical complex in Sri Racha by late 1977 moved closer to reality. Upstream facilities capable of providing 150,000 tons of ethylene and 65,000 tons of propylene annually from naptha cracking will be built by Thai Petrochemical Co., Ltd. (half Thai and the other half Royal Dutch Shell). Downstream facilities to produce the various derivatives will be built by Japanese Mitsui-Mitsubishi interests. The whole complex would cost $300 to $400 million.

In April, Amoco Thailand Petroleum Co. and Idemitsu Kowan Co., Ltd., of Japan were granted rights to explore and develop Blocks 5 and 6 offshore. In the same month Triton Oil & Gas gave up rights to Blocks W5 and W6 in the Andaman Sea, and Mobil Oil expressed interest in Block W5 because it held adjoining rights in Indonesian East Summatra and offshore waters to the south and west of Malaysia. In July, Blocks W7 (28,000 square kilometers) and W8 (32,000 square kilometers) in deeper waters in the Andaman Sea were put up for bids. Amoco, Tenneco, British Petroleum, Shell, and Esso were interested in these blocks.

Final agreements were signed in August between Pan Ocean Oil and the Government for Block W3 (8,000 square kilometers) in the Andaman Sea. The company already holds the rights to Block W4. In the same month, Weeks Petroleum (Thailand) was awarded the nearby Block W1 (8,000 square kilometers). As an example to obtain the concession rights, Weeks had to turn over a $160,000 bonus to the Thai Government, with a stipulation that the annual bonus would be $2 million at the end of each January following oil discovery and this could increase to $4 million if production surpasses 50,000 barrels per day.

Between August and December Gulf Oil spudded in four wildcats on its acreage in

[25] As part of the new complex, Esso has also constructed a desalting plant capable of providing 340,000 liters (about 90,000 U.S. gallons) of fresh water daily.

[26] World Petroleum Report 1973. Far East and Asia. June 1973, pp. 83–84.

[27] Petroleum Press Service. Short Cut to Japan. September 1972, p. 326.

the Gulf of Thailand. Three in Blocks 7 and 8 were abandoned. Final well "9-466/IX" was spudded in December in Block 9.[28]

Tenneco had settled the location of its first wildcat at 8° 05′ 19″N 102° 17′ 10″E, in Block 15, and expected to spud in early January 1973.

In September, Thailand and Malaysia signed a preliminary agreement on demarcation of a common offshore boundary in the South China Sea (Gulf of Thailand). Previously in early 1972, an agreement on demarcation in the Andaman Sea had been completed.

Electrical Energy.—In December 1972, the long-pending $135 million nuclear powerplant project of the Royal Thai Government (RTG) moved forward when the International Atomic Energy Organization gave its approval for the project. The nuclear powerplant will be a light-water reactor type with a capacity of 600 megawatts. Plans for completion in 1980 are still in effect.[29]

Work by the Electricity Generating Authority of Thailand (EGAT) on the Mae Moh Power Project to expand electric power distribution moved ahead during the year.

On Thailand's Chao Phyra River, close to the Gulf of Siam and 12 kilometers south of Bangkok, EGAT was building the South Bangkok thermal plants. Unit one, which has a maximum capacity of 240,000 kilowatts, is already in production, and unit two with equal capacity is scheduled for completion in 1973. Plans have been approved for construction of a third unit with a maximum capacity of 360,000 kilowatts.

[28] Work cited in footnote 26.
[29] U.S. Embassy, Bangkok, Thailand. Planned Construction of Nuclear Power Plant. State Department Airgram A-502, Dec. 22, 1972, p. 1.

The Mineral Industry of Tunisia

By Roland W. Merwin [1]

Tunisia's gross domestic product (GDP) was approximately $2,160 million,[2] an increase of 19% over the revised GDP of 1971. The mineral share of the GDP, exclusive of the manufacturing sectors of the mineral industry, was about 5% of the 1972 total. Crude petroleum production accounted for approximately 80% of the mineral portion of the GDP. Not only is the mineral segment of the GDP significant by world standards, but it is of particular importance to Tunisia as a source of foreign exchange. Most of Tunisia's mineral products were exported, as in the past. However, some nonmetallics such as cement, lime, clays, salt, and petroleum products were locally consumed.

The petroleum industry continued to be the most important sector of the mineral industry both as to present output and prospects for the future. Two new major fields were in the process of being developed and brought into production, one onshore and one offshore, in eastern Tunisia near Sfax. Additionally, two new fields were discovered in 1972 in the Sfax area, one onshore and one offshore. Exploration for additional petroleum fields was continuing at an accelerated rate, spurred on by promising geological indications, a stable political climate, and the favorable terms under which concessions may be obtained.

The phosphate industry continued to be the second most important segment of the mineral industry. The Government of Tunisia continued to regard its revitalization as one of its most important objectives. Such revitalization would be of economic significance to southern Tunisia where the mines are located, serve as a base for the industrialization of the coastal areas, and contribute toward obtaining much-needed foreign exchange. One phase of the program covered modernization of mines to improve productivity and improvements in beneficiation facilities to obtain a higher grade marketable phosphate rock product that would be more competitive in foreign markets.

The Government of Tunisia pressed ahead on an ongoing program for establishing a chemical industry complex at Gabes, including facilities for the production of phosphoric acid for export. Favorable trade agreements with the European Community (EC) makes this an attractive method of upgrading Tunisia's low-tenor phosphate ores for export. Additionally, the exportation of phosphate in a finished product obtains a better return of foreign exchange than if the product were exported in the form of phosphate rock.

The completion of a natural gas pipeline from the El Borma field in southern Tunisia to the industrial complex at Gabes provided a firm foundation for further expansion of the fertilizer and petrochemical industries which are being established in this area and which will serve as the main base for Tunisia's future industrial expansion.

The nonferrous and nonmetallic mineral industries continued to receive increasing attention from the Government-owned mining company, Société Tunisienne d'Expansion Minière (SOTEMI). Particular emphasis was placed on increasing the production and exportation of lead, zinc, and fluorspar minerals.

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[1] Mining engineer, Division of Nonmetallic Minerals—Mineral Supply.

[2] Where necessary, values have been converted from Tunisian dinars (TD) to U.S. dollars at the rate of TD1 = US$2.13.

PRODUCTION AND TRADE

Tunisia's mineral output continued to be very much export oriented. Available data on mineral production and trade are given in the following tables:

Table 1.—Tunisia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
METALS				
Iron and steel:				
Iron ore and concentrates, gross weight	thousand tons	774	936	890
Pig iron	do	130	98	[e] 100
Steel, crude	do	99	86	[e] 90
Lead:				
Mine output, metal content		22,533	18,900	18,277
Metal, primary, unalloyed plus antimonial		22,541	19,159	25,073
Mercury metal, primary	76-pound flasks	102	340	238
Silver metal, primary	thousand troy ounces	[r] 56	106	106
Zinc, mine output, metal content		[r] 12,300	11,800	10,164
NONMETALS				
Barite		1,936	1,783	1,188
Cement, hydraulic	thousand tons	[r] 547	584	629
Clays, construction [e]	do	230	[r] 245	260
Fertilizer materials:				
Crude, natural, phosphate rock	do	3,016	3,162	3,387
Manufactured:				
Hyperphosphate	do	28	7	9
Superphosphate	do	30	422	42
Triple superphosphate	do	382		413
Fluorspar, all grades		30,700	32,959	46,032
Lime, hydraulic	thousand tons	168	166	[e] 170
Salt, marine	do	300	250	330
MINERAL FUELS AND RELATED MATERIALS				
Gas, natural:				
Gross production	million cubic feet	316	327	1,353
Marketed production	do	[r] 177	35	699
Petroleum:				
Crude oil	thousand 42-gallon barrels	34,296	31,542	31,607
Refinery products:				
Gasoline	do	747	850	796
Jet fuel	do	493	320	484
Kerosine	do		563	
Distillate fuel oil	do	2,242	2,274	2,453
Residual fuel oil	do	2,980	2,840	2,989
Other	do	1,097	1,257	[e] 612
Refinery fuel and losses	do	1,302	1,020	[e] 807
Total	do	8,861	9,124	8,141

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

[1] In addition to the commodities listed, a variety of crude construction materials, common clays, sand, gravel, and stone is also produced, but output is not reported, and available information is inadequate to make reliable estimates of output levels.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms	95	121	Italy 96; Belgium-Luxembourg 25.
Copper metal, including alloys, all forms	782	491	West Germany 137; Spain 133; Belgium-Luxembourg 90.
Iron and steel:			
Ore and concentrate	628,450	812,243	Italy 631,029; Romania 175,184; Libya 6,015.
Metal:			
Scrap	16,974	4,581	Yugoslavia 2,596; Spain 1,300; Italy 685.
Pig iron and ferroalloys	18,157	3,310	All to Italy.
Steel, primary forms	11,707	8,262	Do.
Semimanufactures	62,667	28,928	Morocco 7,921; France 7,902; Spain 4,341.
Lead:			
Ore and concentrate	2,650	2,805	All to France.
Metal, including alloys, all forms	19,461	13,809	France 5,530; Italy 4,550; Greece 2,002.
Magnesium metal, including alloys, all forms	7	(2)	NA.
Mercury—76-pound flasks	--	275	Netherlands 175; Arab Republic of Egypt 100.
Nickel metal, scrap	7	(2)	NA.
Silver—troy ounces	35,301	32,119	All to Italy.
Zinc:			
Ore and concentrate	12,353	16,143	Italy 11,643; Poland 4,500.
Metal, including alloys	11	(2)	NA.
NONMETALS			
Barite and witherite	781	2,000	All to France.
Cement	50,038	26,464	Spain 12,788; Libya 8,647; Italy 2,507.
Clays and clay products (including all refractory brick):			
Crude clays	8	159	Libya 122; Algeria 35.
Products, nonrefractory	81,860	99,757	Libya 98,657; Algeria 1,100.
Feldspar and fluorspar	8,665	17,372	Italy 13,872; Netherlands 3,000.
Fertilizer materials, phosphatic:			
Natural—thousand tons	374	415	Bulgaria 101; France 79; Italy 60; Poland 33.
Manufactured	1	--	
Lime	1,224	1,800	Libya 1,600; Algeria 200.
Salt and brine	234,260	223,130	United States 92,500; Norway 55,057; Finland 22,077.
Sulfur:			
Elemental, all forms	--	30	All to France.
Sulfuric acid, oleum	--	1,639	Algeria 1,600; Libya 39.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, including briquets	10	5	All to Libya.
Carbon black	1	--	
Petroleum:			
Crude—thousand 42-gallon barrels	24,442	22,686	West Germany 9,656; Spain 3,945; Italy 3,578.
Refinery products:			
Gasoline—do	929	967	Italy 955.
Kerosine—do	445	473	Bunkers 473.
Distillate fuel oil—do	423	260	Netherlands 143.
Residual fuel oil—do	83	195	United States 169.
Lubricants—do	5	11	Bunkers 11.
Total—do	1,885	1,906	

NA Not available.

[1] Data in this edition of this table are from official trade returns of Tunisia rather than from trade returns of partner countries as in past editions, therefore data for 1970 differs in many cases from that appearing in the 1971 edition of this chapter.

[2] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum metal, including alloys:			
Unwrought	54	(2)	NA.
Semimanufactures	614	861	Spain 259; France 227; Sweden 119.
Chromium, oxide and hydroxide	3	6	West Germany 5.
Copper metal, including alloys, all forms	1,084	937	France 760; Belgium-Luxembourg 97; Italy 62.
Gold metal, unworked or partly worked thousand troy ounces	32	22	Switzerland 20.
Iron and steel:			
Ore and concentrate	38,852	NA	NA.
Metal:			
Scrap	256	232	France 176; United States 40; Italy 14.
Pig iron and ferroalloys	1,015	787	Yugoslavia 315; France 215; West Germany 95.
Sponge iron, powder and shot	38	53	France 40; Italy 12.
Steel, primary forms	7,179	22,165	France 16,023; Belgium-Luxembourg 1,708; Italy 1,623.
Semimanufactures	59,519	54,644	France 36,640; West Germany 6,636; Belgium-Luxembourg 6,317.
Lead:			
Oxides	(2)	11	Mainly from France.
Metal, including alloys, all forms	28	23	France 22.
Magnesium metal, including alloys, all forms	(2)	7	Italy 6.
Mercury 76-pound flasks	98	(2)	NA.
Nickel metal, including alloys, all forms	8	10	France 6; United Kingdom 2.
Platinum-group metals and silver metals, including alloys:			
Platinum group troy ounces	450	1,029	All from France.
Silver do	36,973	45,879	Sweden 32,215; France 7,877.
Tin metal, including alloys, all forms long tons	126	47	Malaysia 27; France 7.
Titanium oxide	166	182	France 95; West Germany 52; United Kingdom 20.
Zinc:			
Oxide	338	283	France 215; Belgium-Luxembourg 60.
Metal, including alloys, all forms	472	329	France 313; Italy 9.
Other:			
Ore and concentrate, n.e.s	1	6	Japan 5; France 1.
Oxides, hydroxides and peroxides of metals, n.e.s	86	161	United Kingdom 146; West Germany 14.
Base metals, including alloys, all forms, n.e.s	17	39	Belgium-Luxembourg 22; Italy 17.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	17	16	Italy 12; France 4.
Grinding and polishing wheels and stones	53	61	France 32; West Germany 9; United States 7.
Asbestos	1,766	1,859	Canada 908; Italy 545; U.S.S.R. 405.
Barite and witherite	2,845	2,201	Greece 1,200; France 600; Italy 401.
Boron materials:			
Crude natural borates	33	2	All from France.
Oxide and acid	34	86	Italy 85; France 1.
Cement	22,654	18,084	Turkey 9,500; France 7,366; Italy 1,218.
Chalk	299	249	All from France.
Clays and clay products (including all refractory brick):			
Crude clays	7,790	8,541	United Kingdom 3,764; France 2,044; Morocco 1,515.
Products:			
Refractory	4,320	4,333	Italy 1,004; Austria 926; Morocco 918.
Nonrefractory	2	--	
Diatomite and other infusorial earth	137	88	France 83; Spain 5.
Feldspar and fluorspar	1,180	1,403	Italy 1,000; France 403.
Fertilizer materials:			
Manufactured:			
Nitrogenous	11,630	74,539	Romania 36,471; Bulgaria 20,083; Poland 9,600.
Phosphatic	22	141	France 131; West Germany 4.
Potassic	4,419	6,386	United States 3,386; West Germany 2,010; East Germany 990.
Other, including mixed	501	1,619	France 1,223; West Germany 396.
Ammonia	56	53	West Germany 22; France 15; Belgium-Luxembourg 8.
Graphite, natural	2	1	Mainly from France.
Gypsum and plasters	776	602	France 600.
Lime	(2)	5	All from France.
Magnesite	24	25	Austria 20; Italy 5.
Mica, all forms	20	18	United Kingdom 17.
Pigments, mineral, including processed iron oxides	68	102	West Germany 82; France 7.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Pyrite (gross weight)	7,470	10,020	All from U.S.S.R.
Salt and brine	6	3	United Kingdom 2.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	3,990	6,496	France 3,767; Italy 1,533; Netherlands 500.
Caustic potash, sodic and potassic peroxides	15	48	Italy 20; West Germany 19.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	2,839	1,970	All from Italy.
Worked	528	119	Italy 117.
Dolomite, chiefly refractory grade	41	158	France 139; Italy 19.
Gravel and crushed rock	317	810	Italy 781; France 29.
Quartz and quartzite	1,211	1,004	Belgium-Luxembourg 1,000.
Sand, excluding metal bearing	31	15	West Germany 10; France 4.
Sulfur:			
Elemental, all forms	168,973	172,348	Poland 112,260; United States 49,007; France 11,076.
Sulfuric acid, oleum	1,549	4,282	Italy 2,248; West Germany 1,760; France 156.
Talc, steatite, soapstone, pyrophyllite	1,320	1,825	Italy 1,305; France 515.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	12	1,112	Italy 1,106; United States 5.
Carbon black	--	300	All from Morocco.
Coal, all grades, including briquets	28,961	37,487	U.S.S.R. 22,017; Poland 10,028; Spain 4,000.
Coke and semicoke	115,727	65,347	Netherlands 42,069; United Kingdom 8,781; Italy 5,800.
Peat, including peat briquets and litter	--	1	All from France.
Petroleum:			
Crude and partly refined—thousand 42-gallon barrels	3,238	2,387	Iraq 2,075; Saudi Arabia 252; Algeria 60.
Refinery products:			
Gasoline—do	9	6	Netherlands 4.
Kerosine—do	15	18	United Kingdom 7; Netherlands 4.
Distillate fuel oil—do	1	3	Mainly from United Kingdom.
Residual fuel oil—do	6	824	Italy 625; Ghana 99; Romania 99.
Lubricants—do	93	91	United States 61; Netherlands 15; France 13.
Mineral jelly and wax—do	3	5	West Germany 2.
Other—do	75	117	Italy 115.
Total—do	202	1,064	

NA Not available.

[1] Data in this edition of this table are from official trade returns of Tunisia rather than from trade returns of partner countries as in past editions, therefore data for 1970 differs in many cases from that appearing in the 1971 edition of this chapter.

[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Iron and Steel.—Iron ore production decreased slightly below that of 1971, with a major portion of the output being obtained from the Djebel Djerissa mine in northern Tunisia. While the remaining reserves at this mine are limited, it is reported that large new reserves have been developed nearby.[3] The Tunisian Government is attempting to attract foreign investment to help develop the adjacent deposits and build a pelletizing plant to improve the market value of the ore. The major part of the production was for export, mainly to Italy. The remaining production went to the State-owned El Fouladh iron and steel mill at Menzel-Bourguiba near Bizerte. A substantial portion of the finished iron and steel production was exported, mainly to Italy. Plans were announced for a $10 million expansion of the steel mill to be financed with a government guarantee.[4]

Lead and Zinc.—Mine output of lead and zinc decreased from those of 1971. All production was obtained from the operations of SOTEMI, which is actively engaged in attempting to expand operations. Lead concentrates were smelted by a private foreign company, Peñarroya Tunisia, which operates a lead smelter at Mégrine. Its production of lead metal was greater than that of 1971. Zinc concentrates were

[3] Mining Annual Review (London). 1972, p. 367.

[4] U.S. Embassy, Tunis, Tunisia. State Department Airgram A-228, Jan. 17, 1973, p. 9.

exported directly. In both cases, the products were mainly marketed in Europe.

NONMETALS

Fertilizer Materials.—*Phosphates.*—Tunisia maintained its position as the world's third largest exporter of phosphate rock, ranking below Morocco and the United States. The major markets for these exports were in Europe. The production of phosphate rock in 1972 amounted to 3.39 million tons, or 7% more than that of 1971, and only slightly less than the peak output of 3.44 million tons in 1968. While the major portion of the production was exported as phosphate rock, an increasing percentage of the production was converted to triple superphosphate and phosphoric acid, also for export. It is the long-range objective of the Government of Tunisia to not only increase the production and exports of phosphate rock but to further stimulate the development of plants for the manufacture of finished fertilizer products, also for export.

The Government-controlled Compagnie des Phosphates et du Chemin de Fer de Gafsa (Sfax-Gafsa), which owns and operates all of Tunisia's phosphate mines, was actively engaged in the modernization of mining systems and the opening of new mines, with the objective of increasing phosphate rock production to 5 million tons per year by 1975.[5]

Two new phosphate rock mines were placed into production at Mraata and Kef Chefair in the Gafsa region. These two new mines are each expected to produce approximately 1 million tons per year. Additionally, the mechanized mine at Djebel Sehib is expected to make a substantial contribution to the supply in 1973.

One of the major problems facing Tunisia's phosphate rock industry is the marketing of its relatively low-tenor crude ores in competition with higher grade ores from other exporting countries. To alleviate this problem Sfax-Gafsa was actively engaged in the development and installation of sophisticated beneficiation techniques. A major effort in this respect was the installation and operation of a 250-ton-per-day pilot plant at the Kalaa Djerda mine, using a process developed by Chemie und Metall Rheax of Vienna, Austria.[6]

The Government of Tunisia considers the further expansion of its domestic fertilizer manufacturing facilities as offering the best opportunity to improve the position of the Tunisian phosphate rock industry, with the eventual objective of exporting phosphate in the form of fertilizer rather than as phosphate rock. This thinking is based on the availability of low-cost (but low-grade) phosphate rock which is difficult to market, the projected cheap supply of sulfur, and the favorable trade agreement with the EC which gives Tunisia an advantage in the European market.

Tunisia's two established fertilizer manufacturers, the Government's Société Industrielle d'Acide Phosphorique et d'Engrais (SIAPE) and the private sector NPK Engrais, maintained their normal rate of production, with the major products being triple superphosphates. However, the major development of the year was the placing into production of a phosphoric acid plant at Gabes, with a rated capacity of 120,000 tons per year.[7] The plant is owned and operated by Industries Chimiques Maghrébines (ICM), a government-owned company in which French and Italian organizations have a participating interest. In cooperation with Gazocean, a French company, ICM established a company called Gabes Chimie Transports (GCT), which has responsibility for the shipment of the phosphoric acid product to the European market in specially designed tankers. One company-owned and one chartered tanker are presently in service, and an order has been placed for the construction of a second company-owned tanker. ICM plans to increase its phosphoric acid production and for this purpose has awarded a contract for construction of a new 400-ton-per-day phosphoric acid plant and an accessory 1,500-ton-per-day sulfuric acid plant, which will be brought into production near the end of 1974.[8]

Fluorspar.—Production of chemical-grade fluorspar increased very substantially over that of 1971, while the production of metallurgical-grade fluorspar was approximately the same as that of the previous year. The marked improvement in output of the high-value chemical-grade fluorspar

[5] Phosphorus & Potassium (London). No. 62, November–December 1972, pp. 3–5.
[6] Phosphorus & Potassium (London). No. 61, September–October 1972, pp. 17–20.
[7] Phosphorus & Potassium (London). No. 63, January–February 1973, p. 17.
[8] Page 11 of work cited in footnote 6.

was the result of improved beneficiation methods and obtained a higher degree of profitability for the industry. SOTEMI was active in further development of the industry and was negotiating with foreign interests for the conclusion of joint venture agreements for exploration, mining, and beneficiation of fluorspar deposits. Such ventures hopefully could double the present production of fluorspar within the next few years. It is felt that currently estimated reserves were sufficient to support such projects.[9]

MINERAL FUELS

Natural Gas.—The 300-kilometer natural gas pipeline from the El Borma field to the city of Gabes was completed and placed in operation at its initial rated capacity of approximately 20 million cubic feet of gas per day.[10] Its construction was financed by the World Bank and the Kuwait Fund for Arab Economic Development. This pipeline is of significant economic importance to Tunisia as it will afford an ample supply of cheap natural gas to the State-owned powerplant at Gabes as well as to the new fertilizer-petrochemical complex which is in the process of being developed in the Gabes area.

The Government of Tunisia revived its interest in the proposal to construct a natural gas pipeline from Algeria through Tunisia, underwater to Sicily, and ultimately to the Italian mainland.[11] Participation would enable Tunisia to obtain additional natural gas supplies for its rapidly growing petrochemical and fertilizer industries, as well as transit fees on the natural gas flowing to Europe.

Petroleum.—The petroleum industry was in the midst of a rapid expansion, which showed promise of making Tunisia a major oil producer. One reason for this intense activity has been the favorable investment climate in Tunisia, including the absence of turbulent government-company confrontations which have recently harassed operations in other countries. Generally, concession terms have allowed for government participation, but under terms which are regarded as very reasonable for the companies participating in these exploration and development efforts. During 1972, two major fields were in the process of being developed—one onshore and one offshore. Additionally, exploration drilling indicated that two other major fields might soon be developed; one onshore and one offshore.

Prior to 1972 the major portion of Tunisia's crude oil production was obtained from the El Borma field in southern Tunisia. In 1971 the major onshore Sidi el Itayem field was discovered by Compagnie Franco-Tunisienne des Pétroles (CFTP) which is owned 50% each by Compagnie Française de Pétrole (CFP) and the Tunisian Government. This field, located 30 kilometers northwest of Sfax, was in the process of being brought into production during 1972 at an initial rate of 400,000 tons per year.[12] An 83-kilometer pipeline was built to transport the oil to a tanker terminal at La Skhirra. The other major field which was being brought into production during 1972 is the offshore Ashtart field located 80 kilometers southeast of Sfax in the Gulf of Gabes in a water depth of 70 meters. It was estimated that its initial production rate would be approximately 1.5 million tons of oil per year.[13] The field is controlled by Société Franco-Tunisienne d'Exploitation Pétrolière (SOFRATEP), a company in which the Tunisian Government has a 50% interest. Production will be stored in a floating storage unit from which tankers will be loaded.[14]

Two new fields were discovered in Tunisia during 1972, both by CFTP. One was the Sidi Behara field located 10 kilometers southwest of the Sidi el Itayem field and 40 kilometers west of the city of Sfax. This is an onshore discovery.[15] The second discovery was offshore in the Gulf of Gabes in the Sfax-Kerkennah concession east of Sfax.[16]

The President of Tunisia announced that a new petroleum refinery would be built at Gabes to meet the growing demands of this industrial region, rather than expand the existing refinery at Bizerte.[17]

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[9] Page 367 of work cited in footnote 3.
[10] Oil and Gas Journal. V. 70, No. 32, Aug. 7, 1972, p. 30.
[11] World Petroleum Report. V. 19, 1973, p. 70.
[12] Petroleum Press Service. V. 39, No. 8, August 1972, p. 309.
[13] Page 70 of work cited in footnote 11.
[14] Petroleum & Petrochemical International. V. 12, No. 12, December 1972, pp. 73–74.
[15] Page 70 of work cited in footnote 11.
[16] World Oil. V. 175, No. 3, Aug. 15, 1972, pp. 106–107.
[17] Petroleum Press Service. V. 39, No. 11, November 1972, p. 430.

The Mineral Industry of Turkey

By E. Shekarchi [1]

Continued economic buoyancy and improving relations between the Government and private sectors characterized the mineral industry of Turkey in 1972. Private investment increased and the new 5-year plan (1973–77) promised new funds for the public sector, particularly in manufacturing, heavy industry, and mining.

December 31, 1972, marked the end of the second 5-year development plan and the beginning of the third 5-year development plan. The third plan projects a Turkish economy competitive with those of the European Community (EC) countries by 1995, when Turkey hopes to become a full EC member. The third plan establishes the following immediate targets (1973–77): gross national product (GNP) to increase by $4.8 billion;[2] mining to increase at an average annual rate of 13% to 14%; energy to increase by 13% to 14%; and exports to increase by 8.5%.

Under the third plan Turkey expects to minimize the role of foreign aid in its economy. It proposes that not more than 4% of total expenditures, or about $186 million annually, should be covered by foreign aid. The planners foresee that nearly 95% of the funds required for the third plan can be met from Turkey's resources.

The long-range strategy under the third plan establishes the following targets for 1995; (1) Per capita income to increase fourfold and reach $1,500 while GNP is to rise at an annual rate of 7% to 8%; (2) iron and steel production, which was 10 million tons in 1970, to reach 20 million tons; (3) cement production to rise from 6.5 million tons in 1970 to 40 million tons; (4) generation of electricity to increase from 8.6 billion kilowatt-hours to 125 billion kilowatt-hours; and (5) aluminum production to rise from 17,600 tons to 1 million tons. Under the plan the rate of increase in population is to be kept within a low fertility range so that the total population will not exceed 65 million by 1995.

The National Assembly continued discussing the controversial Mining Reform Bill amid signs that the administration would insist on its own version of the legislation. Objectives of the Government version of the Bill are limitation on foreign capital in mining operations; nationalization of certain minerals, and priority to state agencies in mining operations.

The Bill was amended by an ad hoc House committee early in December 1972, to permit the private sector to play a somewhat greater role. In the latter part of December the National Assembly voted to send the bill back to the committee for reconciliation of controversial and disputed articles. At the end of December, the outcome was uncertain.

A reorganization of the State Economic Enterprises was published in the Official Gazette in December 1972. Under the decree two new supervisory organs were created, the General Administration of State Economic Enterprises and the Supreme Council. All funds and budgetary allocations for State Economic Enterprises, as well as profits of these agencies, will be transferred to the accounts of the proposed General Administration. The Administration will see that all funds earmarked for State Economic Enterprises are utilized by state holding companies to be formed. The Supreme Council will be headed by the Prime Minister and composed of the ministers concerned. It will provide top-level coordination between State Economic Enterprises and will see that their pricing, investment, and tariff policies conform to the Government's general economic policy.

Labor in its widest sense has, in fact, become an economic factor of unprecidented importance for Turkey. In 1972 there were

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from Turkish Liras (TL) to U.S. dollars, at the rate of TL1 = US$0.15.

some 550,000 Turkish workers abroad, principally in West Germany and other EC countries. Their currency remittances during 1972 were $750 million, an increase of 50% compared with the 1971 remittances.

In March 1972 a decree was issued, revising and extending duty-free importation of equipment to be used in specified investment fields and on projects approved by the Ministry of Industry. The provisions of this decree reportedly apply equally to approved domestic and foreign investments.

Maden Tetkik ve Arama Enstitususu (MTA), the Mineral Research and Exploration Institute of Turkey, continued exploration and mapping during the year. During the year MTA prepared maps of various scales on phosphate, pyrite, and chromite deposits for public distribution.

PRODUCTION

Table 1 gives the production of primary minerals and processed metals and nonmetals.

Table 1.—Turkey: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum, bauxite, metal content	51,067	153,253	259,289
Antimony:			
Ore and concentrate:			
Gross weight	4,616	[e] 4,500	[e] 4,700
Metal content	3,362	2,834	2,705
Regulus	21	3	NA
Chromite, salable product	540,623	[2] 351,180	[2] 271,317
Copper:			
Mine production, metal content	27,225	19,440	24,691
Metal (blister)	16,979	17,556	16,885
Iron and steel:			
Iron ore—thousand tons	[3] 2,949	[3] 2,079	1,109
Pig iron and ferroalloys:			
Ferrochromium	9,500	[e] 9,500	[e] 10,000
Pig iron and other ferroalloys—thousand tons	1,034	882	1,135
Crude steel (excluding castings)—do	1,312	1,122	1,442
Lead:			
Mine output:			
Gross weight of lead ore (excluding zinc-lead ore)	27,511	28,999	26,273
Metal content (including content zinc-lead ore)	[e] 10,700	6,586	[e] 6,229
Smelter output [e]	200	200	200
Manganese ore	14,394	13,942	15,077
Mercury—76-pound flasks	8,592	10,460	7,963
Zinc ore and concentrate:			
Gross weight:			
Zinc-lead ore, hand sorted	56,161	61,612	64,523
Zinc concentrate	22,204	[e] 20,000	[e] 22,000
Metal content	[r] 24,400	24,226	24,635
NONMETALS			
Abrasives, natural emery	116,020	79,246	79,046
Asbestos	3,274	3,893	4,924
Barite	29,543	28,547	48,918
Boron minerals	388,378	571,031	618,142
Cement—thousand tons	[r] 6,374	7,546	8,424
Clays, all types [e]—do	15,000	15,000	16,000
Fertilizer materials, manufactured, chemical, all types	[e] 450,000	[e] 450,000	680,884
Fluorspar	1,665	[e] 1,100	[e] 1,100
Gypsum [e]—thousand tons	320	340	340
Magnesite (crude ore)	284,807	307,814	333,286
Marble [e]	95,000	115,000	120,000
Meerschaum—kilograms	20,250	[e] 50,000	18,650
Quartzite	36,287	37,286	[e] 38,000
Pyrite, cupreous:			
Gross weight	91,108	58,447	77,062
Sulfur content	43,422	26,887	35,880
Salt, all types—thousand tons	[r] 649	660	[e] 660
Sodium sulfate	16,616	18,467	30,213
Sulfur, refined	26,760	23,603	21,020

See footnotes at end of table

Table 1.—Turkey: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	35,518	22,693	167,329
Coal:			
Bituminous ---thousand tons	[r] 4,573	4,639	4,641
Lignite ---do	[r] 3,992	4,217	4,673
Total ---do	[r] 8,565	8,856	9,314
Coke: [4]			
Coke oven ---do	[r] 1,341	1,288	[e] 1,284
Gaswork [e] ---do	180	[r] 100	100
Semicoke [e] ---do	[r] 99	[r] 57	66
Total ---do	[e] 1,620	1,445	1,450
Fuel, briquets [e] ---do	50	50	50
Gas, natural:			
Gross production [e] ---million cubic feet	25,000	25,000	24,000
Marketed [e] ---do	5,000	5,000	5,000
Petroleum:			
Crude ---thousand 42-gallon barrels	24,776	24,723	24,416
Refinery products:			
Gasoline, aviation ---do	20	25	--
Gasoline, motor ---do	8,309	9,873	11,900
Jet fuel ---do	586	888	1,710
Kerosine ---do	3,383	3,744	3,918
Distillate fuel oil ---do	12,088	14,991	18,788
Residual fuel oil ---do	21,835	26,619	31,365
Other ---do	3,986	4,821	7,284
Refinery fuel and losses ---do	2,624	1,323	3,959
Total ---do	52,831	62,284	78,924

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

[1] In addition to the commodities listed, pumice and crude construction materials including a variety of industrial stone are undoubtedly produced, but information is inadequate to make reliable estimates of output levels.

[2] Data are for metal content of ore produced.

[3] Sales.

[4] Figures for gaswork and semicoke represent difference between reported total and reported coke oven coke.

TRADE

Details of foreign trade including total tonnage by commodities are given in tables 2 and 3.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destination, 1971
METALS			
Aluminum, alloys, all forms	--	68	West Germany 48; Switzerland 20.
Chromite, including all grades	352,143	376,567	United States 121,695; France 65,111; Norway 47,323.
Copper:			
Matte	--	25	All to Italy.
Metal, including alloys, all forms	3,482	1,524	Spain 1,484.
Iron and steel:			
Ore and concentrates	29,502	--	
Metal, pig iron, ferroalloys, and similar materials	5,288	2,006	Italy 1,035; France 971.
Lead ore and concentrates	5,792	500	All to West Germany.
Manganese ore and concentrates	1,402	3,438	All to United States.
Mercury ---76-pound flasks	3,771	6,034	West Germany 1,828; United States 1,421; United Kingdom 1,276.
Silver and platinum, waste and scrap value, thousands	$173	$247	Mainly to United Kingdom.
Zinc ore and concentrates	26,358	14,797	West Germany 6,842; Italy 5,827; United Kingdom 1,250.
Other:			
Ore and concentrates	10,092	4,523	France 2,610; West Germany 1,611.
Slag and other metallurgical residues	6,501	693	Belgium-Luxembourg 483; West Germany 183.
Nonferrous metals, n.e.s value, thousands	$800	$69	United States $57.
NONMETALS			
Abrasives, natural	73,380	79,639	France 43,850; United Kingdom 29,290.
Barite	26,848	13,185	All to West Germany.
Boron materials:			
Crude natural borates	288,969	258,535	Italy 84,757; France 75,125; West Germany 37,614.
Boric oxide and acid	5,162	5,246	West Germany 1,817; United Kingdom 1,657; Netherlands 752.
Cement	97,197	146,951	Yugoslavia 74,398; Israel 72,553.
Clays and clay products (including all refractory bricks): Crude clays n.e.s	3,110	8,055	All to Italy.
Fertilizer materials: Crude, phosphatic	3,075	--	
Magnesite	85,307	78,233	Austria 65,906; West Germany 7,457.
Pyrite (gross weight)	58,294	43,254	All to West Germany.
Stone, sand and gravel, marble	3,408	2,747	Italy 2,455.
Other nonmetals, n.e.s	NA	30,367	United Kingdom 25,810.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	280,572	18,531	All to Greece.
Petroleum refinery products:			
Gasoline --thousand 42-gallon barrels	--	353	West Germany 224; Sweden 129.
Distillate fuel oil ---do	--	119	All to West Germany.
Residual fuel oil ---do	613	--	
Total ---do	613	472	

NA Not available.

[1] Recorded imports from Turkey by selected trading partner countries published by the Statistical Office of the United Nations in 1970 Supplement to World Trade Annual. V.4 (Near East), Walker and Co., New York, 1972, pp. 238–245, and 1971 Supplement to World Trade Annual. V. 4 (Near East), Walker and Co., New York, 1973, pp. 255–263. As such data are incomplete and do not represent actual exports.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	268	188
Metal, including alloys:		
Unwrought	12,851	19,416
Semimanufactures	3,316	3,661
Copper metal, including alloys, all forms	384	366
Iron and steel:		
Metals:		
Scrap	66,051	70,147
Pig iron, including cast iron	84,473	49,287
Sponge iron, powder, shot	--	251
Ferroalloys	6,022	15,150
Steel, primary forms	28,826	184,251
Semimanufactures	205,889	126,394
Lead metal, including alloys, all forms	4,636	6,233
Manganese oxide	144	--
Nickel metal, including alloys, all forms	98	304
Silver and platinum-group metals, unwrought and semimanufactures value, thousands	$366	$663
Tin:		
Oxide long tons	10	--
Metal, including alloys, all forms do	534	490
Titanium oxide	2,127	2,411
Zinc:		
Oxide	1,009	--
Metal, including alloys, all forms	11,784	9,846
Other:		
Ores and concentrates of nonferrous metals, n.e.s value, thousands	$253	$1,101
Oxides, hydroxides and peroxides of metals, n.e.s	52	170
Base metals, including alloys, all forms	33	6
NONMETALS		
Abrasivs, natural, n.e.s value, thousands	$114	$31
Asbestos	5,048	5,476
Barite	1,045	--
Cement	1,996	898
Clays and clay products, crude	964	4,922
Feldspar and fluorspar	1,575	--
Fertilizer materials:		
Crude, phosphatic	19,451	10,396
Manufactured:		
Nitrogenous	260,893	254,330
Phosphatic and potassic	15,808	23,000
Mixed	201,061	206,244
Graphite	341	136
Magnesite	--	313
Other nonmetals, n.e.s	224	327
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	9,903	12,456
Coal	4,146	--
Coke	816	--
Petroleum:		
Refinery products:		
Gasoline thousand 42-gallon barrels	1,156	314
Kerosine and white spirit do	r 679	772
Distillate fuel oils do	2,311	1,132
Residual fuel oils do	36	1,657
Liquefied petroleum gas do	r 697	182
Lubricants do	102	112
Mineral jelly and wax do	26	25
Total do	r 5,007	4,194

r Revised.

[1] Recorded exports to Turkey by the selected trading partner countries published by the Statistical Office of the United Nations in 1970 Supplement to the World Trade Annual. V. 4 (Near East), Walker and Co., New York, 1972, pp. 246-265, and 1971 Supplement to the World Trade Annual. V. 4 (Near East), Walker and Co., New York, 1972, pp. 264-283. As such, data are incomplete and do not represent actual imports.

COMMODITY REVIEW

METALS

Bauxite.—The Seydişehir aluminum complex, which has planned annual capacity of 200,000 tons of alumina, 60,000 tons of aluminum billets, beams, plates and foils, and about 25,000 tons of semifinished aluminum products, was still under construction in 1972. Bauxite ore for the plant is to be brought from the Mortaş and Dogankuzu ore bodies north of Seydişehir.

Chromite.—Metals and Chemical Co. of Japan received the first shipment of chromite from Etibank under the long-term contract signed in 1971. The contract calls for delivery of 1 million tons of metallurgical-grade chrome ore over 12 years; in return the Japanese firm is to provide expertise and some equipment for erection of a ferroalloy plant (primarily ferrochrome) near Kaban Dam.

Copper.—The Karadeniz Bakir Işletmeleri (KBI), the Black Sea Copper Co. Inc., was established in 1968 to evaluate and develop the major copper deposits of the Black Sea region. By the end of 1972 Etibank owned 49% of the shares in the company and private Turkish banks owned the remainder. Installations of KBI in 1972 included (1) the Cakmakkaya open pit-copper mine and the Cakmakkaya concentrator, (2) the Hopa filtering, thermal drying, and loading plants, (3) a copper concentrate-slurry pipeline between Cakmakkaya and Hopa, (4) underground copper mines at Küre-Bakibaba, (5) a central copper smelter in Samsun, (6) a sulfur acid plant in Samsun, and (7) the Murgul and Esbiye-Lahanos copper mines in northeastern Turkey. Annual production of the complex is expected to be 41,000 tons of blister copper, 365,000 tons of sulfuric acid, 6,817 kilograms of silver, and 234 kilograms of gold.

Trial shipments of copper concentrate from the Cakmakkaya mine and 27,000 tons from the Küre mine marked opening ceremonies of the Samsun smelter. The copper slurry pipeline from Cakmakkaya to Hopa was not operational by the end of 1972 because of filtering difficulties.

Iron Ore.—MTA's exploration and development work indicated an iron ore deposit with proven reserves of 100 million tons near Cakmakkaya on the Black Sea Coast. Drilling in Malatya Province disclosed additional iron ore reserves, bringing the total for the field to 132 million tons.

Iron and Steel.—Construction work on the integrated iron and steel plant at Iskenderun near the eastern Mediterranean coast financed by the U.S.S.R. continued during 1972. In August the Minister of Industry and Technology of Turkey and Soviet authorities agreed to increase the initial annual capacity of the steel plant from 1 million to 2 million tons. Financing of this project was arranged between Turkiye Demir ve Çelik, the Turkish state steel corporation, and Tiajpromexport of the U.S.S.R. The total cost was estimated at $535 million with a completion date of 1974.

Ereğli Demir ve Çelik Fabrikalari A.A. (ERDEMIR) Ereğli steel plant, completed in 1965, produced flat-rolled steel products and tinplate. Facilities at the plant included a 1,600-metric-ton-per-day blast furnace and two 95-metric-ton-per-day basic oxygen furnaces. In 1972 the company proposed expansion to include another blast furnace with a capacity of 2,800 tons per day, a third 95-million-ton basic oxygen furnace, a 300,000-ton continuous billet caster, two 130-ton slab heating furnaces, a 60-inch continuous pickling line, a battery of 85 byproduct coke ovens, a 200-ton-per-day oxygen-producing plant, a powerplant, a plate normalizing furnace, a twinslide plate shear, and related water generation and material-handling equipment. The export-import bank made a $28.5 million loan available to Turkey to finance initiation of the program. The total cost of the proposed expansion was estimated at $78 million.

Construction of sintering facilities at the Erdemir plant was on schedule, and partial production started in 1972. When in full operation, the plant will produce about 1.3 million tons of sized sinter annually.

The feasibility study for the iron ore concentration and pelletizing plant of the Turkish Iron and Steel Works at Karabük, started by G. McKee & Co. of Cleveland in 1971, continued in 1972. The study is for a plant able to produce annually 1.6 million tons of 66.5% concentrate, 600,000 tons of 61% to 63% concentrate, and 1.3 million tons of pellets. To reach this target Karabük Steel Co. intends to increase output of the A-Kafa

sulfurous iron ore mine to 3.6 million tons per year and the output of the B-Kafa non-sulfurous iron ore mines to 360,000 tons per year. Total investment, for the mining expansion and sintering plant and for extension of the railway and other facilities, was estimated at $43 million. The project is to be completed by 1976.

Lead and Zinc.—Cinko Kursum Metal Sanyii A.S. (CINKUR), lead-zinc metal company of Turkey, awarded a contract to design and build the Zemanti lead-zinc smelter to Surveyor Nenniger and Chenevert Inc. of Canada. The smelter, which will cost an estimated $42 million, is to be financed partially by Export Development Corp., a government agency of Canada, and partially by Etibank, the Turkish industrial development bank. The plant will be designed to process 238,000 tons of high-grade lead-zinc ore per year using the Waelz method to yield 20,000 tons of electrolytic zinc, 10,000 tons of galvanized zinc, 2,000 tons of refined zinc, and lead ingots. Construction of the smelter was to start early in 1973 and be completed by 1975. Production of lead-zinc in 1972 was 26,273 tons, of which Etibank produced the major part.

Mercury.—Production of mercury decreased 24% in 1972, compared with 1971 output. Etibank, produced 60%; the remainder came from several small private producers.

Mercury deposits in Turkey extend from Kara Burn west of Izmir, to Nigde, 750 kilometers to the east. The known deposits, either dormant or operational, were as follows: Kara Burn, Aydin, Ödemis, Tire, Germencik, Bozdoğan, Alaşehir, Maraş, Banaz, and Gediz.

Tungsten.—Construction of a concentrator to utilize tungsten ore from deposits a few miles north of Bursa in western Anatolia, continued during the year. Etibank, the present owner of the deposit, reported a proven ore reserve of 9.7 million tons of 0.4% WO_3. The concentrator will produce 3,000 tons of concentrate containing 65% WO_3 annually. Total investment for the project was estimated at $16 million.

NONMETALS

Asbestos.—Exploration by MTA from 1968 to 1971 showed that Turkey has a large asbestos potential. Deposits were found in the vicinity of Sivas, Erzincan, and Bursa. The first estimate, indicated asbestos reserves of about 300,000 tons. According to feasibility studies by MTA, three fiberizers are suggested for construction near the deposits.

Barite.—Production of barite in 1972 increased 71% compared with the 1971 output. Barit Maden Turk A.S. remained the sole producer and exporter. Turkish barite was exported to Libya, Europe, and the United States.

Boron.—After the United States, Turkey remained the most important source of boron minerals in the non-Communist world. The principal deposits of colemanite and ulexite are in the Emet and Bigadiç Basins of western Anatolia.

Etibank, the main boron producer of Turkey, announced the increase of annual production from 150,000 to 600,000 tons at Emet Area. Also, a new concentrator of 400,000 ton capacity was under consideration at Kirka, from which Etibank plans to supply all the concentrate required for their boric acid plant at Bandirma.

Celestite.—Barit Maden Turk A.S. reportedly found a celestite deposit some 25 kilometers south of Sivas. Analysis of five samples indicated $SrSO_4$, 94.00% to 99%; $BaSO_4$, 0.40% to 1.75%; SiO_2, 0.12% to 0.35%; Fe_2O_3, trace to 0.22%; and CaO, 0.14% to 0.36%. According to company reports 2 million tons of ore of this analysis has been blocked out.

Cement.—Turkish consumption of cement increased 30% in the first 6 months of 1972 over a comparable period in 1971, according to the director of the Turkish Cement Industry. The increase was most notable in southeastern Anatolia, where, for the first time. villagers used cement blocks in construction instead of the traditional mud bricks.

Exports of cement, in recent years, have provided Turkey with a new source of foreign exchange; 1972 earnings were about $15 million. Most Turkish cement exported went to Hungary, Nigeria, Austria, Yugoslavia, and Syria. Though the price of Turkish cement rose from $8 per ton in 1971 to $12 per ton in 1972, the demand remained strong. Cement production rose from 7.5 million tons in 1971 to 8.4 million tons in 1972. The increase was due to the opening of a new plant during the year, coupled with full production in Elâzig plant. Construction of the Hostas cement plant and Hostas cement product plant was

on schedule; first production was expected in early 1973.

Clays.—*Bentonite.*—Bentonite deposits of the sodium variety were found in the Reşadiye and Tokat regions of northeast Turkey. Reserves of 15 million tons were proved by drilling in 1972. Somas Sanayii Madenleri, A.S., organized in 1971, with Etibank as a major partner, started a bentonite beneficiation plant in the area in November 1972. Proposed annual capacity of the plant is 30,000 tons of processed bentonite. Domestic consumption in 1971 was 20,000 tons, and MTA estimated demand will reach 40,000 tons by 1974 and 100,000 tons by 1982.

Magnesite.—A recent study of the magnesite deposits of Eskişehir, Kütahya, and Tavşanli indicated 6 million tons of proven reserves. During 1972, eight opencast magnesite mines supplied feed for the Eskişehir calcining plant. Turkish crude magnesite ore, as well as calcined ore, was exported principally to European markets.

Soda Ash.—The construction of an integrated soda ash plant, owned by Kerbset Cie, of France, the Polish Polimex-Cekop organization, and Turkish Soda Sanayii A.S., continued in 1972. Reportedly the plant will cost $16 million, and will have annual capacity of 150,000 tons of soda ash and caustic soda.

Sulfur.—Production of sulfur decreased 11% during 1972 compared with 1971 output, due to startup of the petroleum refinery in Aliaga. The Bandirma sulfuric acid plant on the coast of the Sea of Marmara was completed in 1972. At the inauguaration of the plant the Turkish Prime Minister reviewed the current sulfuric acid facilities as follows: Construction of the Samsun and Mersin plants, each with an annual capacity of 250,000 tons, had been completed; soon to be completed were a second plant at Samsun with an annual capacity of 365,000 tons, a plant with annual capacity of 280,000 tons at Iskenderum, and a plant with annual capacity of 110,000 tons at Ergani. All facilities are to include an associated fertilizer plant. Acordingly, Turkey's fertilizer production is to be increased from 1.4 million tons per year to more than 5 million tons per year. Referring to a need of exploration for pyrite and phosphate rock in Turkey, the Prime Minister pointed out that the country was spending $25 to $30 million per year on imports of these raw materials and that the cost would rise to $130 million annually by the end of the third 5-year plan.

MINERAL FUELS

Coal.—Lacking known indigenous sources of other fossil fuels, Turkey is largely dependent on domestic production of coal and lignite to meet industrial fuel demands. In years past Turkey exported hard coal from its Zonguldak Fields. Now it is barely able to meet domestic needs.

The Zonguldak coalfields are about 342 kilometers from Istanbul and 268 kilometers from Ankara by road. The fields extend from Ereğli to Amasra along the Black Sea coast for a distance of 80 to 112 kilometers; they are up to 12 kilometers wide. Deep drilling exploration and prospecting are in progress to determine possible extension of the fields to the east. Complex geology of the area has made evaluation of reserves exceedingly difficult and has resulted in minimal underground mechanization. The major Zonguldak coal operations from east to west are at Gelik, Üzülmez, Kozlu, Armutcuk, and Amasra.

Lignite.—Most of the known lignite fields are in western Turkey, but during the last few years vast reserves have been discovered at Maras-Elbistan in eastern Turkey, about 160 kilometers north of the Syrian border. The lignite deposits of eastern Turkey, estimated by the MTA in 1972 at 3 billion tons, will be mined by both opencast and underground methods.

The main western deposits of lignite, which have been worked for many years, lie in Tuncbilek, Soma, and Seyitomer. Reserves in the three areas as estimated in 1971 were as follows, in million tons:

Area	Proven	Probable
Tuncbilek	184.3	59.3
Soma	38.5	--
Seyitomer	188.3	29.7

Coal and lignite production and consumption during 1971 and 1972 are shown in the following tabulation, in thousand tons:

Type	Mine [1] production		Consumption	
	1971	1972	1971	1972
Bituminous coal	7,846	7,862	4,490	4,467
Lignite	7,241	7,170	4,344	4,762

[1] Figures differ from those shown on table 1 because of source.

Natural Gas.—A protocol was signed bebetween Iraq National Petroleum and Turkiye Petrolleri Anonim Ortakligi (TPAO), the state-owned petroleum enterprise, for the construction of two pipelines, one to carry crude oil and the other natural gas, from Iraq to terminals in Turkey. The cost of the pipeline, 240 kilometers in Iraq and 700 kilometers in Turkey, and five pumping stations was estimated at $400 million. Financial arrangements and details of volume and tonnage were to be settled in 1973.

Petroleum.—The Turkish National Assembly passed a petroleum law in 1972 that gave priority to TPAO over all other companies and created the Turkish Petroleum Directorate, a new agency, to issue licenses, control all oil operations, and oversee crude imports.

The law does not stipulate significant changes in the status of the 13 foreign companies that held exploration licenses in 1972. Of the 202 licenses covering 38 million acres, 128 were held by foreign companies or by foreign companies in partnership with TPAO. Most of the remaining 74 licenses were held by TPAO, and a few were held by small private Turkish groups.

Under the law TPAO may hold 16 licenses for an area, while private companies may hold only 8 licenses in a single area. Private companies may obtain licenses for areas which TPAO has rejected. Foreign companies may have refinery or pipeline operations in Turkey only if they are export oriented and if TPAO is the major partner in the venture. The new law changed the terms of exploration and exploitation licenses. An exploration license will be for 3 years instead of 6 and can be extended for only 2 years. After an oil discovery, license terms will be extended for 3 years instead of 5. For oil extraction, the lease term is reduced from 30 to 20 years and the extension period from 20 to 10 years. If an extraction license holder does not produce petroleum in commercial quantities within 1 year from date of issuance, instead of 3 years, its lease will be revoked.

The new law removes some special taxation rules for oil companies, making them subject to the general tax laws as are other companies. However, oil concerns are permitted more tax deductions than other companies. Oil companies may deduct state royalties and rentals, unutilized assets, exploration costs, cost of drilling wells unproductive in commercial quantities, and a percenage depletion allowance based on these. The Finance Ministry and the petroleum directorate will determine the percentage depletion allowance separately for each field. In the old bill, the allowance was set at 27.5%.

Exploration.—The last of the U.S. companies in Turkey, Gulf Oil Co. and Mobil Oil Co., closed their exploration offices in 1972 and moved to more favorable areas. Thus TPAO became the only large exploration company in Turkey.

Exploratory drilling in Turkey increased slightly in 1972, over that of 1971, mainly through the activities of TPAO and the Royal Dutch/Shell subsidiary, N.V. Turkse Shell. During the year, 30 wildcats were active, 21 in southeastern Turkey and 9 in the northwest. Four petroleum discoveries were reported in 1972, three by Shell and one by TPAO. No test figures for the wells were released, however, the Barbes and the Malatepe wells were reporting to be promising.

During 1972 two other companies carried out exploration drilling, Aladdin and Ersan. The Wichita-based Aladdin Co. spuded one well in which drilling was suspended in December at a depth of 8,873 feet. Ersan, an independent Turkish company, tested a shallow well on the Sinan structure where Mobil Oil Co. was drilling a few years ago. The well was abandoned in September 1972.

Production.—Turkish crude petroleum production in 1972 was 3.4 million tons, a decrease of 4% compared with 1971 output. The breakdown of 1971 and 1972 crude petroleum production by company follows in million tons:

Company	1971	1972
Turkish Petroleum Corp	990,977	941,000
Ersan Co	70,422	82,000
Mobil-Panoil	494,156	471,000
Shell Oil Co	1,935,970	1,836,000
Total	3,491,525	3,330,000

With offshore oil production in Turkey slumping slowly despite some new oil developments and discoveries, the Government was looking to its Continental Shelf for the new oil reserves needed to meet growing domestic petroleum demand. Until 1972, Turkish waters had only five wildcat wells, and all five were dry. However, offshore seismic activity late last year off the north-central and the northwestern coasts may point to a new horizon to be drilled in 1973. The Turkish Government invited new tenders, considering applications for new concessions.

Domestic civilian consumption of petroleum products during 1971 and 1972, in thousand metric tons, was as follows:

Product	1971	1972
Refinery fuel gas	176.5	251.5
LPG	284.3	332.9
Naphtha	131.8	128.6
Gasoline, super	61.3	87.6
Gasoline, regular	890.4	1,018.1
Jet fuel	98.1	144.3
Kerosine	485.0	505.4
Solvents	r 9.3	10.8
Diesel oil	2,117.4	2,403.0
Fuel oil	4,100.0	4,714.6
Asphalt	183.8	224.7
Aircraft fuel	1.4	.6
Paraffin, vaseline	.4	.2
Mineral oils	129.7	137.6
Special preparation	7.5	6.1
Sulfur	.7	7.7
Total	8,677.6	9,973.7

r Revised.

Refineries.—According to data submitted in the 1973 budgetary report of the Petroleum Department, a total of 10.2 million tons of crude oil was processed in Turkish refineries during 1972. Of this amount, 3.4 million tons was domestic crude oil, while the remaining 6.8 million tons was imported. Istanbul Petrol Rafineresi A.S. (IPRAS) at Yarimca handled about 5.1 million tons of crude oil and produced 12 different petroleum products. The IPRAS refinery, built about 10 years ago, has been expanded three times, and in 1972 had an annual capacity of 5 million tons of crude oil.

A 3-year purchase contract was signed between Iraq National Oil Company (INOC) and IPRAS petroleum refinery in 1972. Under the terms of the agreement IPRAS will purchase 2 million tons of Iraq crude oil in 1973, 2.5 million tons in 1974, and 3 million tons in 1975, with an option on another 1 million tons for each year. The crude oil will be carried to Turkey by tankers from the Iraq port of Banias to Yarimca, a small port on Sea of Marmara.

Construction of the U.S.-built TPAO petroleum refinery at Aliaga, which was Soviet designed and partially financed by Soviets, was completed and tested in 1972. At full capacity the refinery will process 70,000 barrels per day. An addition to the refinery, docking facilities to accommodate two 100,000-ton tankers for crude and four small tankers for refined products, was also completed during the year. The Aliaga refinery is the only plant of its type in Turkey with full storage capacity for various products. Also it will produce and store 99% pure sulfur to meet domestic market requirements.

Turkish export of refinery products, even though small in quantity, became a significant exchange earner in 1972. Exports of petroleum products by refineries during 1971–72 follows in thousand metric tons:

Refinery	Product	1971	1972
TPAO	Asphalt	5.2	--
IPRAS	Gasoline, super	14.9	168.5
	Gasoline, regular	27.0	150.8
	Jet fuel	12.8	70.6
	Diesel oil	33.1	134.6
ATLAS	Naphtha	--	17.4
	Diesel oil	--	19.6
IPRAS	Fuel oil	--	18.4
	Diesel oil	--	83.3
TPAO	Fuel oil	--	135.7
	Naphtha	--	80.1
Total		93.0	879.0

Production of various Turkish refineries during 1971–72 and their locations are given in the following tabulation in thousand metric tons:

Refinery plant and location	1971	1972
Turkiye Petrolleri Anonim Ortakligi: (TPAO) Batman:		
Domestic	825.8	809.2
Istanbul Petrol Refineresi A.S. (IPRAS): Izmit:		
Domestic	791.0	679.1
Imported	3,026.0	4,400.2
Anadolu Tasfiyehanesi A.S. (ATLAS): Mersin:		
Domestic	1,668.9	1,796.7
Imported	2,386.0	2,414.5
Turkige Petrolleri Anonim Ortakliqi: (TPAO) Aliaga:		
Domestic	--	43.0
Imported	--	810.4
Total	8,697.7	10,953.3

The Mineral Industry of the U.S.S.R.[1]

By V. V. Strishkov [2]

The U.S.S.R., with complete nationalization and low-wage labor, maintained its position in 1972 as the world's second largest producer of industrial products. Production schedules are mutually coordinated and production targets are predetermined in principle by the 1971–75 national plan for economic development.

Economic growth of the U.S.S.R. is closely linked with development of its vast mineral resources. The country ranks second in the world in coal reserves and has extensive deposits of oil, natural gas, and ferrous and nonferrous metals. The U.S.S.R. is the world's leading producer of iron, manganese and chromium ores, crude steel, platinum-group metals, potassium salts, and cement. It occupies second place, following the United States, in output of aluminum, lead, petroleum, natural gas, coal, and phosphate rock; it ranks after Canada in the production of nickel, and asbestos, and follows the Republic of South Africa in gold production.

Compared with 1971, raw coal production, in million tons,[3] has increased by 14; oil, by 22; pig iron, by 3.1; crude steel, by 4.9; finished rolled, ferrous metals, by 3.4; mineral fertilizers, by 4.7 (Soviet standard); and cement, by 3.7. Natural gas has increased by 9 billion cubic meters, and electric power by 58,000 million kilowatt-hours. There were also increases in the output of nonferrous and rare metals and oil refinery and oil chemistry products.

Despite impressive gains in mineral production, as reported in the Soviet press, there also have been consistent reports of the failure of mineral commodities to reach planned goals and supply industrial needs. The failure to reach planned output levels brought subsequent emphasis on meeting revised production goals with the result that a considerable part of the industrial output was not of established quality standards.

The expansion of the mineral industry continued to be achieved mainly through increased labor and capital rather than advancing technology. It is estimated that two to three times more investment and labor in real terms are required in the U.S.S.R. than in the principal countries of the West to achieve a given increase in mineral output. Because of shortages of mineral commodities, efforts were directed chiefly toward fulfilling quantitative goals and less attention was paid to quality. The productivity of labor and equipment was below planned levels, and practically all sectors of the mineral industry maintained a greater number of production personnel than called for by plan targets.[4] At the root of these problems is apparently technological backwardness in mining and recovery of commodities and inefficient production and consumption of metals, fuels, and energy; the Soviet economic system does not generate innovation.

There were about 1.5 million "production workers" and some 75,000 university graduate engineers and 125,000 graduate technicians in the Soviet ferrous industry in 1972. The coal industry employed over 2.2 million, including 61,500 university graduate engineers and 141,000 technicians. The oil, gas, and petrochemical industries employed 2.6 million, including 250,000 in the development of oilfields and gasfields. Some 65,000 specialists with higher and secondary specialized education were in the supply system, which is served by 30 computer centers and 56 machine calculating stations. As a whole, according to Soviet sources, 69% of the graduate Soviet engineers performed various kinds of work not requiring specialized university training. For example, in the Ukrainian coal industry, 860 graduate engineers and more than

[1] This publication is based entirely on a review of the sources published by the U.S.S.R.

[2] Mining engineer, Division of Fossil Fuels—Mineral Supply.

[3] All tons in this publication are metric tons.

[4] Pravda (Moscow). Jan. 18, 1971, p. 2.

16,000 graduate technicians were employed as workers in 1972.[5]

To ease the shortage of labor, many employees were permitted to hold more than one job, and able-bodied pensioners were encouraged to supplement their incomes by returning to active employment.

Labor turnover, a continuing serious problem, was attributed mainly to the lag in building houses and in providing medical and public services, to low material incentives, and to the heavy manual work involved. More than one-half of the machinery employed in the mineral industry was idle, owing largely to the quality of the machines and the unsatisfactory supply of spare parts and materials at the mines and plants.[6]

The price-rate principle, although previously condemned, has become an important feature of the mining industry. Soviet labor legislation requires that workers achieve a minimum output within a given period of time. This minimum is the work norm and is established for virtually every phase of employment.

Although the trade unions in Western countries are principally wage-bargaining organizations, their Soviet counterparts function largely as an avenue for increasing labor productivity and the fulfillment of planned quotas. The average monthly earnings of the Soviet workers and employees comprised 130.3 rubles[7] in 1972, or 3.5% over those of 1971.

Extensive prospecting and exploration for practically all commodities was carried out on a large scale. There were over 500,000 employees in the geological prospecting organizations of the U.S.S.R. in 1972, including about 120,000 graduate specialists with university and technical education. A total of some 3 billion rubles were spent on geological exploration in 1972.

Prospected reserves of mineral fuels have grown considerably in recent years, but most of the reserves are concentrated in relatively underdeveloped areas. Although some raw material deposits, such as manganese, chromite, diamond, and asbestos, are comparable with the quality of ores mined elsewhere, many of the known deposits are poor, and many mineral ventures of the Soviet Union were uneconomic by Western standards.

The U.S.S.R. continued to experience difficulties in completing construction of mineral industry projects on schedule because of shortages of material, equipment, and labor. Often, the time required to complete projects is up to twice as long as that specified by the U.S.S.R. State Construction Committee. This has contributed to the disparities between mine, concentrator, and metallurgical plant capacities. The practice of putting mines and plants into operation with many "imperfections" has resulted in great inefficiencies in production. Labor productivity lags much behind design indicators. Prolonged delays are necessary to achieve design capacity. Renovation of mines works slowly. Some republics and organizations, trying to attract large development appropriation to their area, have exaggerated the value of local mineral deposits, and, according to Soviet reports, many projects have had to be dropped after expensive reinvestigation.

In 1972, a number of mines and plants were commissioned despite numerous imperfections and inadequate equipment. Many projects have operated over a long period with lower capacities than originally planned.[8]

New enterprises that became operational in the iron and steel industry included the first stages of the Lebedinsk and Lisakovsk mining and dressing combines, the third oxygen convertor at the Karaganda works, a rolling mill at the West Siberian iron and steel works, and coking batteries at the Cherepovets metallurgical and Avdeyevsk coking plants.

In the field of nonferrous metallurgy, new facilities were put into operation at the Krasnoyarsk, Bratsk, Pavlodar, and Kirovobad aluminum plants, and at the Almalyk complex, Chimkent lead plant, and Ukrtsink zinc plant. The second stage of the Uchaly ore-dressing plant in Bashkiria is recorded as having gone into operation.

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[5] Sotsialisticheskaya industriya (Socialist Industry), Moscow. Sept. 17, 1972, p. 2.

[6] Sotsialisticheskaya industriya (Socialist Industry), Moscow. Mar. 2, 1972; Apr. 4. 1972, p. 2.

[7] Official exchange rate is 1 ruble=US$1.34. Approximate buying power of 1 ruble relative to prices in the United States for hard goods and food according to some estimates ranges from about $0.20 to $0.50 cents.

[8] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazahkstan), Alma-Ata. No. 8, August 1972, pp. 25–32; No. 7, July 1972, pp. 2–7.

Planovoye khozyaystvo (Planned Economy), Moscow. No. 3, March 1972, pp. 79–82.

Sotsialisticheskaya industriya (Socialist Industry), Moscow. Mar. 18, 1972, p. 2.

Big new capacities for the production of mineral fertilizers were started up at the Novomoskovsk and Cherkassy chemical works and at the Rovny and Ionava nitrogen fertilizer plants. New installations at the Uvarovo chemical and Dzhambul double superphosphate plants and at the Soligorsk Nos. 1 and 2 potassium plants were also commissioned.

In the coal industry, three facilities were reported to have come onstream in 1972: The third stage of the Bogatyr open pit in Kazakhstan, the second stage of the Azeysk in Irkutsk Oblast', and the Western Donbass No. 20/23 underground mine in Dneprovsk Oblast.

New capacities for the refining of crude oil were started up at the Kremenchug, Novo-Ishimbay, Novo-Gor'kiy, Angar, Kirishi, and Omsk plants.

The Supreme Soviet of the U.S.S.R. adopted a resolution on September 20, 1972, creating a new Ministry for construction of Enterprises in Petroleum and Gas Industries of the U.S.S.R.

Government Policies and Programs.—With state-owned and state-operated enterprises and low-wage labor, the U.S.S.R. has become the most self-sufficient of the worlds leading industrial nations in minerals and metals. In the Soviet economy, the selling price of a given commodity may be set at any reasonable level that could yield the desired overall results. Such trade-offs over a wider range of enterprises are not possible in a Western-style economy and could only be accomplished by government intervention or control through subsidies or other measures.

The Soviet mineral policy continues to be based upon the principle of maximum use of the domestic resources even at the cost of submarginal production. In contrast to Western mineral economies, the U.S.S.R.'s 5-year plans and the year-to-year plans set a definite mineral policy for all mineral and energy sources. In addition to the national priorities and goals set for each industry, the plan is also law and carries an obligation to comply.

The Soviet Union has large technical assistance and economic aid programs. Soviet programs include over 250 projects in 45 countries at a cost of several billion dollars. At the beginning of 1972, the distribution of the substantial Soviet credits to developing countries was 68.7% to industry, 6.2% to agriculture, 10% to geological prospecting, 10% to transport, and 4.2% to education. By 1972, 275 industrial projects had been completed or were under construction with Soviet help in the developing countries.

In many instances, the developing countries pay for their assistance with mineral commodities. The U.S.S.R. is now able to secure a substantial flow of cheaper mineral imports from friendly developing countries, and there are indications that it intends to extend this pattern to gain an exclusive access for itself and other COMECON [9] countries to deposits of exceptional quality.

PRODUCTION

Mineral production statistics were not officially reported for a number of commodities. Therefore, many of the data in the production table were estimated and represent at best an order of magnitude. The increase in Soviet mineral production in 1972 was not the result of productivity gains but rather was due to the addition of new capacity. Production capacity for almost all mineral commodities rose during the year.

In 1972 for the first time, contrary to the plan, Group "A" (heavy industry) grew faster than consumer goods output 6.8% and 6.0%, respectively.

Reportedly, 70 elements were produced in the U.S.S.R. in 1972. The Asian part of the country (east of the Urals) provided some 45% of the total Soviet coal output, 30% of the natural gas, about 20% of crude oil, and over 27% of the electric power. In 1972, the Russian Soviet Federated Socialist Republic (R.S.F.S.R.) continued to rank first among the 15 Soviet Republics in mineral production and produced over 80% of the gold and silver, practically 100% of platinum-group metals, more than 80% of the petroleum, over 55% of the coal and steel, and about two-thirds of the electric power. The Ukraine occupied first place in output of coking coal, manganese, and iron ore, and second

[9] COMECON (CMEA)—Council for Mutual Economic Assistance comprising the following countries: Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Romania, and the U.S.S.R.

place in natural gas. This republic continued to provide about one-third of the total Soviet coal and natural gas output, about 60% of iron ore, about 50% of pig iron, more than 40% of steel and rolled metal, and nearly 50% of metallurgical and electric engineering equipment.

Kazakhstan occupied third place in Soviet mineral production and was the Nation's leading producer of lead, zinc, chromite, and rare metals, but metallurgical plants in Kazakhstan continued to suffer from inadequate feed owing to lag in mine expansion and beneficiation technology.[10]

Crude steel output in the U.S.S.R reached 126 million tons in 1972. Nonetheless, the economy continued to experience shortages of ferrous metals. Soviet published data established that millions of tons of iron and steel were not reaching end users in the form of new products because of excessively high crude metal consumption per unit of finished usable product, shortage of varieties of rolled products resulting in the consumption of heavier units, and heavy weight of finished usable products compared with Western practice. According to Soviet sources, the utilization factor of metal in the metal-working and machine-building industries in 1972 was, on the average, 0.6, and there was potential for improving metal utilization in these industries by 25%.

Approximately one-half of the finished steel produced (including bars, plates, structural shapes, rails, wire, and coated and uncoated sheet steel) reportedly does not properly meet consumer specifications. Similarly, use of incorrect types and sizes of pipe in the gas and petroleum industries particularly, resulted in the use of 16% more metal than was necessary. According to Soviet sources, the utilization factor of metal in the metal-working and machine-building industries in 1972 was approximately 25% lower than that in the United States, Western Europe, and Japan.

About 75 million tons of steel and pig iron scrap were used by the Soviet steel industry in 1972. More than 80% was new scrap from metallurgical and machine-building plants, and less than 20% was in the form of old scrap, mainly unused machines and spare parts.[11]

According to A. Kosygin, Chairman of the Council of Ministers of the U.S.S.R., "Our industry produces a large number of various machines, many of which weigh more than the same machines produced abroad. This is one of the reasons why with annual steel output of 120 million tons, the economy is still short of metal."[12]

A careful and exhaustive study of the Soviet publications shows that only about one-third of the total crude steel production is effectively used in the Soviet economy and two-thirds is remelted or lost as a result of inefficient production and consumption of metal.

The Soviet nonferrous industry continued to suffer from high production costs, low productivity, and excessive loss of metal during recovery processes. Nonetheless, production of all nonferrous metals gained slightly in 1972.

Problems in the Donets Basin arising from labor shortages and low productivity, aggravated by the exportation of petroleum fuels needed for domestic uses, resulted in the uneconomic transportation of coal from eastern regions to the European part of the U.S.S.R. and to the Urals. Such shipments amounted to over 100 million tons of coal in 1972. According to Soviet estimates, this amount may increase several times by 1980.

While the U.S.S.R. does not publish statistical data on injuries in the mineral industry, available Soviet information reveals that there were many fatal injuries in the mineral industry in 1972.

About 90% of the total tonnage of mineral industry products moved in the U.S.S.R. in 1972 was shipped by rail. The quantity and the average distance of railroad deliveries of mineral commodities in 1972 was as follows:

Commodities	Quantity (million metric tons)	Distance (kilometers)
Coal	649.2	692
Coke	33.1	769
Crude and petroleum products	339.3	1,203
Ore:		
Iron and manganese	214.0	727
Nonferrous	54.7	940
Ferrous metals	152.9	1,358
Chemical and mineral fertilizers	80.5	993
Cement	82.4	566

[10] Kazakhstanskaya pravda (Alma-Ata). Jan. 20, 1972, p. 2.

[11] Material'no-tekhnicheskoye snabzheniye (Material-Technical Supply), Moscow. No. 10, October 1972, pp. 25–32.

[12] Planovoye khozyaystvo (Planned Economy), Moscow. No. 11, November 1972, p. 5.

Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Ores and concentrates:			
Bauxite, 26% to 52% alumina	4,300	4,500	4,700
Nepheline concentrate, 25% to 30% alumina	400	500	600
Alunite ore 16% to 18% alumina	200	300	300
Alumina	r1,800	2,000	2,200
Metal, smelter:			
Primary	1,100	1,180	1,250
Secondary	120	120	120
Antimony, mine output, metal content—metric tons	6,700	6,900	7,000
Arsenic, white (As_2O_3)—do	7,150	7,150	7,200
Beryllium, beryl, cobbed, 10% to 12% BeO—do	1,300	1,300	1,350
Bismuth, mine output, metal content—do	50	55	55
Cadmium, smelter—do	2,350	2,400	2,450
Chromium, chromite ore, 30% to 56% Cr_2O_3	1,750	1,800	1,850
Cobalt:			
Mine output, metal content—metric tons	1,550	1,600	1,650
Smelter—do	1,550	1,600	1,650
Copper:			
Ore:			
Gross weight, 0.5 to 2% Cu	57,000	62,000	66,500
Metal content, recoverable	570	620	665
Blister:			
Primary	570	620	665
Secondary	140	140	150
Gold, mine output, metal content—thousand troy ounces	6,500	6,700	6,900
Iron and steel:			
Iron ore, 55% to 63% Fe [2]	195,492	203,008	208,000
Agglomerated products: [3]			
Sinter	138,199	140,658	NA
Pellets	10,620	13,475	
Pig iron and ferroalloys: [3]			
Pig iron for steelmaking	75,649	79,044	
Foundry pig iron	9,160	9,203	
Spiegeleisen	102	124	NA
Ferromanganese	968	856	
Other blast furnace ferroalloys	54	27	
Total	85,933	89,254	92,304
Steel: [3]			
Ingots	108,736	112,984	NA
Steel for casting	7,150	7,653	
Total	115,886	120,637	126,000
Semimanufactures: [3]			
Sections	31,618	32,599	
Wire rods	6,950	7,350	NA
Pipe stock	4,610	4,931	
Tubes from ingots	1,497	1,577	
Plates and sheets:			
Over 5 millimeters thick	10,194	11,169	NA
Other	14,333	14,467	
Total plates and sheets	24,527	25,636	NA
Strip	7,577	8,154	
Railway track material	3,573	3,683	
Wheels, tires, and axles	925	927	NA
Unspecified shapes for sale	794	716	
Other	71	81	
Total semimanufactures	82,142	85,654	NA
Selected end products: [3 4]			
Welded pipes and tubes	7,042	7,655	NA
Seamless pipes and tubes	5,392	5,701	
Total	12,434	13,356	NA
Cold rolled sheet	5,178	5,458	
Tinplate	501	515	
Galvanized sheets	508	538	NA
Electrical sheets	952	980	
Cold reduced strip	199	223	
Wire, plain	3,081	3,293	

See footnotes at end of table.

Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS—Continued			
Lead:			
Mine output, recoverable metal content	440	450	460
Smelter:			
Primary	440	450	460
Secondary	90	90	90
Magnesium metal, including secondary	50	52	54
Maganese ore, gross weight [2]	6,841	7,318	7,800
Mercury metal, including secondary—76-pound flasks	48,000	50,000	50,000
Molybdenum, mine output, metal content—metric tons	7,700	8,000	8,200
Nickel:			
Mine output, metal content	110	120	125
Smelter	110	120	125
Platinum, mine output, metal content—thousand troy ounces	2,200	2,300	2,350
Silver metal, including secondary—do	38,000	39,000	40,000
Tin:			
Mine output, recoverable metal content—long tons	27,000	28,000	28,500
Smelter:			
Primary—do	27,000	28,000	28,500
Secondary—do	10,000	10,000	10,000
Titanium metal—metric tons	12,500	13,300	13,500
Tungsten concentrates, contained tungsten—do	6,700	7,000	7,200
Vanadium content of exported slags—do	3,064	2,646	e 2,600
Zinc:			
Mine output, recoverable metal content	r 610	650	650
Metal:			
Primary	610	650	650
Secondary	70	70	70
NONMETALS			
Asbestos	1,065	1,150	1,220
Barite	285	300	310
Boron minerals and compounds, B_2O_3 content	70	72	75
Cement, hydraulic [2]	95,200	100,300	104,040
Clays: Kaolin (including china clay)	1,800	1,900	2,000
Corundum, natural—metric tons	6,500	6,500	7,000
Diamond:			
Gem—thousand carats	1,600	1,800	1,850
Industrial—do	6,250	7,000	7,350
Total—do	7,850	8,800	9,200
Diatomite	370	370	380
Feldspar	250	250	260
Fertilizer materials:			
Crude:			
Nitrogen compounds, N content	[2] 5,423	[2] 6,055	6,500
Phosphtic:			
Apatite:			
Ore 17.7% P_2O_5	[2] 27,200	28,000	28,300
Concentrate 39.4% P_2O_5	11,300	11,650	12,000
Sedimentary rock:			
Ore 13% P_2O_5	19,000	20,000	21,000
Concentrate 19% to 25% P_2O_5	9,500	10,000	10,500
Potassic, potash, K_2O equivalent	[2] 4,087	[2] 4,807	5,500
Manufactured:			
Nitrogenous, gross weight	[2] 26,442	[2] 29,530	31,800
Phosphatic:			
Meal, gross weight	[2] 5,709	[2] 5,420	4,530
Other, gross weight	[2] 13,370	[2] 14,826	16,000
Potassic, gross weight	[2] 9,824	[2] 11,556	13,300
Other and unspecified, gross weight	55	66	470
Total [2]	55,400	61,398	66,100
Fluorspar	410	420	430
Graphite	75	80	80
Gypsum	[2] 4,700	[2] 4,700	4,700
Lime, dead burned	[2] 21,500	[2] 21,000	22,000
Magnesite, crude	3,100	3,200	3,300
Mica	38	38	39
Pyrite:			
Gross weight	4,000	4,200	4,500
Sulfur content	2,100	2,200	2,300
Refractory materials:			
Dinas (quartzite-lime)	[2] 597	[2] 597	600
Magnesite and chrome magnesite	[2] 1,423	[2] 1,451	1,500
Magnesite powder	[2] 1,344	[2] 1,319	1,350
Shamotte	[2] 6,097	[2] 6,133	6,200
Total	[2] 9,461	[2] 9,500	9,650

See footnotes at end of table.

Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities—Continued
(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 [p]
NONMETALS—Continued			
Salt, all types	[2] 12,400	[2] 12,000	12,000
Sulfur, elemental (excluding sulfur content of pyrite):			
From ores	1,120	1,190	1,200
Byproduct, recovered	480	510	500
Talc	380	380	390
MINERAL FUELS AND RELATED MATERIALS			
Coal: [5]			
Anthracite	[2] 75,803	[2] 75,760	77,000
Bituminous:			
Coking	[2] 164,809	[2] 169,000	170,000
Other (not specifically identified)	235,794	242,779	253,000
Total "hard" coal	[2] 476,406	[2] 487,539	500,000
Lignite and brown	[2] 147,708	[2] 153,342	155,000
Coke, oven, beehive, breeze and gas coke [6]	75,404	78,326	79,750
Fuel briquets: [6]			
From anthracite and bituminous coal	1,448	1,444	NA
From lignite and brown coal	5,765	6,244	
Total	7,213	7,688	NA
Gas, natural:			
Gross production—billion cubic feet	7,520	7,900	8,200
Marketed production [2]—do	6,900	7,501	7,800
Peat:			
Agricultural use	[r] 27,000	27,000	27,000
Fuel use	[2] 47,500	[2] 54,300	55,000
Petroleum:			
Oil shale	[2] 24,319	[2] 26,253	27,000
Petroleum, crude:			
As reported, gravimetric units	353,039	377,075	394,000
Converted, volumetric units—thousand 42-gallon barrels	[r] 2,594,550	2,778,300	2,895,900

[p] Preliminary. [r] Revised. NA Not available.
[1] Estimated except where otherwise noted.
[2] Reported in Soviet sources.
[3] Source: United Nations Quarterly Bulletin of Steel Statistics for Europe. V. 23, No. 4, 1973, New York, 1973, p. A22.
[4] Items reported under this heading are produced from semimanufactures listed above and possibly also from imported materials. Therefore these data are not additive to the total of semimanufactures listed.
[5] Run-of-mine coal; the average ash content of the coal shipped from the mines was 20% and the average calorific value was a little more than 5,000 kilocalories per kilogram in 1972.
[6] Source: United Nations Annual Bulletin of Coal Statistics for Europe. V. 6 1971, New York, 1972, pp. 33, 60.

TRADE

In the Soviet mineral economy, international trade ranks high among the industry's priorities. Since the volume of trade is outlined in the national 5-year plan and is conducted by state enterprises directed by the Ministry of Foreign Trade, planned exports and imports reflect national goals and priorities. There is, therefore, an implied commitment to export to achieve a desired trade balance. Soviet foreign trade continues to be oriented towards the importation of needed production machinery and equipment including complete industrial plants. Exports of minerals help to pay for these imports. The sale of minerals, as of other Soviet products, is carried out largely under bilateral trade agreements negotiated on a state-to-state basis. The U.S.S.R. sells practically nothing that could not easily be consumed in the country.

The value of total Soviet trade turnover (exports plus imports) expanded by 10% from 23.6 billion rubles in 1971 to 26 billion rubles in 1972. Exports from the U.S.S.R. were valued at 12.7 billion rubles, 2.4% more than in 1971. The value of imports amounted to 13.3 billion rubles, an 18.8% increase over that of 1971. Soviet trade with Western European states in 1972 amounted in aggregate to 4.1 billion rubles; trade with countries in Asia, Africa, and Latin America totaled 3.3 billion rubles.

The value of total commodity trade with various groups of countries in 1965, 1970, 1971, and 1972 follows, in billion rubles:

Group of countries	1965	1970	1971	1972	% of increase 1971–72
COMECON countries	8.5	12.3	14.2	15.5	9.2
Other Communist countries	1.6	2.1	1.3	1.3	--
Total Communist countries	10.1	14.4	15.5	16.8	8.4
Developed non-Communist countries	2.8	4.7	5.0	5.9	18.0
Developing non-Communist countries	1.7	3.0	3.1	3.3	6.5
Total non-Communist countries	4.5	7.7	8.1	9.2	13.6
Total Soviet trade value	14.6	22.1	23.6	26.0	10.2

Table 2.—U.S.S.R.: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal:			
Unwrought	368,900	405,600	East Germany 101,300; Czechoslovakia 75,900; Hungary 65,800; Poland 41,000; Bulgaria 21,300; Japan 21,200.
Semimanufactured, rolled only	131,000	118,500	East Germany 22,900; Czechoslovakia 14,700; Poland 7,823; Arab Republic of Egypt 4,500.
Antimony, unwrought	r 868	416	Bulgaria 411.
Cadmium, unwrought	885	869	Netherlands 387; East Germany 171.
Chromium, chromite ore and concentrate thousand tons	1,200	1,100	United States 275; Sweden 150; West Germany 117; Czechoslovakia 106; Poland 105.
Copper and copper alloys:			
Unwrought:			
Unalloyed	123,100	173,600	Netherlands 57,100; Czechoslovakia 37,000; Hungary 16,100; Poland 5,956.
Alloyed	8,700	7,900	West Germany 3,817; Netherlands 3,251; Cuba 150.
Semimanufactures, rolled only:			
Unalloyed	8,400	7,900	Cuba 3,147; Romania 1,788; Poland 941; Czechoslovakia 888.
Alloyed	10,300	9,700	Cuba 959; Romania 543; Bulgaria 391.
Iron and steel:			
Iron ore thousand tons	36,100	36,500	Czechoslovakia 11,000; Poland 10,308; Romania 4,300; Hungary 3,001.
Scrap do	1,400	1,700	Italy 480; Japan 404; East Germany 256; Finland 103; Sweden 100.
Pig iron do	4,800	5,100	Poland 1,538; East Germany 882; Czechoslovakia 726; Romania 525; Japan 235; Bulgaria 214; Hungary 198.
Ferroalloys:			
Ferrochrome	44,800	42,300	NA.
Ferromanganese	118,500	124,800	NA.
Ferrosilicon	124,900	124,000	NA.
Ferrovanadium	1,200	1,200	NA.
Silicomanganese	r 6,889	9,213	NA.
Other (unspecified)	r 29,800	43,100	NA.
Total	326,089	344,613	Czechoslovakia 103,200; Romania 80,000; Hungary 43,300; West Germany 25,500; United Kingdom 19,400; Sweden 15,400; Netherlands 14,000.
Ingots and other primary forms thousand tons	1,214	1,101	Romania 293; Yugoslavia 139; East Germany 134; Arab Republic of Egypt 128.
Steel semimanufactures:			
Angles, shapes, sections do	1,822	1,763	East Germany 476; Bulgaria 316; Hungary 157; Poland 136.
Wire rod do	423	485	East Germany 107; Poland 104; Romania 92; Hungary 68.
Plate do	r 2,115	2,116	East Germany 1,036; Czechoslovakia 272; Bulgaria 111; Romania 103.
Sheet:			
Tinplate do	112	106	Bulgaria 41; Cuba 26; East Germany 18.
Other do	923	838	East Germany 410; Poland 140; Bulgaria 70.
Strip do	13	--	
Railway track materials do	390	400	East Germany 176; Poland 81; Bulgaria 50.
Wheels, tires, axles do	r 44	48	East Germany 26; Poland 17.
Pipes, tubes, fittings do	341	474	East Germany 184; Czechoslovakia 153; Bulgaria 54; Cuba 28.
Wire do	77	67	Cuba 20; East Germany 13; Bulgaria 7.

See footnotes at end of table.

Table 2.—U.S.S.R.: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Lead, unwrought	92,400	93,200	East Germany 46,400; Czechoslovakia 22,300; Hungary 11,200.
Magnesium metal, unwrought	16,800	14,800	West Germany 4,242; East Germany 3,371; Netherlands 1,678.
Manganese:			
Ore and concentrate:			
Metallurgical grade thousand tons	1,200	1,400	Poland 360; Czechoslovakia 252; East Germany 193; Japan 111.
Battery and chemical grade do	16	17	Netherlands 5; East Germany 2; Poland 2.
Metal [2]	60	40	All to Sweden.
Titanium minerals, ilmenite [2]	6,010	--	
Vanadium slag	38,300	29,400	NA.
Zinc, unwrought	95,100	136,600	East Germany 40,600; Czechoslovakia 37,800; Netherlands 17,400; United Kingdom 12,700; India 12,500.
Other nonferrous metals:			
Unwrought	r 38,899	46,907	NA.
Semimanufactures, rolled:			
Bimetal	r 3,600	2,700	Bulgaria 2,433.
Other	r 500	1,800	NA.
NONMETALS			
Abrasives, hard alloys	128	93	Romania 50; Bulgaria 15; Poland 11.
Asbestos	385,300	433,000	Japan 56,100; East Germany 43,700; Poland 43,300; France 35,700; West Germany 22,800; Bulgaria 22,800.
Cement, hydraulic thousand tons	3,200	3,400	Hungary 569; Czechoslovakia 465; Poland 349; Yugoslavia 294; Libya 291.
Clays and clay products:			
Refractory clays and baked slate	38,300	42,900	Hungary 6,203.
Refractory products, including magnesite products	162,000	144,000	Bulgaria 34,500; India 24,000; Cuba 15,200; Romania 12,800.
Fertilizer materials:			
Crude phosphatic:			
Apatite ore thousand tons	49	50	All to East Germany.
Apatite concentrate do	5,600	6,300	East Germany 1,172; Poland 948; West Germany 865.
Manufactured:			
Nitrogenous:			
Urea do	222	254	Cuba 66; Sudan 44; India 38; Pakistan 30; Arab Republic of Egypt 29.
Other do	r 1,024	920	Czechoslovakia 319; Cuba 259; North Vietnam 123; Hungary 100.
Phosphatic do	r 651	566	Bulgaria 219; Hungary 181; Cuba 77.
Potassic do	3,100	3,900	Poland 1,658; Hungary 369; Belgium 312; Japan 269; Czechoslovakia 261; Yugoslavia 231.
Fluorspar and cryolite (cryolite only)	5,600	5,700	Poland 1,414; Hungary 1,039; Romania 487; Yugoslavia 486.
Graphite	17,600	22,964	All to East Germany.
Gypsum [2]	20,100	21,200	All to Finland.
Salt	293,600	264,500	Czechoslovakia 122,700; People's Republic of China 112,600; Hungary 73,900; Finland 40,900.
Sodium and potassium compounds, n.e.s:			
Caustic soda	23,200	40,600	Cuba 33,600; Arab Republic of Egypt 3,900.
Soda ash	70,300	89,600	Czechoslovakia 26,700; Turkey 22,500; Cuba 16,300; Arab Republic of Egypt 9,158.
Sulfur and pyrites:			
Pyrite, gross weight thousand tons	1,800	1,800	Italy 534; West Germany 416; Yugoslavia 179; East Germany 174.
Sulfur, elemental do	464	464	Czechoslovakia 163; Cuba 141; Hungary 106.
Sulfur acid do	215	211	Czechoslovakia 73; Hungary 56; East Germany 49; Romania 33.
Talc [2]	13,000	6,172	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	45,300	60,500	East Germany 21,700; Czechoslovakia 11,100; Bulgaria 10,144; Hungary 9,135.
Coal:			
Anthracite thousand tons	4,300	4,300	France 1,289; Czechoslovakia 321; Italy 216; Belgium 164; Yugoslavia 112; East Germany 101.
Bituminous do	20,000	20,500	East Germany 3,753; Czechoslovakia 2,567; Japan 2,450; Italy 1,553; Poland 1,157; Yugoslavia 1,032.
Unspecified do	200	100	NA.
Total do	24,500	24,900	

See footnotes at end of table.

Table 2.—U.S.S.R.: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Coke—thousand tons	r 4,200	4,400	East Germany 1,294; Romania 1,080; Hungary 628; Finland 579.
Gas, natural—million cubic feet	116,470	162,447	Czechoslovakia 57,881; Poland 52,548; Austria 50,429.
Petroleum: [3]			
Crude—thousand 42-gallon barrels	490,980	549,780	
Refinery products:			
Gasoline—do	r 29,750	34,850	
Kerosine and jet fuel—do	r 16,400	18,759	
Distillate fuel oil—do	85,044	85,044	
Residual fuel oil—do	75,924	79,254	
Lubricants—do	r 2,176	1,845	Czechoslovakia 11.2%; East Germany 9.9%; Italy 8.6%; Finland 8.2%; Bulgaria 7.6%; Cuba 6.1%; West Germany 5.8%; Hungary 4.8%. [3]
Other:			
Asphalt and bitumen—do	220	218	
Paraffin—do	299	312	
Petroleum coke—do	856	505	
Unspecified—do	r 409	477	
Total—do	r 211,078	221,264	
Crude chemicals from coal, gas, and oil distillation—thousand tons	371	434	France 74; East Germany 68; Italy 58; West Germany 49.

r Revised. NA Not available.

[1] Except where otherwise noted, data are taken directly from official foreign trade returns of the U.S.S.R.

[2] Data possibly incomplete; total not reported. Totals given represent sum of quantities reported under individual countries.

[3] Details on destination of crude oil and the various refinery products are not reported individually. Total exports of these commodities are reported on a tonnage basis by destination, but are not convertible to a barrel basis owing to the varying specific gravity of the different commodities that constitute the total.

Table 3.—U.S.S.R.: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite—thousand tons	1,548	1,400	Yugoslavia 600; Greece 526; Guinea 211.
Alumina—do	518	755	United States 447; Hungary 161.
Metals and alloys, semimanufactures	1,600	1,500	West Germany 251; Finland 103.
Cadmium, primary forms	310	229	Poland 200.
Copper metal:			
Unwrought, unalloyed	1,021	7,400	United Kingdom 6,403.
Semimanufactures:			
Powder [1]	560	620	All from West Germany.
Rolled:			
Unalloyed	5,000	6,700	Yugoslavia 4,876; United Kingdom 216.
Alloyed	5,000	6,400	Yugoslavia 1,910.
Iron and steel:			
Pig iron—thousand tons	69	72	All from North Korea.
Ferroalloys—do	6	10	Norway 5.
Semimanufactures:			
Pipe—do	1,300	1,400	West Germany 727; Romania 132; Japan 106.
Other, rolled only—do	r 1,651	2,045	Romania 320; Japan 283; Bulgaria 171; West Germany 138.
Lead:			
Ore [1]	50,700	48,000	All from Iran.
Metal, unwrought	38,800	43,000	Yugoslavia 21,200; United Kingdom 9,522; Bulgaria 8,654.
Mercury [1]—76-pound flasks	2,321	2,901	All from Peoples' Republic of China.
Tin, metal, unwrought—long tons	8,169	4,331	United Kingdom 1,655; Bolivia 1,065; Malaysia 1,021.
Zinc:			
Ore [1]	r 9,230	12,634	All from Iran.
Concentrate [1]	17,800	5,500	All from North Korea.
Metal: Unwrought:			
Unalloyed	53,300	49,400	Poland 39,700; North Korea 6,271.
Alloyed	4,000	4,000	All from Poland.
Semimanufactures:			
Dust	1,400	1,300	Mainly from Poland.
Rolled	4,200	5,300	North Korea 4,373; Poland 604.

See footnotes at end of table.

Table 3.—U.S.S.R.: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Other metals, n.e.s.:			
Unwrought	313	4,571	NA.
Semimanufactures, rolled	r 200	955	NA.
NONMETALS			
Barite	151,700	190,100	North Korea 82,800; Romania 42,500; Yugoslavia 24,900; Bulgaria 24,800.
Cement, hydraulic thousand tons	481	371	North Korea 358.
Fluorspar	144,700	176,200	Mongolia 76,200; Thailand 41,900; Japan 20,800; People's Republic of China 16,279.
Magnesite powder [1]	208,494	376,454	North Korea 375,500; France 954.
Mica	483	478	All from India.
Quartz crystal, optical kilograms	3,343	NA	
Sodium and potassium compounds, n.e.s.:			
Caustic soda	170,100	164,900	Italy 62,900; Romania 38,500; Netherlands 28,000; Poland 13,450.
Soda ash	573,000	403,100	Romania 99,400; Belgium 73,900; Poland 69,900; United Kingdom 46,200.
Caustic potash	8,900	9,100	Czechoslovakia 4,135; West Germany 2,725; East Germany 2,210.
Sulfur	216,700	218,500	Poland 197,900.
Talc	92,200	53,800	North Korea 34,800; Bulgaria 18,900.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	2,400	3,000	Romania 2,000; East Germany 1,000.
Coal, bituminous thousand tons	7,100	8,400	Poland 8,388.
Coke do	674	794	All from Poland.
Gas, natural [1] million cubic feet	r 125,565	287,315	Iran 198,570; Afghanistan 88,745.
Petroleum:			
Crude oil [1] thousand 42-gallon barrels	r 24,998	36,790	Arab Republic of Egypt 14,135; Algeria 5,738.
Refinery products:			
Gasoline do	r 3,784	3,104	
Kerosine do	r 2,019	2,818	
Distillate fuel oil do	1,332	1,352	
Lubricants do	772	919	
Other:			
Asphalt and bitumens do	144	135	Romania 30.8%; West Germany 1.1%.[2]
Paraffin do	47	48	
Solvents do	152	155	
Unspecified do	r 525	3,083	
Total do	8,775	11,614	

r Revised. NA Not available.

[1] Data possibly incomplete; total not reported. Totals given represent sum of quantities reported under individual countries.

[2] Details on origins of various refinery products are not reported individually. Total imports of these commodities are reported on a tonnage basis by distination, but are not converted to a barrel basis owing to the varying specific gravity of the different commodities that constitute the total.

In 1972, the Soviet Union traded with 110 countries, including 90 countries with which it has trade agreements. Almost two-thirds of the Soviet foreign trade was transacted with Communist countries, the largest turnover being achieved by East Germany. The volume of Soviet trade with these countries decreased from 65.4% in 1971 to 64.5% in 1972. The U.S.S.R.'s major trading partners are the COMECON countries. Trade with them increased from 56.2% of the total in 1971 to 59.6% in 1972. Compared with 1971, trade with individual countries increased in 1972 as follows, in billion rubles: East Germany, from 3.4 to 3.7; Poland, from 2.5 to 2.8; Czechoslovakia, from 2.4 to 2.6; Bulgaria, from 2.1 to 2.3; Hungary, from 1.7 to 1.9; Romania, from 0.9 to 1.1; and Mongolia, from 0.235 to 0.287. The trade turnover increased with Yugoslavia from 548 million rubles in 1971 to 569 million rubles in 1972; and with the People's Republic of China, from 139 million rubles to 211 million rubles. There was a reduction in trade turnover with Cuba, from 891 million rubles in 1971 to 822 million rubles in 1972.

The value of Soviet trade with non-Communist developed countries expanded from 5.1 billion rubles in 1971 to 5.9 billion rubles in 1972. These countries accounted for 22.6% of the Soviet foreign trade. Compared with 1971, trade with individual countries increased in 1972 as follows, in million rubles: West Germany, from 667 to 828; Japan, from 734 to 816; Finland, from 569 to 602; France, from 476 to 544; and the United States, from 184 to 538. There was a reduction in trade turnover with the United Kingdom, from 607 million rubles in 1971 to 558 million rubles in 1972, and with Italy, from 495 to 466 million rubles.

In 1972, the developing countries continued to account for 13% of Soviet foreign trade. Compared with that of 1971, trade with individual countries increased in 1972 as follows, in million rubles: India, from 372 to 451; Iraq, from 105 to 152; Turkey, from 102 to 145; and Syria, from 78 to 112. There was a reduction in trade turnover with the Arab Republic of Egypt, from 644 million rubles in 1971 to 514 million rubles in 1972; followed by Iran, from 239 to 230; Algeria, from 122 to 115; and Afghanistan from 80 to 69. Trade with developing countries grew through the expansion of the economic and technical assistance that is now given to 45 countries.

Quantitatively, there was no significant change in patterns of Soviet mineral trade in 1972 compared with those of 1971. Fuels, metals, and mineral raw materials continued to play the largest role in Soviet exports and represented over 39% of total official exports during 1972. Along with gold, platinum-group metals, diamond, chrome ore, manganese ore, aluminum, zinc, lead, asbestos, apatite concentrate, potassium, cement, pig iron, ferroalloys, steel, coal, petroleum, and coke, the country now exports titanium, nickel, copper, rare metals, and natural gas. With the development of the Soviet nonferrous metal industry in recent years, the U.S.S.R. has become a factor on the world market for rare earth and rare element metals.

Compared with those of 1971, exports of mineral commodities increased in 1972 as follows, in thousand metric tons unless otherwise specified:

Commodities	1971	1972
Aluminum	406	455
Copper	174	202
Cadmium (metric tons)	869	1,338
Iron ore	36,500	38,400
Ferroalloys	345	414
Magnesium	14.8	19.9
Apatite concentrate	6,000	6,300
Potassium	3,900	4,100
Nitrogenous fertilizers	920	1,062
Crude oil and petroleum products	105,000	107,000
Natural gas (billion cubic meters)	4.6	5.1
Power, electric (billion kilowatt hours)	7.0	7.5

There was a reduction in Soviet exports of manganese ores, ferrous scrap, sulfur, superphosphate, and coal from 1.4, 6.8, 0.5, 0.6 and 24.9 million tons respectively, in 1971 to 1.3, 6.7, 0.4, 0.5, and 24.4 million tons respectively, in 1972.

Most of the U.S.S.R.'s 1972 export trade in minerals was with Europe and Japan. Mineral trade between the United States and the U.S.S.R. was insignificant. The Soviet Union is urging a formal U.S.-Soviet trade pact, and there are possibilities for expansion of economic cooperation. Over 60% of the mineral trade was limited to Communist countries where Soviet deliveries represented one-third of the import requirements of these countries in machinery and equipment, almost 100% in crude oil and pig iron, some 85% in iron ore, and about 75% of the demand in mineral fertilizers.

According to Soviet official sources, 32 countries on three continents were being helped in mineral prospecting by Soviet geologists. Oil exploration, development of producing units, and studies for utilization of associated gas were included in the Soviet contracts with developing countries of Africa and the Near East.

The most important categories of mineral commodity imports in 1972 were ferrous and nonferrous semimanufactures, steel pipes, bauxite and alumina, tin, tungsten concentrate, barite, talc, and mica. Soviet purchases of machinery and equipment accounted for approximately one-half of the imports from the United Kingdom, France, and Italy, including complete equipment for a chemical industry complex. A considerable part of the imports from developing countries were goods delivered in payment for loans and services from the U.S.S.R. The Soviet Union received almost one-half of the entire export

of machinery and equipment from COMECON countries, primarily from East Germany and Czechoslovakia.

There was an increase in the imports of ferrous rolled metals from 3.2 million tons in 1971 to 3.8 million tons in 1972, bauxite from 1.4 million tons to 1.7 million tons, and natural gas from 8.1 billion cubic meters in 1971 to 11 billion cubic meters in 1972.

Trade tables are derived from the official statistics of the Ministry of Foreign Trade for 1969, 1970, and 1971. Official detailed figures for 1972 are not yet available, but much the same general pattern can be expected.

COMMODITY REVIEW

METALS

Development of ferrous and nonferrous industries lagged behind goals, as foreseen in the 1971–75 5-year plan; however, production of metals and alloys continued to grow. Many products of the industry were not up to quality and variety requirements.

Nonferrous ore beneficiation facilities continued to experience poor recoveries of metal, particularly from oxide and mixed ores. Lead concentrates produced from mixed ores at the Zyryanovsk and Leninogorsk complexes contained about 60% of the lead present in the ore, and zinc concentrates carried only 30% to 50% of the zinc present in these ores. From 80% to 90% of rare and dispersed elements were discarded in tailings in 1972.[13]

Utilization of machinery and equipment continued to be considerably below the planned levels, and modernization and replacement of obsolete equipment were slow. As a result, productivity even at advanced enterprises in Kazakhstan's nonferrous industry was lower than that of comparable enterprises in the West. The quality of drilling rigs and self-propelled equipment lagged.

Aluminum.—The Soviet Union operated 13 primary reduction plants with a total probable capacity as of January 1, 1973, of 1.65 million tons. Although exact production figures are not available, it is believed output of primary metal was about 1.25 million tons in 1972, a 6% increase over that of 1971. It had been planned to increase primary production by 10%, but production fell short at the Achinsk, Kirovabad, and Pavlodar alumina plants and the Krasnoyarsk aluminum plant.

At present, most of the Soviet Union's primary aluminum comes from the Bratsk, Ural'sk, Bogoslovsk, Novokuznetsk, and Krasnoyarsk plants. Output of metal at the Bratsk plant, which was the largest in the country, increased by 20% in 1972. The primary aluminum refinery at Volgograd, where three potlines have been installed, is supplied by Hungarian alumina.

The aluminum supply position in 1972 was as follows, in thousand metric tons:

Production of primary aluminum	1,250
Production of secondary aluminum	120
Imports of aluminum (ingots)	--
Exports of aluminum (ingots)	455
Apparent consumption	915

Four potlines (two at each plant) at the Bratsk and Krasnoyarsk aluminum plants and two rolling mills (one at each plant) at the Kandalaksha and Kanaker aluminum plants were commissioned in 1972. A mill for rolling aluminum foil was under construction at the Voroshilov secondary nonferrous metals plant in Leningrad.

Construction continued at the Bratsk, Krasnoyarsk, and Irkutsk primary aluminum plants. A new aluminum plant in Tadzhikistan was also under construction, with a new target for completing the first potline in 1975. Electric power will come from the Nurek G.E.S. (Nurek hydroelectric power station), the first stage of which, with a capacity of 600,000 kilowatts (total capacity 2.7 million kilowatts), was put into operation in 1972. However, there were no plants in the area to utilize the power. In the early sixties, as a result of poor planning, the same thing had happened at Bratsk when, for years, the powerplant was operating at a fraction of capacity, because the first stage of the Bratsk aluminum plant was not completed.

In 1972, attention was given to the shortfall in bauxite and alumina supplies compared with aluminum electrolysis capacity. A serious deficit of bauxite and alumina seems probable in the future, and substantial quantities of high-grade baux-

[13] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 3, March 1973, p. 36.

ite and alumina continued to be imported from Hungary, Yugoslavia, Greece, Guinea, Japan, and the United States. The U.S.S.R. is apparently interested in purchasing large tonnages of alumina from Japan and France and both bauxite and alumina from Australia on long-term contract.

The Soviet Union proposed to the Greek Government construction of a $100 million 450,000-ton-per-year alumina plant to be 100% Greek-owned. The U.S.S.R. would take the entire output for the first 7 years of operation (estimated at 3.15 million tons worth $280 million). Under a new agreement, the U.S.S.R. will increase assistance to Guinea with respect to development of its bauxite deposits; beginning in 1974, 2.25 million tons of bauxite from the Kindia mine, now under development with the assistance of the U.S.S.R., will be delivered annually.

Construction of a large shop for processing secondary aluminum has begun at Sumgait aluminum works. Transcaucasian and Central Asian metallurgical works will send aluminum scrap to the shop, where it will be sorted and remelted for use in the production of aluminum ware and other consumer goods. The Soviet Union is negotiating the purchase of French scrap aluminum crushers, which will be installed at the above-mentioned shop.

The U.S.S.R. is building a 100,000-ton-per-year aluminum plant near the Aswan Dam in Egypt. It is expected to be commissioned in phases starting the end of 1974. About three-quarters of the production is to be exported to the Soviet Union. The U.S.S.R. is also supplying equipment to the Indian state aluminum refinery in Korba which will have a 100,000 ton-per-year initial capacity at the end of 1974. Turkish personnel who will work at the Turkish aluminum plant, which is being built with Soviet assistance, have been given a training course at the Dneprovsk aluminum plant in the Ukraine. The Irkutsk branch of the Union Research and Planning Institute of the Aluminum, Magnesium and Electrode Industry has completed plans for an aluminum plant to be built in North Korea. Soviet equipment will be installed.

The Northern Urals continued to be the main bauxite and alumina producing area in 1972. Four underground mines in this region were undergoing expansion, but the opening of two new underground mines progressed slowly, and they were rescheduled for completion in 1974.

Output of bauxite in Kazakhstan, the second most important producing area, increased by about 4% in 1972. Development of the Turgay open pits continued, although bauxite output was only about three-quarters of the planned 1972 quota. The capacity of the Pavlodar No. 1 alumina plant, however, was already approaching the planned level, but it did not meet planned targets (an increase of 12%) in 1972. The Pavlodar No. 2 alumina plant was under construction.

Although the Soviet Union is a large producer of low-grade bauxite, supplies are insufficient to meet demand, and attention is being given to both nepheline and alunite deposits. The development of technology for producing alumina from the Kiya-Shaltyrsk (Belogorsk) nepheline open pit on the border of Krasnoyarsk Kray and Kemerovo Oblast' was given priority in the Soviet aluminum industry. The Achinsk alumina-from-nepheline plant in West Siberia, which began operation in December 1971, showed very poor performance in 1972, as did the Kirovabad alumina-from-alunite plant in Azerbaydzhan.

At Karaganda, designers have constructed and started testing an experimental plant to extract alumina from the ashes of Ekibastuz coal. The ashes are obtained from the Alma Ata powerplant in Kazakhstan.

Antimony.—The Kadamzhay complex in the Kirghiz S.S.R. remained the principal antimony center. The integrated facilities produced most of the country's refined products. In 1972, new facilities for antimony trioxide production and an electric ore-smelting furnace were commissioned. The furnace is the first of its kind in the Soviet Union. A number of furnaces at this plant have been converted to natural gas. Development continued on a new underground level at the mine. Ore extraction is to be doubled in the future. The Sarylakh antimony-gold deposit in Yakutia, which is located near the Arctic Circle, continued under development; completion of the first stage was rescheduled for 1975.

Arsenic.—All output in 1972 was obtained as a byproduct of smelting or roasting of metallic ores. The first shop in the U.S.S.R. for the extraction of arsenic from sulfur was installed at the Mednogorsk

copper and sulfur complex in Orenburg Oblast' in January.

Beryllium.—The Soviet Union continued to be one of the world's largest producers and consumers of beryl, beryllium alloys, and metal. Production rates for these commodities were being expanded rapidly. The increase indicated a probable production level of 1,350 tons of beryl (10% to 12% BeO) in 1972.

Bismuth.—As in 1971, bismuth was produced in 1972 almost entirely from complex ores such as tungsten-molybdenum-bismuth ores of the North Caucasus, and scheelite and cassiterite ores of Kazakhstan and Siberia.

Cadmium.—Cadmium was produced at various Soviet lead and zinc smelters as a byproduct. Kazakhstan recently became an important producer of cadmium. A new installation for the purification of cadmium solutions has been tested successfully at the Institute of Nonferrous Metals experimental plant at Ust'-Kamenogorsk. Average total cadmium recovery was about 60%.

Chromium.—With an estimated output of 1.85 million tons, the U.S.S.R. continued to be the world's leading producer and exporter of chromite in 1972. Exports totaled 1.1 million tons during the year, with about 90% destined for non-Communist countries. Approximately one-third of the output was consumed or stocked in the Soviet Union. Based on 1964–71 data, Soviet consumption of chromite was distributed, as follows: metal production, 45%; refractories, 32%; and chemicals and other products, 23%.

The unofficial Soviet figure for 1970 marketable chromite output, 3 million tons, appeared in the January 1971 issue of Gorny Zhurnal. The magazine also said that production in 1965 was 2.53 million tons. According to the Exploration and Conservation of Mineral Resources (Razvedka i okhrana nedr, (Moscow). No. 6, June 1970, p. 6), output of crude chromite in 1970 was 3.4 million tons.

Chromium ores are situated in Kazakhstan and in the Ural Mountains. The Donskoye operations at Khrom-Tau in Western Kazakhstan, which produced 85% of the Soviet output, are the only suppliers of high-quality ore in the U.S.S.R. Deposits of chromium ores in the Ural Mountains have a low chromium oxide content (20% to 40%), as well as low Cr_2O_3:FeO ratio, and are mostly used in the chemical and refractory industries.

Most ores were high enough in grade to be shipped without beneficiation other than hand picking. The beneficiation method used in the Soviet Union comprises primary and secondary crushing, grinding, and classification. There were two crushing and grinding mills in operation at Khrom-Tau in 1972. The first Soviet chromite concentrator, with an annual capacity of 1 million tons of crude ore (300,000 tons of concentrate), was under construction at Donskoye in 1972 and scheduled for completion by 1975.

Several 40-ton dump trucks and two 8-cubic-meter shovels were delivered to the Donskoye open pits in 1972. These units will replace the 27-ton dump trucks and 3-cubic-meter shovels.

Reportedly, deposits of high-grade chrome ore have recently been found in the Urals beyond the Arctic Circle. Surveying of these deposits was in progress in 1972.

Cobalt.—In 1972, cobalt was produced at Norilsk in West Siberia; at Monchegorsk and Pechenga on the Kola Peninsula; in the Urals at the Yuzhuralnikel, Ufaley, and Rezhsk nickel plants; and also at some copper plants. Cobalt production quotas were not reached in 1972, primarily owing to design defects at the Khovu-Aksinsk complex in Tuva Autonomus Republic, the first stage of which was commissioned in 1970.[14]

Cobalt production rose by more than 15% between 1958 and 1972, although losses in slags remained high. In 1972, only 20% of the cobalt in slag was recovered. Average total cobalt recovery was about 50%.

Copper.—Copper production in 1972 is estimated at 815,000 tons, including 150,000 tons of secondary copper; the planned 7% increase in blister output and 5% increase in refined copper were achieved. According to Soviet sources, it is necessary to process 150 tons of ore to obtain 1 ton of copper. Exports increased from 123,000 tons in 1970 to 173,000 tons in 1971 and to 202,000 tons in 1972.

The Urals continued to be the main center of copper production. The second stage of a concentrator at Uchaly mining

[14] Tsvetnyye metally (Nonferrous Metals), Moscow. No. 9, September 1971, pp. 4, 6; No. 1, January 1972, p. 3.

and concentration combine in Bashkiria, with a design capacity of 1 million tons of copper-zinc ore per year, was put into operation in October 1972. The plant will be processing ores of the Uchaly and Mezhozernoye mines. Renovation of production facilities was in progress at the Krasnoural'sk copper-smelter. At the same time construction of the Volkov mining and concentration combine, which began in 1964 and is to be one of the main suppliers to the Krasnoural'sk plant, progressed very slowly. During the 7-year period, only 4 million of the total 17-million-ruble project cost has been invested.[15] During the current 5-year period, the output of blister at the Mednogorsk plant will be increased "substantially."

Kazakhstan was the second largest copper-producing region. Renovation of the Belousovsk concentrator of the Irtysh polymetallic complex was completed in January, and construction of a new smelter started in April 1972. The exploration of the "50 Let Oktyabrya" copper deposit in West Kazakhstan was completed in 1972.

The Irtysh complex in Kazakhstan has not met its production quota for 1972. Of its three mines, Belousovsk, Irtysh, and Berezovsk, only the Berezovsk mine met the 1972 production target. The Irtysh mine, with a design capacity of "several hundred thousands" tons of ore per year has been under construction since 1960 and is scheduled for completion in 1975. According to Soviet sources, the Balkhask mining and metallurgical complex in Kazakhstan expels into the atmosphere 400 kilograms of copper, 500 kilograms of zinc, 2.5 tons of tin, and up to 200 tons of sulfur per day, which forms an artificial cloud over the town.

In Armenia, the No. 6 mill was put into operation at the Agarsk copper-molybdenum concentrator in December. Reportedly, a few copper polymetallic deposits have been discovered at Kafan, and a copper-barite deposit has been found in Shamshadin Rayon of Armenia. The first stage of the Madneuli copper ore dressing plant in Georgia went into operation in December. Development of the Vostok copper-nickel mine of the Pechenganikel combine at Kola Peninsula was completed in January 1972. A deposit of low-grade copper ore was discovered in the area of Plastun Bay in the Soviet Far East.

The Soviet Union has been negotiating with Japanese, French, and British companies to develop the Udokan copper deposit in East Siberia, northeast of Lake Baykal. At the same time, the U.S.S.R. has offered assistance to the nationalized Chilean copper mines, and it has agreed to purchase 130,000 tons of copper from Chile over the next 3 years and will extend $260 million credit to Chile for the purchase of Soviet mining equipment and for technical assistance.

Gold.—Gold output in 1972 was estimated at 6.9 million troy ounces. About three-quarters of the total output came from the Soviet Far East and East Siberia (mainly from placer deposits at Kolyma, Aldan, Dzhugdzhur, Indigarka, Kular, and Chukotka); most of the balance came from gold and polymetallic ores in the Urals, Kazakhstan, Armenia, and Uzbekistan. Alluvial deposits contributed about two-thirds of the output.

There are no accurate figures on how much gold is traded annually in London and other leading centers, but, according to some estimates, Soviet gold exports to the Western World totaled 200 tons in 1972 and a similar amount is expected in 1973. The U.S.S.R. made record sales to the United States in 1972. American firms bought some 245,000 ounces over the January–September period. Substantial quantities of gold were sold in October. Nevertheless, the 1972 rate of sales is below the rate in 1964 and 1965.

During the current 5-year plan, production of gold is to be increased in Magadan Oblast', Khabarovsk Kray, Yakutia, Amur Oblast', the Transbaykal area, Kazakhstan, the Urals, Armenia, Uzbekistan, and other regions of the U.S.S.R. It is planned to renovate the Nizhne-Kuran, Sovetsk, Drasun, Taseyev, Lebedin, and Matros gold plants in Siberia and the Soviet Far East and to construct the Ararat in Armenia and the Angren and Zarafshan (second stage) gold plants in Uzbekistan.

Although Soviet sources reported that explored reserves are sufficient for 16 to 17 years of operation at the present rate of production, extensive prospecting continued, and, in fact, in three main gold-producing areas, plants are being shifted to more distant localities. In Magadan Oblast'

[15] Sotsialisticheskaya industriya (Socialist Industry), Moscow. June 30, 1972, p. 2.

more than one-third of the gold came from mines developed in the last 5 or 6 years; several big mines are suffering from the lack of measured reserves of gold, and consequently, new mines had to be opened in the far northeastern parts of the territory. The same is happening in Yakutia.

Magadan Oblast' continued to be the main center of gold production in the country. Three new small dredges were commissioned at Polyarnyy (Chukchi National Region). In this region, the best results were achieved at the Leningrad placer, which improved on the 1972 plan by 3.5%, and the Polyarnyy mine, which improved on the plan by 2.5%. The Belov placer mine was set up in Tenkin county of Magadan Oblast'. Primary gold-silver deposits were found in Karamken and Ducat, some 100 kilometers from Magadan, on the coast of the Ohotsk Sea. Prospecting has not yet been completed, but construction of an ore dressing plant at Karamken started in 1972.

In Yakutia, the second largest gold-producing region, ion-exchange equipment for gold extraction was installed for the first time in the U.S.S.R. at the Kuranakh concentration plant of the Aldanzoloto gold-mining complex. The Entuziast mine was the first in Yakutia to fulfill the annual plan for gold production, but the Yakutzoloto Association, as a whole, did not meet the 1972 targets. The Zabaykalzoloto Association, Chita Oblast', failed also to fulfill the 1972 gold production plan. Development of the new Teremki mine at the Darasun gold-mining complex, Chita Oblast', northern Transbaykal region, was completed in August, although the Teremki deposit was under exploration in 1972. The first gold was produced from the Bodaybo's Artemov mine in Irkutsk Oblast'.

The Primorzoloto Association, one of the largest in the Soviet Far East, fulfilled its annual plan for gold production on November 2. It has placer mines in Kamchatka, Sakhalin, Maritime Territory, and Khabarovsk Kray. This Association began developing gold production in Ayano-Mayskiy county in 1972.

Production at the Krylatov gold mine, the oldest in the Urals, is to increase by one and one-half times by 1980. In addition to the Krylatov shaft now in operation, the new Severnaya-Ventilatsionnaya shaft has been completed and two other shafts, Tsentral'raya and Yuzhnaya, were under development in 1972.

The Ararat concentrator for the Zod gold-mining complex in Armenia was under construction and is scheduled for completion in 1975. The Zod gold complex is to be put into operation by 1975. Its construction will cost about 160 million rubles. The complex will consist of three separate sections. The first will be the extraction plant in Ararat. The mining site will be developed in Vardenis county, near Lake Sevan, where gold has been discovered; it will supply the crude ore to the Ararat plant. The third section of the complex will be a 122-kilometer railway that will connect the plant with the mines. All three sections are to be put into operation at the same time by 1975. On completion, the Zod complex will be one of the largest of its kind in the U.S.S.R.

The Uzbekzoloto Association has fulfilled its 1972 gold production plan more than a month ahead of schedule. The second stage of the Zarafshan (Muruntau) extraction plant was under construction in Uzbekistan. The first stage of the Angren plant is to be put into operation in the first half of 1973. It is expected that construction of a gold-extracting plant at Angren will be complete by 1975, to process ore mined at the Koch-Bulak and Kauldy deposits. During the 1971–75 period, the Uzbekzoloto Association is to increase gold extraction by 130%. It is also planned to construct an extraction plant at Charmitan by 1980.

Reportedly, new gold deposits were discovered in several regions of the Soviet Far East, Yakutia, and Uzbekistan in 1972. The Mnogovershinnaya gold deposit at the Lower Amur was being prepared for development.

Iron Ore.—The Soviet iron ore industry operated 71 underground mines and 62 open pits with a total capacity of about 230 million tons of usable ore in 1972. About 80% of ore production was from open pits, nearly half of which came from six pits, each producing over 10 million tons annually. Half of the open pits required hard rock mining, and the overall average overburden-to-ore ratio was about 3.5 to 1.

Production of usable ore was 208 million tons, an increase of 5 million tons over that of 1971. However, the 1972 production

quota was not fulfilled by about 1.5 million tons. Annual production capacity of crude ore was increased by 28.5 million tons in 1972, compared with a planned increase of about 40 million tons. Concentrates were produced in 90 plants, of which 29 had sintering and 3 had pelletizing facilities; over 62% of production was concentrate. The average iron content was 33.4% in crude ore and 58.8% in usable ore including concentrate. Iron content of direct-shipping ore averaged 54% to 55% in 1972, and that of concentrate averaged about 61%. The average grade of all ore mined (crude and direct shipping) was 38.4%.

Exports of iron ore increased from 36.5 million tons in 1971 to 38.4 million tons in 1972. The principal increase was in exports to Bulgaria, Hungary, East Germany, Poland, and Czechoslovakia, which totaled about 90% of the total exports. The U.S.S.R. is meeting 85% of the iron ore requirements of the COMECON countries. In the period 1966–70, Soviet iron ore exports to these countries totaled 72 million tons iron content. At the same time, the Soviet Union is extremely interested in a joint development of the Kostomuska deposit in Karelia with Western countries.

At yearend 1971, the measured, indicated, and inferred reserves of iron ore in place (Soviet categories A+B+C1) totaled 60,200 million tons, and averaged 38% Fe; speculative reserves in place (category C2) totaled 50,800 million tons and averaged over 30% Fe. There is a shortage of high-grade iron ore reserves in the U.S.S.R.[16]

The Ukraine produced over 57% of Soviet iron ore in 1972, and the plan provides for increased output of 14% during 1971–75. The Urals was the second largest producer, followed by Kazakhstan, Siberia, the Kursk region, and the Kola Peninsula. The Krivoy Rog Basin in the Ukraine produced 89% of the Republic's total 1972 output. Both underground mines and open pits, as well as five concentrating plants, were operating in the region. Production at the Kerch, Kremenchug, and Belozersk iron ore basins in the Ukraine contributed only 11%. The first stage of the pellet plant at the northern combine in Krivoy Rog, with an annual capacity of 4 million tons, was put into operation in April, and construction of the second stage, with the same capacity, continued in 1972. Construction of the second stage of the Dneprovsk mining and concentration combine, with the same annual capacity (7.35 million tons of crude ore) as stage 1, began in September.

Iron ore production in Kazakhstan accounted for over 9% of the total, mainly from the Sokolov-Sorbay mining and concentration combine with an annual capacity of 26.3 million tons of crude ore. The open pit of this combine employed 2,500 workers in 1972.[17] At the Lisakovskiy mining and concentration combine in Kazakhstan, with a designed capacity of 36 million tons of crude ore, the first stage (4.5 million tons of crude ore or 2.6 million tons of concentrate) was completed on the eve of 1973, and the second stage, with the same capacity as that of stage No. 1, was under construction in 1972.

About 9% of the total iron ore was produced in the Kursk region. The first section of the Lebedin concentrator in this region, with an annual capacity of 3.75 million tons of crude ore (1.75 million tons of concentrate), was completed in December 1972. Prospecting of the Korotkov and Chernyanka iron ore deposits was completed in 1972. It is planned to develop these deposits.

An intensive iron ore exploration program covering many Soviet regions was undertaken in 1972.

Iron and Steel.—With a production of about 126 million tons in 1972, the Soviet steel industry is the largest in the world. Output of pig iron rose by 3.1 million tons over that of 1971 (planned quota 3.3 million tons); steel increased by 4.9 million tons[18] (planned quota 4.7 million tons); finished rolled ferrous metals by 3.4 million tons (planned quota 3.8 million tons); and steel pipe by 0.4 million tons. The industry showed quantitative, but not qualitative growth; production of rolled products, in particular, was not closely geared to market demand. Therefore, a large quantity of rolled products were imported from Japan and Western countries. The shortage of many steel products in

[16] Razvedka i okhrana nedr (Exploration and Conservation of Natural Resources), Moscow. No. 3, March 1972, p. 1.

[17] Kazakhstanskaya pravda (Alma-Ata). Oct. 8, 1972, p. 3.

[18] Officially reported increase; differs from increase that would be derived by subtracting 1971 output from that of 1972 (as officially reported and as shown in table 1 of this chapter). Presumably the disparity results from rounding of the 1972 output figure and/or from revision of the 1971 figure.

the U.S.S.R. is creating a big problem in the Soviet economy.[19] The steel industry suffers from technological difficulties and low productivity. For example, 10 years have passed since work started on automation of the Krivoy Rog blooming mill. Investments in this particular project have amounted to more than 4.5 million rubles, but no progress has been made.[20] In a statement published in the Soviet press, the Central Committee of the Soviet Communist Party confirms that the automation of the Soviet iron and steel industry is running into difficulties. The automation equipment so far supplied to iron and steel works is also criticised. According to the Economic Gazette[21] as of January 1, 1973, 16 blast furnaces, three open-hearth shops, and four rolling and five pipe mills, which were put into operation after 1958, operated below planned capacities.

In the Soviet ferrous industry, production was increased at a slower rate than the growth of capital investment. In 1972, return on capital decreased by 3% in comparison with 1971. Incomplete utilization of existing capacities, prolongation of construction projects, and unsatisfactory performance of many plants and units were the principle reasons. Unsatisfactory introduction of planned capacities of new units also had a pronounced negative effect on the level of returned capital. New units were slow in attaining capacities, mainly because actual conditions of their operation did not correspond with their designed and planned utilization.[22]

Among the main causes leading to failure of the ferrous industry to meet planned production costs were overly large consumption of raw materials, supplies, and energy. The excessive uses stemmed to a considerable degree from high losses due to defective quality of production. Thus, the specific metal intensity of Soviet machine building is 25% higher than in other countries; around 30% of the consumed metal was lost as waste. The Soviet consumers lose almost threefold to fourfold more metal in shavings and chips than other nations.[23]

In 1972, additional capacity for steel was 2.2 million tons, and for finished rolled products, 1.6 million tons.

The Soviet Union is investigating contracts for new Western technology and machinery to increase its steel output and upgrade steel products especially modernization of mills for the production of tinplate, steel sheet, and electric sheet. Two West German companies, Korf Stahl of Düsseldorf and Salzgitter Industriebau, are to supply a $1 billion plant and equipment for an integrated iron and steel complex (5 million tons of sponge iron per year, 3 million tons of rolled steel) at Kursk, 400 kilometers south of Moscow. It is a typical Soviet barter deal with sponge iron repayment during 10 to 15 years. This project will use natural gas as a fuel and is being negotiated with the Ministry of Ferrous Metallurgy and V/O Metallurgimport of the Foreign Trade Ministry. Siemens A.G. of West Germany has signed an agreement to build automated control systems for the Soviet steel and other industries. Three United Kingdom companies are participating in a project worth £6 million for the installation of a coated steel strip plant at Chelyabinsk metallurgical complex. Pre Finish Metals, Inc., had contracted to provide coil-coating technology for two coil-coating lines in the U.S.S.R. The Soviet lines, each of 75,000 tons annual capacity, will be located at Kuybyshev and Chelyabinsk. Sweden's Asea has received an order from the U.S.S.R. for an Asea-SKF ladle furnace.

At the same time, iron and steel plant construction accounts for 22% of Soviet foreign economic and technical assistance to Communist and developing countries. The U.S.S.R. has signed agreements for 88 steel plants, of which 46 are already in operation.

Pig Iron.—In 1972, 36 enterprises produced 92.3 million tons, a 3% increase over that of 1971.

Completion of the Novolipetsk, 3,200-cubic-meter (No. 5) blast furnace, with an annual capacity of 2.2 million tons of pig iron, was rescheduled for 1973. About 9,000 workers were employed at the construction

[19] Rabochaya gazeta (Workers' Gazette), Kiev. Dec. 22, 1971, p. 3.
[20] Trud (Labor), Moscow. Oct. 27, 1972, p. 2.
[21] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 7, February 1973, p. 2.
[22] Planovoye khozyaystvo (Planned Economy), Moscow. No. 3, March 1972, pp. 79–83.
Pravda (Moscow). Jan. 16, 1973, p. 3.
Sotsialisticheskaya industria (Socialist Industry), Moscow. Nov. 26, 1972.
[23] Pages 9-21 of work cited in footnote 12.
Pravda (Moscow). Oct. 13, 1972, p. 2; Nov. 15, 1972, p. 2.
Voprosy ekonomiki (Problems of Economics), Moscow. No. 12, December 1970, pp. 27–38.

of this furnace in 1972.[24] Construction of the following blast furnaces began in 1972 —a 5,000 cubic meter (4 million tons per year) at the Krivoy Rog Lenin complex and No. 4, 2,000 cubic meters, at the Orsk-Khalilovo complex in Orenburg.

Steel.—In 1972, 76 metallurgical works produced 126 million tons of steel, 4% increase over that of 1971. The share of steel produced in oxygen converters increased from 19.2% in 1971 to 20% in 1972, while that produced by open hearth furnaces diminished from 70.6% to 68.8%. Soviet oxygen furnaces are smaller and less advanced than in the West, and continuous-casting technology is likewise more advanced in the West. The degree of automation in the Soviet mills was very low; in fact, the Soviets are just beginning to automate a few processes.

In 1972, production of crude steel at major metallurgical works was as follows, in million tons:

Works	Actual		Planned 1973
	1970	1972	
Magnitogorsk complex	12.3	13.5	14.5
Krivoy Rog plant	8.8	10.1	10.8
Zhdanov Il'ich plant	6.6	6.8	7.1
Nizhniy Tagil complex	6.1	6.3	6.4
Cherepovets plant	5.5	6.0	6.3
Chelyabinsk plant	4.8	5.6	6.2
Kuznetsk complex	4.5	4.6	4.6
Zaporozhstal' plant	4.3	4.4	4.7
Karaganda complex	2.1	3.9	4.6
West Siberian plant	2.4	3.2	3.4
Other plants (66 plants)	58.5	61.6	62.1
Total	115.9	126.0	130.7

Construction of the third 300-ton Linz-Donawitz (LD) converter at the Karaganda plant in Kazakhstan was completed in June. Total annual capacity of the first shop (three converters) at this plant is now 4 million tons. Construction of the second shop, with three 300-ton converters (total annual capacity of both shops, 8 million tons), at the West Siberian works began in 1972, and it is planned to complete the shop in 1973.

The share of steel produced in electric furnaces (about 9.5% of the total) was relatively low, mainly because of the limited number of furnaces, and some of the existing units did not reach rated capacities. Continuous casting of steel was about 5% of the total.

About 72 million tons of steel and pig iron scrap was remelted in 1972. Approximately 80% of the scrap came from metallurgical and metal fabrication plants, and the remainder was old scrap, mainly unused machines and spare parts. Metallurgical enterprises received mainly light unprocessed scrap, which caused difficulties in steel smelting shops. Soviet scrap plays an important part in the international scrap trade, and for many years the U.S.S.R. exported scrap in quantities to Italy, Japan, Finland, and Sweden.

Rolled Products.—Soviet rolled ferrous output in 1972 totaled 99.4 million tons of which 87.4 million tons was finished products, a 4% increase over that of 1971. Despite increased total output, production of many structural shapes remained inadequate. Output of rolled products is measured in tons; therefore, metallurgical plants prefer to produce heavy types of products and are reluctant to manufacture thin sheet and light sections. The first section of a new shop was put into operation at the Orel rolling plant. Over 7,000 workers are employed at the construction of the 3,600-millimeter plate mill at the Azov Zhadanov works. It will be the largest in the U.S.S.R.

Steel Pipe.—In terms of tonnage the Soviet Union was the largest world producer of steel pipe, with a total of 13.8 million tons in 1972, a 4% increase over 1971 production. Fabrication was, however, inadequate for internal demand, and some 10% of requirements had to be imported from West Europe and Japan. About 60% of the total Czechoslovakian pipe production goes to the U.S.S.R. Quality of pipe is poor and does not correspond to state standards.

Lead and Zinc.—The estimated output of zinc and primary lead was 650,000 and 460,000 tons, respectively, during 1972. The 1966–70 plan envisaged an increase of zinc production in 1970 at 60% to 70% over that of 1965, but neither lead nor zinc output quotas were reached in that or the 1971–72 period, because of slow construction of new facilities and low metal recoveries.[25]

Kazakhstan continued to be the leading lead and zinc producer. In 1972, additional facilities were put into operation at the Chimkent lead plant and at the Ukrtsink zinc plant in the Ukraine. An automatic

[24] Pravda (Moscow). Feb. 4, 1973, p. 1.
[25] Work cited in footnote 13.

system for control of the concentrating process was put into operation at the Zyryanovo complex. Development of the Glubokiy underground mine of the Achisay polymetallic complex was completed in May 1972. The Leninogorsk complex received a consignment of large flotation units for the concentration of polymetallic ores. A new blast furnace was under construction at the Ust'-Kamenogorsk lead and zinc complex.

Magnesium.—Five magnesium plants, with an estimated combined annual capacity of over 60,000 tons, produced an estimated 54,000 tons in 1972, a 4% increase over 1971 production. Deliveries of Soviet magnesium to Western European countries have taken on more regularity over the past 3 years. Exports of metal increased from 14,800 tons in 1971 to 19,900 tons in 1972.

Manganese.—The Soviet manganese output of marketable ores totaled 7.8 million tons in 1972, 0.5 million tons more than in 1971. Over 76% came from the Nikopol' Basin in the Ukraine, and the rest from Chiatura Basin in Georgia. Exports of manganese ore increased from 13% in 1966 to about 17% (1.3 million tons) of total production in 1972.

The Nikopol' manganese basin fulfilled its 1972 production plan on December 21 and produced 5.9 million tons of marketable ores, a 5% increase over that of 1971. More than 70% of ore mined in the Nikopol' Basin was from open pits. The second stage of the Chkalov No. 1 open pit at the Ordzhonikidze combine at the Nikopol' Basin, with a capacity of 1.2 million tons of crude ore, was commissioned in January. The Severnyy open pit and concentrator at the Ordzhonikidze combine and the No. 8 underground mine at the Marganets combine were under development and scheduled for completion in 1973.

There were 20 underground and open pit mines in operation in the Chiatura Basin. Approximately, 80% of the ore came from underground mines. A new section with an annual capacity of 50,000 tons was commissioned at the Rgansk mine in July.

Mercury.—Output of mercury was estimated at 50,000 76-pound flasks, and the U.S.S.R. was apparently self-sufficient in mercury in 1972. Exports of mercury to Western countries are expected to start in 1973–74. Enlargement of the Khadarkan combine in Kirghizia, the largest Soviet mercury operation, was completed in 1972. Construction continued on the Dzhidzhikrut underground mine and a recovery plant in Tadzhikistan, scheduled for completion by 1975. Development of the Sarasinsk section of the Aktash mine in Gorno-Altay Autonomus Oblast began in 1972. Reportedly, a deposit of mercury in commercial quantities was discovered in Chukotka in 1972. It is planned to build a mining and concentrating complex.

Molybdenum.—Output of molybdenum concentrate (metal content) was estimated at 8,200 tons, 2.5% above that of 1971. The deposits of molybdenum now being exploited are in eight geographical areas. About 50% of production was based on copper-molybdenum ores from Armenia, Kazakhstan, Sorskoye, and Okurs in Siberia; over 30% was from molybdenite ore mined in Uzbekistan and at Umaltinsk and Chikensk in Siberia. The remainder came from tungsten-molybdenum ores of Tyrny-Auz (Kabardin A.S.S.R. in North Caucasus) and from miscellaneous types. Armenia was the major producer of concentrates shipped out of the Republic for future processing.

Nickel.—The U.S.S.R. retained its position as the world's second largest producer of nickel, with an estimated 125,000 tons of smelter products, 4% more than in 1971. All of the known important deposits of nickel ores are situated at Norilsk in Western Siberia, the Urals, and the Kola Peninsula. Norilsk was the foremost producer of nickel, the Urals second, and the Kola Peninsula third. Six smelters were in operation in 1972 at Norilsk, at Rezh, Ufaley, and Khalilovo in the Urals, and at Monchegorsk and Pechenga in the Kola Peninsula.

The Kola ores of the Nikel' Association, which was organized on the basis of the Severonickel and Pechenganickel complexes, the Zhdanov mining and concentrating combine, and the Africanda Ore Administration in 1969, are mined by both open cast and underground methods, and the Zhdanov combine is the largest of the operations in this area. The Vostok mine at the Pechenganickel complex was commissioned in January, and development of a new underground mine began in February.

In the Ukraine, the Pobuzhsk Soviet's first ferronickel plant was not completed

in 1972, although the first stage of this plant was scheduled for completion in July 1972.

The U.S.S.R. was negotiating with French, British, and Japanese companies for "joint" development of the Buruktal nickel deposit in the southern Urals. At the same time, the Soviet Union has given large technical assistance to Cuba for enlarging existing nickel plants and designing two nickel plants. Cuba pays for these services with nickel.

Platinum.—The Soviet Union remained the largest world platinum-group metals producer and exporter, supplying 20% of international exports of platinum and more than one-half of world consumption of palladium and rhodium. Reserves are adequate to maintain current production for many years with increased exports. The U.S.S.R. is steadily expanding its output of platinum-group metals; the estimated output was 2.35 million ounces in 1972.

Production was principally from Norilsk copper-nickel mines in West Siberia with additional output from Severonickel and Pechenganickel complexes on the Kola Peninsula, and some placer deposits in the Urals. Virtually all platinum and platinum-group metals were produced as byproducts.

Silver.—Almost all silver was produced as a byproduct of nonferrous metals, with production mainly centered in the Soviet Far East, East Siberia, the Urals, Kazakhstan, and Armenia.

Production of silver in lead and zinc concentrates at most mines apparently increased in 1972. The Sikhali ore combine in Maritime Kray, one of the largest silver producers, increased output of silver in 1972. The small Teremki mine at the Darasun combine in Irkutsk Oblast' was commissioned in August 1972.

Tin.—Although the Soviet tin production policy is based on self-sufficiency at any price, estimated output of 38,500 long tons was inadequate to meet demand, and about 15% of the requirements were imported in 1972.

The Soviet Far East, Yakutia, and Transbaykal were main regions of tin production. Tin deposits of commercial significance are found in Maritime Kray, Magadan Oblast', Khabarovsk Kray, and Yakut A.S.S.R. The Maritime Kray produced the greatest amount of tin in the country in 1972.

The third and last stage of the Tsentral concentration plant at the Solnechnyy mining and concentrating combine in Khabarovsk Kray was commissioned in October. This will not only increase the capacity of the combine but also enable it to produce copper concentrates. Development of the Molodezhnyy mine at this combine was completed in January. Development of the Berezovo underground mine began in 1972. The ore will be processed at the Khingan concentrator in Khabarovsk Kray. Preparation for the development of the Billingsa Cape deposit in Chaunsk county of Magadan Oblast' began in 1972.

It is planned to increase production of tin ore in Severo-Deputat and Tsentr-Yansk districts of Yakutia.

Bolivia and the Soviet Union are reported to have signed several contracts in connection with the mining and processing of tin. The U.S.S.R. will supply Bolivia with equipment, machinery, and technical assistance for development of its tin industry; the loans reportedly will be repaid in mineral exports.

Titanium.—Development of the titanium industry continued in the U.S.S.R. With an estimated production of 13,500 tons, a 2% increase over that of 1971, the Soviet Union was the world's second largest producer of titanium in 1972. Large amounts of titanium sponge are now sold to the West. The industry continues to be based mainly on Ukrainian and Siberian ilmenite and rutile. The first titanium dioxide pigment production line went into operation at Zaporzhye in the Ukraine in October. Prospecting for titanium ores was in progress along the west coast of the Aral Sea in Uzbekistan.

Tungsten.—At 7,200 tons, estimated production of tungsten in concentrate was insufficient to satisfy growing domestic needs, and about one-third of concentrate requirements had to be imported. The Soviet tungsten industry development continues to be in the North Caucasus, Transbaykal, the Soviet Far East, Central Asia, and Kazakhstan. A new openpit mine was under development at the Dzhida tungsten-molybdenum combine, located in Buryat A.S.S.R. in a permafrost zone. Prospecting of the central part of the Lermontov tungsten ore deposit at Maritime Kray was completed in 1972. The ore can be extracted by opencast mining.

Vanadium.—The Soviet Union, with

large vanadium resources, is becoming an important producer and exporter. The principal sources of vanadium in 1972 continued to be slag from smelting of titaniferrous magnetite from the Kachkanar mine in the Urals and iron ore from Lisakov in Kazakhstan. However, the metallurgical problems of vanadium recovery have not been solved. Reportedly, the Kachkanar complex has reached rated capacity of ore production.

Minor Metals.—The Soviet Union possesses commercial deposits of all those rare metals that have assumed such importance in modern rocketry, aircraft, and atomic energy. The U.S.S.R. began production of virtually all the rare metals during the 1959–70 period; however, extraction of many of them remains low. Despite this, the Soviet Union showed keen interest in expansion of minor metals trading with the United States and other Western countries.

Performance of the minor plant at the Ust'-Kamenogorsk complex in Kazakhstan, which is one of the largest plants in the U.S.S.R., was poor in 1972. The recovery of indium from dusts at the Chimkent lead plant in Kazakhstan decreased by 11.8% during the 1967–70 period.[26] Construction of an experimental plant for extraction of minor metals from iron wastes at the Sokolov-Sarbay iron ore mining and concentration combine began in 1972. A special plant for extracting rhenium from waste water from the processing of molybdenite was installed at the Chirchik refractory metals works in Uzbekistan.

NONMETALS

Production of practically all nonmetallic minerals continued to rise, and the 1972 output was nearly 6% over that of 1971. However, the resource position varies from adequacy for many nonmetals to apparent shortages of others such as barite, fluorspar, mica, and talc.

Amber.—The Kalinin amber combine increased its yearly output by "several percent" and in 1972 exported amber and amber jewelry to 30 countries. Reportedly, development of the world's largest amber-mining open pit on the banks of the Kaliningrad Peninsula was nearing completion in 1972.

Asbestos.—In 1972, the U.S.S.R. produced an estimated 1.22 million tons of six grades of chrysotile asbestos. These figures are significantly lower (million tons) than those given by most other sources. The lower figures are based on Soviet publications[27] which state that the seventh grade is not included in total reserve calculations and that asbestos combines are relieved of the responsibility for extracting such lower grade material. It has been indicated that the lower grade material is used as railway track ballast and in other applications not really requiring the use of asbestos. Most Western and some Soviet sources assume that the U.S.S.R. recovers the seventh group, and this raises the output substantially. After Canada, Soviet production is the world's second largest, and output is expected to rise. Canadian equipment is used in large-scale expansion plans. Asbestos exports rose from 303,600 tons in 1968 to 433,000 tons in 1972, with approximately two-thirds of the tonnage going to Western markets—principally to Japan, France, and West Germany. In spite of the export expansion in recent years, the domestic deficit reached 200,000 tons in 1971 and is expected to be about 100,000 tons by 1975.[28]

Construction of the first stage of the Kiembay asbestos combine in Orenburg Oblast' continued. It is planned to develop the Molodezhnoye and Il'chirsk chrysotile asbestos deposits in Buryat A.S.S.R. in the future.

For some time, anthophyllite and other nonchrysotile varieties of asbestos have been mined at small deposits in the Urals and Kazakhstan.

Barite.—Domestic barite output remained significantly inadequate to meet the demand, and about one-third was met by imports in 1972. The main center of production continued to be the Georgian S.S.R., which produced about 70% of the total output.

The increase in output in 1972 was attributed largely to the commissioning of new capacities. Development of the Glubo-

[26] Narodnoye Khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 4, April 1972, p. 56.

[27] Izvestiya vysshykh uchebnykh zavedeniy, Vypusk Gornyy zhurnal. No. 1, 1973, p. 16.
Pravda, Moscow. July 9, 1972, p. 2.
Sovetskaya geologiya. No. 7, 1968, p. 57.
Voprosy ekonomiki. No. 9, 1968, p. 76.

[28] Narodnoye Khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 12, December 1971, p. 89.

kiy lead-barite mine at the Achisay combine in Kazakhstan was completed in 1972. Construction of a 45,000-ton-per-year mining and concentrating combine was continued in Khaishi in Svanetia, Georgia, in 1972. Development of the Zharemskiy barite underground and open pit mines in Kazakhstan started in 1972.

It appears that the Soviet Union will participate in further development of the Kresevo "Barit" enterprise in Yugoslavia. The U.S.S.R. will either provide equipment for this project or the hard currency for the purchase of equipment not available in the Soviet Union. A condition is, however, that about 65,000 tons of barite yearly be delivered for the Soviet Union.

Cement.—Cement output was 104 million tons, or about 4% over that of 1971. Plans called for the construction of 5.1 million tons of new capacity in 1972, but only 4.2 million tons of the total was completed. Production of cement by ministries in million tons was as follows:

Ministry	1970	1972	1973 (planned)
Construction materials	88.1	96.50	100.90
Nonferrous metallurgy	4.5	5.00	5.60
Ferrous metallurgy	.6	.51	.46
Chemical industry	1.1	1.11	1.12
Collective farms	.9	.88	.92
Total	95.2	104.00	109.00

The U.S.S.R. Council of Ministers has adopted a resolution "On Measures for Insuring the Fulfillment of Targets" of the 5-year plan for development of the cement industry and for improving its technical standard. The resolution notes that the dry method of cement production was not properly developed; highly durable, quickly solidifying, and decorative type cements have not been produced in sufficient quantity. Poor quality of cement produced has remained virtually unchanged in the past few years, and much of the cement was wasted.[29] Because of poor cement production technology the Achinsk alumina complex wasted 275,000 tons, and Razdan complex lost 216,000 tons of cement.[30]

Clays.—*Bentonite.*—Armenia, Tadzhikistan, and Kazakhstan remained the three principal centers of bentonite production in the U.S.S.R. The Isfara plant in Tadzhikistan, which supplies ground clay for oil drilling, was enlarged in 1972. Construction of the Izhdevan bentonite combine in Armenia, with an annual capacity of 700,000 tons, continued in 1972. The first stage of the complex is scheduled for completion in 1973. The total cost of the project is estimated at over 40 million rubles.

Diamond.—Since the discovery of the first kimberlite pipe in northwestern Yakutia, in 1954, about 200 kimberlite pipes and dykes have been found in Yakutia, but no more than seven or eight have a diamond content justifying their economic exploitation. Production of diamond in this region started at a small concentrating plant in 1957. In 1972, output was estimated at 7.35 million carats of industrial quality and some 1.85 million carats of gem stones, mainly from Mirnyy, Udachnaya, and Irelyakh deposits. Small quantities of gem and industrial stones were produced from the Vishera River region in Perm Oblast', Western Urals. The diamond industry remains a major foreign exchange earner with receipts of some $250 million in 1972.

At present about 80% of Yakut diamond output is used for industrial purposes and 20% for jewelry. Gem stones are being cut with the assistance of Belgian specialists at Leningrad, Sverdlovsk, and Smolensk.

The Antwerp Diamond Company signed an agreement with the Soviet foreign trade organization Almazyuvelirexport, obtaining exclusive sales rights for all Soviet diamonds throughout the world. According to Antwerp Diamond Company, a corporation will be established during the first half of 1973 in which Almazyuvelirexport will have the controlling interest, and which will bring all Soviet polished diamonds on the world market via Antwerp.

Fertilizer Materials.—Fertilizer production totaled 15.9 million tons in nutrient content or 66.1 million tons in bulk fertilizer content,[31] an increase of 8% over that of 1971. Nitrogen fertilizers constitute 48.5%, phosphorus fertilizers 31.7%, and potassium fertilizers 19.8% of the total production. This increase was obtained mainly through the commissioning of new capacities, but production targets were not always fulfilled.

[29] Pravda, Moscow. Oct. 6, 1972, p. 1.
[30] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 9, February 1973, p. 2.
[31] The active ingredients (nitrogen, phosphorus, and potash) are expressed in terms of Soviet standard units, which are not the same as used in the United States. Nitrogen is expressed as ammonium sulfate, 20.5% N; phosphate is expressed as 18.7% P_2O_5; potash is expressed as 41.6% K_2O; and ground rock phosphate (phosphatic flour) is expressed as 19% P_2O_5.

There was a significant increase in exports of mineral fertilizers from the U.S.S.R. in 1972. Exports of potassic salts (41.6% K_2O equivalent) increased from 3.9 million tons in 1971 to 4.1 million tons in 1972. Exports of nitrogen fertilizers totaled 920,000 tons in 1971 and 1,062,000 tons in 1972. Shipments of superphospate declined from 582,000 tons in 1971 to 509,000 tons. However, despite the substantial production and large exports, fertilizers were in short supply, and the quality of mineral fertilizers produced did not meet domestic consumer demands. Soviet fertilizers had a comparatively low total nutrient content, only around 25%.

The Novoi plant failed to produce almost a half million tons of mineral fertilizers in 1972.[32] At the Uvarovo plant, out of four production lines, only two were operating, and even those were utilizing only one-third of their planned capacity. Each year, the output of fertilizers at this plant keeps decreasing. In 1970, it produced 273,000 tons of concentrated superphosphate; in 1971 it produced 230,400 tons; and in 1972 it produced only 192,400 tons, although the planned capacity was 700,000 tons.[33]

The Rustavi, Navoi, and Aktyubinsk chemical complexes, the Cherepovets and Vaksh nitrogen fertilizer plants, and the Dzhambul and Gomel superphosphate plants did not produce standard output. The Maardu and Kedaynyay chemical complexes shipped superphosphate to consumers without sufficient ripening in the storehouse, with increased free acidity. As a result, a large amount of fertilizer caked, which complicated its use in agriculture. Installations for cooling granular superphosphate have not been constructed at the Sumy chemical complex. As a result, the enterprise shipped fertilizer at a temperature of 70 to 80° C. The Chirchick chemical complex alone supplied agriculture with approximately 35,000 tons of substandard fertilizers in 1972 and received more than 40 complaints.[34] A considerable share of mineral fertilizers was produced in nongranulated form and caked during shipment and storage.[35]

Losses of mineral fertilizers during transportation and storage reached more than 10% of the total shipped.[36]

In 1972, 53.6 million tons of fertilizers were delivered to farms in the U.S.S.R. The recording of incoming mineral fertilizers and control over them were badly organized on many farms. A considerable quantity was lost because of the unsatisfactory state of storehouse management. Plans for the construction of fertilizer storehouses in the Sel'khoztekhnika association were fulfilled only 80%, and on Sovkhozes and Kolkhozes plans were met 57% and 69%, respectively. Organic fertilizers were being poorly utilized in a number of places.

Of 78 fertilizer projects, only 33 met construction schedules in 1972.[37] The main reason for the delay at many sites was the poor organization of labor, low labor productivity, and the poorly timed and incomplete supply of material. The practice of putting fertilizer plants into operation with many "imperfections" has resulted in great inefficiencies in production. For example, at the Uvarovo plant, "Unfinished items were accepted as finished ones. With the approval of the U.S.S.R. Ministry of Chemical Industry, the concentrated superphosphate shop was accepted, although it lacked a section for preparing phosphorite meal, a lime store, and the installation for the preparation of milk of lime. The country's largest production line for the production of sulfuric acid was accepted without stores for the keeping of raw material." [38]

During 1972, 7.2 million tons in bulk capacities for the production of mineral fertilizers were commissioned at the Novomoskovsk and Cherkassy complexes, at the Uvarovo, Yanov, and Rovno plants, and at the Dzhambul double-superphosphate plant and others.

The U.S.S.R. and the Occidental Petroleum Co. were negotiating a trade deal for long-term Soviet exports of ammonia in return for the supply of phosphate fertilizers by the U.S. firm. India was exploring the possibilities of importing machinery and equipment for fertilizer plants from the U.S.S.R. The Soviet Union is already supplying equipment for a 500,000-ton/year

[32] Pravda, Moscow. Jan. 23, 1973, p. 1.
[33] Sovetskaya Rossiya (Soviet Russia), Moscow. Feb. 14, 1973, p. 2.
[34] Izvestiya, Moscow. Apr. 19, 1973, p. 3.
[35] Sel'skaya zhizn' (Rural Life), Moscow. Mar. 11, 1973, p. 1.
[36] Sovetskaya Rossiya (Soviet Russia), Moscow. Mar. 27, 1973, p. 1.
[37] Work cited in footnote 32.
[38] Work cited in footnote 33.

fertilizer plant to be constructed at Korba in India.

Phosphate.—Phosphate rock production totaled 49.3 million tons in 1972, including 28.3 million tons of apatite ore (17% to 18% P_2O_5) and 21 million tons of sedimentary rock (13% P_2O_5). The bulk of the increased output of phosphate fertilizers in 1972 may be credited to the greater capacity of the "Apatit" complex on the Kola Peninsula and the Karatau combine in Kazakhstan. The main centers of phosphate rock output continued to be the "Apatit" complex and phosphorite deposits of Karatau, Kingisepp in Leningrad Oblast', Egor'evsk and Lopatino in Moscow Oblast', and Upper Kama. The phosphate measured, indicated, and inferred reserves in place were estimated in 1972 at about 3 billion tons of phosphorite (overall average grade 13.8% P_2O_5) and 3.3 billion tons of apatite (average grade 18.5% P_2O_5) in the Khibiny (Kola Peninsula) and 870 million tons (average 4% P_2O_5) at the Oshurkovo deposit in the Transbaykal. Reserves of apatite totaling 50 million tons were confirmed in 1972 in the Koashva and Kukishvumchor mountain areas of Khibiny.

The apatite-nepheline deposits of the Khibiny in the Kola Peninsula comprised the Soviet's largest single phosphate source. Mined ore, averaging 16% to 21%, was concentrated up to 39.4% P_2O_5 with 92% recovery.

The final section, with a planned capacity of 800,000 tons of apatite concentrate, of the second concentration plant at the Apatit complex was commissioned in December. The second concentrating plant will reach its rated capacity of 10 million tons of concentrate per year in 1973. The first stage of the new apatite open pit, with an annual capacity of 2 million tons of crude ore, was under development, and the new Koashva and Poachvumcherr apatite deposits at Kobiny were under exploration in 1972. The first stage of the Transbaykal apatite complex is to be built during 1974–79 on the Oshurkovo deposit, 18 kilometers from Ulan-Ude, alongside the East Siberian railway.

The 40 commercial deposits in the Karatau Mountains contain over 1.5 billion tons phosphorite. More than half of the reserves of the basin may be extracted by underground mining. Four open pits at the Aksay deposit and two open pits at the Dzhantas deposit and the Molodezhoye underground mine at the Chulaktan deposit, with a total annual capacity of around 4.5 million tons of crude ore, were in operation in Karatau in 1972. The ore, containing up to 26% P_2O_5, was concentrated to 28.5% P_2O_5 but because of poor technology, only about half of the planned capacity was achieved in 1972. The Tsentral'nyy open pit, with an annual capacity of 1.3 million tons of crude ore, was put into operation at the Dzhantas deposit in November. The new section of the Dzhambul double-superphosphate plant in Kazakhstan was put into operation in December.

Potassium.—The Soviet Union is one of the world's leading countries in potassium ore reserves, fertilizer output, and exports of potash salts. Estimated 1972 output of potash was 13.3 million tons (41.6% K_2O), about 15% higher than 1971 production. Increased potassium fertilizer output was attained entirely through the commissioning of new facilities at Soligorsk No. 1 and No. 2 potassium combines. The U.S.S.R. mined about 44.3 million tons of potash ore in 1972. Most of this ore was mined underground. One open pit, with a capacity of 0.5 million tons, was undergoing an expansion program to raise the annual capacity to 1.25 million tons. Production of potash is concentrated in three main areas: Upper Kama in the Urals, Soligorsk in Belorussia, and the Precarpathian area of the Ukraine. More than half of the total of potassium fertilizers production came from Belorussia. Eight combines were in operation in 1972.

Measured, indicated, and inferred reserves in place reported [39] in 1972 at 25.8 billion tons are in the Upper Kama basin in the North Urals. The reserves are principally carnalite and sylvite with a 13% to 20% K_2O equivalent. The second largest reserve region (4.6 billion tons) is Starobinsk (Soligorsk) in Belorussia which contains silvinite (16% to 20% K_2O). The third important basin, L'vov Oblast' (2.9 billion tons), is in the Western Ukraine. The most important potash mineral is hartsalz (16% K_2O), with some deposits of carmallite, polyhalite, and langbeinite. The reserves of potassium ores in the Karlyukskoye deposit in Turkmen S.S.R. were reported in 1972 at 2 billion tons, and those

[39] Razvedka i okhrana nedr (Exploration and Conservation of Mineral Resources), Moscow. No. 11, November 1972, pp. 21–24.

of the Tuva-Gatansk deposit were reported at 0.4 billion tons. The Petryakovsk deposit in Belorussia was under exploration in 1972.

Nitrogen.—Estimated nitrogen production was around 30 million tons (20.5% N) in 1972. The bulk of production was in the form of ammonium sulfate and ammonium nitrate, although production of urea and liquid fertilizers has increased. Plants supplied by Western firms to Soviet Mashinimport started up at the Novomoskovsk and Cherkassy complexes and at the Ionava and Rovno nitrogen plants in 1972.

Fluorspar.—Domestic fluorspar output remained significantly inadequate to meet the demand of the economy, and imports of high-grade fluorspar continued from Mongolia, Thailand, and China, with smaller quantities from elsewhere. All Soviet fluorspar deposits are in the Asian part of the country. Maritime Kray, Chita Oblast', Buryat A.S.S.R., and Central Asia continued to be main production areas in 1972. The Khaydarkan mercury complex in Kirghizia produced its first fluorspar in January 1972.

Mica.—The domestic supply of mica was augmented by large imports, and mica requirements were reduced by increasing use of substitutes. Strategic-grade mica continued to be imported from India to meet special industrial demands. Imports of high-grade mica rose from 160 tons in 1968 to 539 tons in 1972.

Irkutsk Oblast' continued to be the main Soviet supplier of muscovite mica; 75% of all muscovite deposits in the country are in Mamsko-Chuysk county of Irkutsk Oblast'. Over 1,500 veins have been discovered in this area, and there were nine mines in operation in 1972. The Irkutsk mica factory was the largest in the U.S.S.R. Mica was also mined in Murmansk Oblast' on the Kola Peninsula, Yakutia, and elsewhere.

Refractories.—As in prior years, refractory production paced rising industrial output, but product quality was poor. Completion of the first stage of the Shorzha refractory combine in Armenia, which was planned for 1970, was rescheduled for 1973.

Sulfur.—Estimated domestic production of contained sulfur totaled 4.03 million tons, of which 2.3 million tons was recovered from pyrite, 1.2 million tons from native sulfur, and 0.53 million tons from other elemental sulfur. Consumption of sulfur from all sources totaled 3.6 million tons. Exports of sulfur from the U.S.S.R. decreased from 463,700 tons in 1971 to 405,000 tons in 1972, and continued to be primarily oriented to Communist countries.

In 1972, the principal producing centers of native sulfur continued to be Rozdol and Yavorov (West Ukraine); Gaurdak, Shorsu, and Changyrtash (Central Asia); and Alekseyev and Vodnin of the Kuybyshev sulfur complex (Volga group). The Rozdol chemical complex was the country's major producer of native sulfur and, with the Gaurdak combine, provided the bulk of the country's sulfur requirements. The Kuybyshev sulfur combine accounted for only 10% to 12% of the Soviet output of native sulfur in 1972. A commercial installation to produce elemental sulfur using the Frasch process began at the Gaurdak combine in 1972.

Sulfuric acid production began at the Rozdol chemical complex and at the third section for the production of sulfuric acid at the Kedainiai chemical complex in December. The plant to recover sulfur from sour gas will be built at Orenburg. J. E. Pritchard and Co. and a French affiliate, Cie. Centrale d'Etudes Industrielles, will provide equipment and management services for the $76 million plant, which will handle 45 million cubic meters of sour gas per day and produce over 2,000 tons of sulfur per day. Reportedly, the Balkhash complex in Kazakhstan expels up to 200 tons of sulfur per day into the atmosphere, which forms an artificial cloud over the town. According to an agreement, Poland will supply the U.S.S.R. with a sulfuric acid plant of 360,000-ton-per-year capacity. Poland has already delivered 18 such sulfuric acid units to the Soviet Union. It was planned to increase sulfuric acid production by 7% in 1972 over that of 1971.

MINERAL FUELS

In the Soviet Union production of primary energy from fossil fuels, fuel wood, hydroelectric, and nuclear sources rose from 1,301.3 million tons of standard fuel equivalent in 1971 to an estimated 1,349 million tons in 1972. The output of crude oil increased from 377.1 million to 394 million tons and that of natural gas from 212.4 billion to 221 billion cubic meters. The share of these two fuels in Soviet pri-

mary energy supply rose correspondingly, from 60.5% to about 61.5% during the 1971–72 period. In 1972, the U.S.S.R. produced 655 million tons of run-of-mine coal and lignite (including 170 million tons of coking coal). The share of coal (lignite, bituminous, and anthracite) in primary energy supply declined from 34.1% in 1971 to about 33.6% in 1972. While the trend is toward increasing production of crude oil and natural gas, and a decline in the share of coal in total energy output, coal was still the major source of energy consumed in the Soviet Union and will remain so for a number of years. Production of peat and oil shale increased from 2% in 1971 to 2.1% in 1972 of all primary energy.

In 1972, the U.S.S.R. produced 857 billion kilowatt-hours (kW-hr) of electricity, 7.1% more than in 1971. Thermal power plants generated 726 billion kW-hr (84.7%) of electricity, hydroelectric power plants about 123 billion kW-hr (14.4%), and nuclear power plants about 8 billion kW-hr (0.9%). Installed capacity of electric stations in the country at yearend totaled 186 million kilowatts. In 1972, the Soviet industry consumed about 50% of the fuel extracted in the nation and 70% of the electrical energy produced. However, the coefficient of fuel utilization in manufacturing process operations did not exceed 25% to 35%. The secondary energy resources were very poorly utilized.[40]

The production of petroleum, gas, oil shale, peat, and power were below both industry requirements and 5-year plan targets. New goals were planned for 1972 through 1975. Almost 30% of Soviet capital was invested in the fuel and power industry. Coal and petroleum represented more than one-third of all freight carried by Soviet railways. But in spite of the expansion of the primary energy industry during recent years, output has not kept up with the demands of the Soviet economy, particularly in the European part of the U.S.S.R., where three-fourths of all fuel and power were consumed in 1972. The fuel and power deficit in this area cannot be avoided because of a continuous growth in energy consumption, low efficiency of fuel and power industry, and growing fuel exports. Power exports in 1972 amounted to 7 billion kilowatt hours, a 7% increase. Crude oil and petroleum products exports reached 107 million tons, a 2% increase; and gas exports reached 5.1 billion cubic meters, a 11% increase.

Total primary energy balances of the U.S.S.R. for 1971 and 1972 are shown in table 4.

Table 4.—U.S.S.R.: Total primary energy balance for 1971 and 1972
(Million tons of standard fuel equivalent)

Year	Total primary energy	Coal (lignite, anthracite, bituminous) and coke	Crude oil and petroleum products	Natural and associated gas	Peat	Oil shale	Fuelwood	Hydropower	Nuclear power
1971:[1]									
Production	1,301.3	444.2	537.3	250.6	16.7	9.5	26.6	15.5	0.9
Imports	28.7	9.2	9.9	9.6	--	--	--	--	--
Exports	193.6	29.3	158.0	5.4	--	--	--	.9	--
Apparent consumption	1,136.4	424.1	389.2	254.8	16.7	9.5	26.6	14.6	.9
1972:[2]									
Production	1,348.7	453.0	563.0	261.0	18.8	9.8	27.0	15.1	1.0
Imports	34.5	9.5	12.0	13.0	--	--	--	--	--
Exports	197.8	28.9	162.0	6.0	--	--	--	.9	--
Apparent consumption	1,185.4	433.6	413.0	268.0	18.8	9.8	27.0	14.2	1.0

[1] Production data for 1971 taken from the National Economy of the U.S.S.R. (Moscow), 1972; trade data from Foreign Trade of the U.S.S.R. (Moscow), 1972.
[2] Production data reported in Pravda (Moscow), January 31, 1973, p. 1, and in other Soviet sources; trade data reported in Economic Gazette, No. 17, April 1973, pp. 20–21.

Coal.—The economic growth of the U.S.S.R. is closely linked to the development of its mineral resources, among which coal is the most essential. In the Soviet industrialized society, despite the considerable development of recent years, the coal industry has not matched the rising

[40] Promyshlennaya energetika (Industrial Energetics), Moscow. No. 3, March 1973, pp. 5–8.

demand of the chronically energy-short Soviet economy.

In 1972, seven major and numerous minor coalfields produced an estimated 655 million tons of run-of-mine coal—bituminous coal (423 million tons), anthracite (77), and lignite (155),—or an estimated 374 million tons of clean coal, which placed the U.S.S.R. second among the world coal producers. About 29.1% of the total was surface mined.

New facilities with an annual capacity of 18 million tons of run-of-mine coal and lignite were commissioned during the year. Capital investment for 1972 was 1,894.1 million rubles, or 97% of the total planned 1,953.8 million rubles. At many mines, construction schedules were double and even triple what was actually built.[41] Development of the Raspadskaya underground coal mine in the Kuznetsk Basin, for example, began in 1960, and during the 12-year period less than a half of the planned installations have been completed. Two thousand workers were employed at this project in 1972.[42]

There are three steps in the management structure of the Soviet coal industry: The ministry, concern ("Kombinat") and enterprise. In 1972, 38 concerns were operating. Of them, 23 were directly subordinated to the U.S.S.R. Ministry of Coal Industry, and 15 to the Ukrainian Ministry of Coal Industry. Ninety coal trusts, serving as intermediaries between the mines and the concerns, and two concerns have been abolished.

In the last 6 years, to assure a higher concentration of mining operation and to reduce the size of the administrative apparatus, the number of underground coal mines of the Ministry of the Coal Industry has been reduced from 966 in 1967 to 800 in 1972, and they were organized in 580 mine administration units. Nevertheless, 45 small mines, with an annual capacity of up to 100,000 tons of raw coal each, were in operation in 1972.

The 1972 production came from 800 underground mines with an average annual capacity of 584,000 tons and 68 open pits with an average annual output of about 2.7 million tons of run-of-mine coal and lignite. According to the Economic Gazette,[43] 69 mines, or 11% of the total, did not meet their established production quotas, and 22% of coal mines did not attain the planned capacities in 1972.

The relative share of coal and lignite production from gently sloping seams was about 70%, that of inclined seams was 14%, and that from steep seams was 16%. The hand loading of coal and lignite at gently inclined seams was over 20% in 1972. The relative importance of various methods in total output follows:

METHOD	PERCENT
Longwall	85.0
Inclined top slicing	8.0
Shield support	3.2
Room and pillar	1.7
Others	2.1

In 1972, the official average longwall length was about 120 meters and the official average rate of advance was 37.9 meters per month (4 shifts per day and 25.4 days per month). The official average capacity of each mining section (longwall) was 384 tons of raw coal per day (four 6-hour shifts) in 1972. The actual capacity of many mining sections of new deep mines of the Donets Basin was only 250 tons of raw coal per day, or 1.5 to 2 times below the planned targets.[44]

Although the U.S.S.R. does not publish statistical data on injuries in the coal industry, available Soviet information discloses that fatal injuries in the coal industry were high,[45] and production and development faces were very dusty.[46]

Exploration and Reserves.—By world standards, Soviet fuel and energy resources are large. Among the U.S.S.R.'s various energy sources, coal is the largest; on a Btu basis, it is several times as large as all the rest of the fuels combined.

Minable coal and lignite reserves by basin and category (depth down to 1,200 meters) are shown in table 5.

[41] Ugol' (Coal), Moscow. No. 8, August 1972, p. 2.
[42] Sovetskiy shakhter (Soviet Miner), Moscow. No. 3, March 1973, p. 21.
[43] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 6, February 1973, p. 2.
[44] Ugol' Ukrainy (Ukrainian Coal), Kiev. No. 11, November 1972, p. 6.
[45] Bezopasnost' truda v promyshlenrosti (Labor Safety in Industry), Moscow. No. 7, July 1972, p. 3.
[46] Page 18 of work cited in footnote 42.

Table 5.—U.S.S.R.: Minable ("balansovye") reserves of coal and lignite by basin and category on January 1, 1965

(Billion metric tons)

Coal basins and deposits	Total	Hard coal	Lignite	Categories [1]	
				A+B+C1	C2
Donetsk Basin	53.0	53.0	--	38.5	14.5
Pechora Basin	14.3	13.8	0.5	6.9	7.4
Podmoskovnyy Basin	6.1	--	6.1	4.4	1.7
Lvov-Volyn Basin	.7	.7	--	.7	--
Dneprovsk Basin	2.5	--	2.5	2.5	--
Kizelovsk Basin	.6	.6	--	.6	--
Chelyabinsk Basin	.9	--	.9	.9	--
Yuzhno-Ural	1.3	--	1.3	1.3	--
Karaganda Basin	14.0	13.6	.4	7.5	6.5
Ekibastuz Deposit	9.4	9.4	--	8.3	1.1
Maykuben Basin	4.9	--	4.9	1.7	3.2
Turgay Basin	6.7	--	6.7	6.3	.4
Kuznetsk Basin	190.5	167.2	23.3	49.5	141.0
Kansk-Achinsk Basin	85.0	1.6	83.4	68.3	16.7
Minusinsk Basin	2.4	2.4	--	2.4	--
Irkutsk Basin	21.9	19.1	2.8	6.8	15.1
Tungusskiy Region	3.9	3.0	.9	1.8	2.1
Lena Region	3.4	1.7	1.7	2.4	1.0
Yuzhno-Yakutsk	5.2	5.2	--	2.0	3.2
Zabaykal Deposits	7.0	1.3	5.7	5.1	1.9
Taymyr Region	.7	.7	--	.1	.6
Bureya Basin	2.0	2.0	--	.8	1.2
Suchansk Basin	.4	.4	--	.2	.2
Deposits of Central Asia	6.9	2.6	4.3	4.3	2.6
Other	24.9	12.9	12.0	10.8	14.1
Total	468.6	311.2	157.4	234.1	234.5

[1] A—proved reserves in place.
B—probable reserves in place.
C1—possible reserves in place.
C2—speculative reserves in place.

Source: The Role of Coal in the Energy Fuel Resources in the U.S.S.R. by N. V. Mel'nikov (Paper presented at the 74th Annual General Meeting of the CIM, Ottawa, April, 1972).

Total minable coal reserves on January 1, 1968, were as follows, in billion metric tons:

Area	A+B+C1	C2	Total
European U.S.S.R.	59.1	26.1	85.2
Urals	1.8	.2	2.0
Asian U.S.S.R.	200.5	236.0	436.5
Total	261.4	262.3	523.7

Source: United Nations Economic Commission for Europe, Coal Committee. VAB/SYMP/COAL/A-10, May 20, 1969, p. 2.

A major coal deposit has been discovered in Voroshilovgrad Oblast'. The State Commission for Reserves approved the Bogdanov sector of this deposit for development. The first deposit of lignite was found in the Kaliningrad Oblast' in 1972. The lignite lies near the surface and can be extracted by surface mining. Prospecting for lignite was continuing in the Baltic; dozens of wells had been sunk on the Kaliningrad coast.

Production Centers.—Production of coal and lignite by major areas in million tons was as follows:

Basin	1970	1972	1973 [1] (planned)
Donets	217.3	218.9	221.0
Kuznetsk	112.9	122.1	126.2
Karaganda	38.3	41.7	42.4
Pechora	21.5	22.5	22.3
Moscow	36.2	36.7	34.8
Ekibastuz	22.8	32.4	39.7
East Siberia	56.8	62.6	63.6

[1] Including additional assigned output.

The Donets, Kuznetsk, Karaganda, and Pechora coal basins produced over four-fifths of the total coal in the Soviet Union.

A coal production association, the first in the Soviet coal industry, was formed on the basis on the Tkvaracheli mines, Georgia, in December. It will include six mines and also ancillary enterprises.

Coal Preparation.—Coal preparation in the Soviet Union has not had the wide application it has had in Western countries. The shortage of coal and beneficiation facilities forced Soviet planners to direct all efforts to the improvements in quantity rather than quality. As a result, the average ash content of marketable coal in the country increased from 19.6% in 1967 to 20% in 1972. A .1% increase in the ash

content of coal shipped would result in the loss of 18 to 20 million rubles per year.[47]

The goals of the 1960–70 5-year plan as they were originally published in coal preparation plant construction were not fulfilled. Fifteen new preparation plants with a total annual capacity of 55.5 million tons of raw coal are planned to come onstream during the 1971–75 5-year plan.

According to Soviet sources, new preparation plants are equipped with low productive equipment. The plants are not supplied with a sufficient quantity of spare parts and their capacity does not provide for the full mechanization of rock removal. As a result, many workers are employed in the unproductive and labor-intensive manual removal of rock. Practically all coal preparation plants maintained greater numbers of production personnel than called for by plan targets. According to Coke and Chemistry[48] 53 plants of the U.S.S.R. Ministry of the Coal Industry, which were put into operation after 1960, employed 7,400 workers above the number envisaged in the plan.

Because Soviet coal preparation facilities are inadequate, the resultant losses in the fuel efficiency of the overall economy are staggering. Among the most prominent negative effects of inadequate coal preparation and classification are (1) inefficient combustion in the use of coal-containing refuse; (2) high rail transportation costs increased by moving inert wastes in coal; (3) additional supply burdens caused by the displacement of specific coals to accommodate transportation problems; and (4) aggravated existing shortages leading to still further diseconomies of resorting to more costly expedients, crosshauls of coals, and inadequate use and underuse of rail equipment.

Although the results of these negative factors are not known completely, nor have they been adequately quantified, they have been reported widely in the Soviet press. Estimates of coal losses due to the use of unprepared coals at electric powerplants in 1972 were placed at about 25 million tons in terms of raw coal. Rail transportation of untreated coal (average haul in 1972, about 700 kilometers) resulted in the loss of 33 million tons of raw coal, or about 5% of the total output. Annual losses in rail transportation were reported at about 10 million tons of coal, and additional expenditures for cleaning railroads at 50 million rubles.[49]

These losses add to existing shortages and the intense drive to stimulate production leads to a vicious circle of still greater emphasis on expedient quantity, frequently at the expense of quality.

The low utilization factor is the principal reason for the lack of insight into the real problems of Soviet coal. Far too many statements, comparisons, and evaluations published in the West are concerned with only a superficial reporting of Soviet statistical data.

Mechanization.—The expansion of Soviet coal production was obtained more by greater inputs of labor and capital than by advancing technology. The production of mining equipment has grown substantially, but the technical standards and the quality of machinery and equipment produced are poor. The Uzlovaya, Kiselevsk, Druzhkovka, Yasnogorka, and other machine-building plants have been criticized for this in the Soviet press.[50]

There were no high-efficiency continuous miners for hard coal, while the utilization of cutter-loaders on steep seams did not increase labor productivity significantly. Production of mining equipment, especially for mechanizing auxiliary processes, proceeds slowly, and spare parts output for mining machinery is inadequate. The available machinery did not exclude manual labor at coal mines. According to Socialist Industry[51] the work performed manually without machines comprises 60% at longwalls, 57% in development, and 100% on repair of workings. Manual labor is used almost exclusively in longwall roof support (79,000 workers), loading of coal in longwalls (49,000), roof support in development workings (24,000), loading of coal and rock in development workings (20,000), and repair of workings (76,000 workers).[52]

At many coal mines machines are not used satisfactorily. Idle time of equipment is too great, and about 70% of the mining

[47] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 4, February 1973, p. 2.
[48] Koks i khimiya (Coke and Chemistry), Moscow. No. 11, October 1972, pp. 4–6.
[49] Pravda, Moscow. Dec. 8, 1972, p. 3.
[50] Sotsialisticheskaya industriya (Socialist Industry), Moscow. July 7, 1972, p. 2.
[51] Sotsialisticheskaya industriya (Socialist Industry), Moscow. October 5, 1972, p. 2.
[52] Ugol' (Coal), Moscow. No. 8, August 1972, p. 2.

machinery and equipment is under repair or inoperative. The low degree of utilization of machinery resulted from defects in construction, lack of sufficient repair shops and spare parts, poor work organization, and poor training of operators. As a rule, mining machines are operated 22 to 24 hours per day. Expensive equipment is worked until it is worn out. It is impossible under such a regime to organize timely and correct servicing and scheduled preventive maintenance system for equipment.[53]

The first Soviet 65-ton truck, built in Belorussia, was being tested at a coal open pit in Eastern Siberia in 1972.

Productivity.—Labor productivity is the theme of much that is published in the Soviet press, and official labor productivity indexes are given a prominent place in the statistical handbooks. In 1972, average monthly (25.4 shifts) official productivity of the Soviet coal miner was 66.3 tons (50.5 tons per month in underground mines and 335.1 tons per month in surface mines). But these data are misleading because they are limited to a restricted group of "production workers" and are based on unprepared run-of-mine coal.

According to the magazine Coal,[54] monthly productivity of workers at one of the best Soviet open pits in the Kuznetsk Basin—Krasnobrodsk open pit was only 165.4 tons of raw coal in 1969. The Krasin underground coal mine in the "Rostovugol" combine in the Donets Basin, with an annual capacity of about 0.5 million tons of run-of-mine coal, employed over 2,000 workers in 1972.[55]

The Soviet coal industry employed about 2.2 million men and women, including 1.2 million "production workers," and 225,000 university graduate specialists and graduate technicians, of whom 87 were doctors of sciences and 1,317 were candidates of sciences.

On the average, there were 60 specialists (mainly mining engineers and geologists) with a university degree, and over 140 technicians to a mine. The coal industry had 36 research and design establishments with a total staff of over 41,000 persons.

The number of legally prescribed working hours per week was 41 on the surface and 36 underground. There were four shifts per day (6 hours each shift) and 319 working days per year in underground coal mining in 1972.

Consumption.—In 1972, of the total production of 655 million tons of run-of-mine coal and lignite, about 225 million tons was used by thermal electric powerplants, over 170 million tons of raw coal was used to produce coke, 24.4 million tons of prepared coal were exported and the balance was used by industry and domestic heating. The consumption of coal instead of oil wherever possible was encouraged as a means of increasing the availability of oil for export.

Exports.—The Soviet Union became a net exporter of coal and coke in 1956 and has gradually strengthened its position since that time. Coal exports increased from 5.7 million tons in 1956 to 24.9 million tons in 1971, while exports of coke rose from about 2 million tons to 4.4 million tons in the same period. In 1972, 24.4 million tons of coal and 4.5 million tons of coke were exported from the U.S.S.R., mainly from the Donets and Kuznetsk Basins.

Over 34%, or 8.4 million tons, of coal and about 1 million tons of coke were shipped to non-Communist countries in 1972. Among the major markets for Soviet coal, Japan ranks first, followed by Italy, France, and Austria.

One very important aspect of Soviet coal export sales is the actual cost-price relationship. The Soviet system permits the establishment of selling prices at any level believed desirable by trade-offs across the entire economy, if need be, to meet economic requirements.

The high national priority placed on exports, which must meet high international competitive price and quality standards, make Soviet coal exports successful only at supported prices in Western terms of reference.

The Soviet policy of increasing exports of high-quality coal and coke to non-Communists countries is expected to continue in the future, although these exports are not likely to grow significantly. As in the past, the market for coal and coke from the U.S.S.R. will be limited to established coal-deficit markets in Europe (Eastern and Western countries) and Japan.

[53] Work cited in footnote 50.
[54] Ugol (Coal), Moscow. No. 9, September 1970, p. 11.
[55] Sovetskiy shakhter (Soviet Miner), Moscow. No. 5, May 1972, p. 8.

The Soviet Union has proposed to supply up to 10 million tons of coal to Japan on the condition that Japan provides loans and equipment to help develop a coalfield in the southern region of Yakutia. Discussion by the Joint Japan-Soviet Economic Commission on the development of this coalfield continued in 1972.

Soviet export of coal to Communist countries decreased from 16.4 million tons in 1971 to 16 million tons in 1972. East Germany and Bulgaria are the major importers of Soviet coal and coke in the COMECON group countries.

Imports.—Soviet imports of coal and coke increased from 7.8 million tons in 1970 to 9.7 million tons in 1972. Poland is the only exporter of coal and coke to the U.S.S.R. Some of the reported imports of Polish coal and coke may be reexported on Soviet account to East Germany and other countries.

Natural Gas.—The country produced 221 billion cubic meters of usable gas, about 4% more than in 1971, but below the 1972 plan target of 229 billion cubic meters. Of this quantity, over 99% consisted of natural gas and oil associated gases and about 1% was gas from gasification of coal and oil shale. In 1972, gas accounted for 19.3% of the U.S.S.R. primary energy production. Over 70% of the total was produced in the European part of the U.S.S.R., including over one-quarter in the Ukraine. There were about 4,000 producing wells in 1972, but 15% to 20% of them were idle. Because of idle time of wells alone, there was a shortfall of more than a billion cubic meters at the gasfields of Uzbekistan and Turkmenistan.

The Ministry of Construction of the Enterprises of the Oil and Gas Industry did not fulfill plans for development of oil and gasfields and for construction of gas pipelines and compressor stations. On the Ukhta-Torzhok and Central Asia Center pipelines, construction of more than 500 kilometers of gas pipelines and 12 compressor stations was not completed.[56] The Soviet press reported that efforts to equip the Orenburg gasfield and others had run into serious difficulties. An apparent cause of the problems was the poor delivery of equipment and the shortage of labor.

Exploration and Reserves.—At yearend 1972, according to Soviet estimates, natural gas reserves in categories A+B+C1+C2 reached 18 trillion cubic meters. About three-fourths of the gross reserves of gas in the Soviet Union are found in Western Siberia and Central Asia. At the same time, the major producers of gas are situated in the European part of the U.S.S.R.

In 1972, there were over 650 gas, gas condensate, and gas-oilfields in the Soviet Union. Some 11.6 trillion cubic meters of gross gas reserves, or 65.4% of the total gross reserves, are in 17 fields. A majority of the large fields are located in West Siberia, where seven fields with total gross reserves of 8.2 trillion cubic meters have been discovered. The Medvezh'ye, Urengoy, Zapolyarnoye, and some other fields in northern Tyumen' Oblast' are among the largest ones. Over 200 fields were in production in 1972, but the bulk of output was extracted from a relatively few large fields. About two-thirds of natural gas production came from six of the largest fields, including those at Shebelinka in the Ukraine, Gazli in Uzbekistan, Stavropol' in the Northern Caucasus, and the Krasnodar fields.

In 1972 several gasfields were discovered including Zapadnyy Tarkosalinsk in Tyumen' Oblask', Novoselkov and Kovalev in the Ukraine, Kirpichli in Turkmenistan, and one in the Chu-Sarysuysk area of Central Kazakhstan. The first commercial flow of gas and condensate was obtained from the Lam field. This field is located 32 kilometers from the Cheleken Peninsula in Turkmenistan. The depth of the Caspian Sea in this area fluctuates within 20 to 25 meters. Geological structures which may hold reserves of oil and gas have been found in the central part of the Aral Sea. Offshore drilling could be carried out without difficulty, since the depth of water in most parts of the Aral Sea is only 20 to 30 meters.

In the regions of Central Asia, since the beginning of exploration for oil and gas, a total of 12,546,000 meters has been drilled, of which exploration for gas during the past 10 years has totaled 3,634,000 meters. The density of exploratory drilling in the prospective areas of Central Asia and Kazakhstan reaches 6.8 meters per square kilometer which is significantly less than the average density of exploratory drilling in the basic gas-producing regions of the European U.S.S.R.

A special Yakutsk petroleum and gas

[56] Ekonomicheskaya gazeta (Economic Gazette), Moscow. Mar. 29, 1973, p. 22.

prospecting trust has been created within the Yakutsk Territorial Geological Administration to speed assessment of proved gas reserves in this area being discussed for proposed exports to the United States and Japan by the 1980's.

Gasfields.—Extraction of gas by major areas in billion cubic meters was as follows:

Area	1970	1972	1973 [1] (planned)
Ukraine	55.0	58.8	58.0
Uzbekistan	31.4	33.1	36.1
Turkmenistan	11.8	19.8	29.0
Tyumen' Obast'	9.2	11.4	18.3
Komi A.S.S.R.	6.2	12.8	15.0
Stavropol'	15.7	15.2	14.0
Kuban'	22.5	14.3	9.6
Orenburg	.8	4.0	4.2

[1] Including additional assigned output.

The basic increments in gas extraction in 1971–72 were provided by Turkmenistan (8 billion cubic meters), Komi A.S.S.R. (6.6 billion), the Ukraine (3.8 billion), Orenburg (3.2 billion), Tyumen (2.2 billion), and Uzbekistan (1.7 billion).

The Ukraine continued to occupy first place in the production of gas in the U.S.S.R. Thirty-four gasfields were in operation, including Shebelinka and Efremovka. Uzbekistan, with an output of 33.1 billion cubic meters, was the second largest gas producing region. The establishment and development of the gas industry in Uzbek S.S.R. are connected with the exploitation of the unique Gazli Field. For more than 10 years Gazli has supplied gas to the Urals, the central regions of the R.S.F.S.R., and the Republics of Central Asia and Kazakhstan. About 40% of its reserves have already been depleted.

Turkmenistan with an output of 19.8 billion cubic meters was the third largest gas-producing region. More than 30 gasfields have been discovered in this republic. The total daily output of the Republic's five major fields of natural gas reached 70 million cubic meters in 1972. Most of the 1973 increase in Turkmen gas production will be accounted for by the Naip Field, which by the end of the year will have a daily yield of about 30 million cubic meters. By the end of 1975, the Shatlyk Field will be producing at the annual rate of 25 million cubic meters. Measures were being taken to bring the Beurdeshik gasfield in this Republic rapidly into production.

Four fields were in operation in Tyumen' Oblast'—Igrim, Punga, Pakhromsk, and Medvezhye. The latter, which was put into operation in May, is the largest of the four. Thirty-three wells were feeding gas from Vuktyl Field in Komi A.S.S.R. into the Siyaniye Severa pipeline. It is planned to obtain the entire 1973 increase in the output of this region by the development of the Pashnya Field. Development of the Orenburg gas condensate field was seriously behind schedule. The 1972 plan was fulfilled by 62%, and labor productivity fell as compared with 1971. Labor discipline was low, and manpower and machinery were not being put to full use.[57] The first stage of the Kargala gas-processing works with annual capacity of 15 billion cubic meters, which will process gas condensate from this field, is to be put into operation in the third quarter of 1973.

Transportation.—The distant location of the principal consuming centers from the gasfields has made it inevitable that the bulk of natural gas must be transported by large pipelines. Over 80% of 1972 natural gas production was carried by trunk pipelines, and 20% was consumed at or near the places of production. The total length of gas trunk pipelines was 70,700 kilometers at yearend 1971. Completion of some 4,500 kilometers of gas trunk pipelines was planned for 1972, but only 80% of the target was completed, including the 1,420-millimeter-diameter, 55-kilometer Central Asia-Center No. 4 line. The 1972 plan for installation of compressors was met only by 40%.[58] The Ministry of Construction of Petroleum and Gas Industry Enterprises did not meet the deadlines for installing the third and fourth stages of the Central Asia-Center pipeline in Uzbekistan, Kazakhstan (Gur'ev Oblast'), and Saratov Oblast'.

Over 9,500 welders were working on pipeline construction in the country in 1972. About 7,000 students were employed in Tyumen' Oblast' and more than 2,000 in each of the following regions: The Ukraine, Tatar A.S.S.R., and Komi A.S.S.R.

The Soviet foreign trade organizations signed several contracts with Western firms in 1972. These contracts call for the delivery to the U.S.S.R. of tractors and pipelayers (from the United States), armatures

[57] Pravda, Moscow. Feb. 3, 1973, p. 2.
[58] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 8, February 1973, p. 2.

for gas pipelines (France), and automatic equipment for pipeline systems (United Kingdom).

In the near future, there will be a sharp increase in the system of gas pipelines in the northern latitudes. But there has been no Soviet experience in the building of gas pipelines under permafrost conditions.[59]

Trade.—In 1972, the Soviet Union was a net importer of gas to the extent of 5.9 billion cubic meters, as exports to Austria, Czechoslovakia, and Poland were exceeded by imports from Afghanistan and Iran. Exports of natural gas from the Ukraine totaled 5.1 billion cubic meters in 1972, a .5-billion-cubic-meter increase compared with those in 1971. Soviet imports of natural gas from Iran and Afghanistan increased from 8.1 billion cubic meters in 1971 to 11 billion cubic meters in 1972. Delivery of Soviet gas to the West European countries will continue according to long-term contracts.

Three-quarters of the gas pipeline, crossing Czechoslovakia from the Soviet border to Austria, was completed in 1972. The next stage of the line, across Austria, is scheduled for completion in May 1974.

On July 5, 1972, West Germany and the U.S.S.R. signed a second agreement covering the supply to West Germany of increased volumes of natural gas in exchange for large tonnages of steel pipes. A similar agreement was concluded in February 1970.

The construction of a 162-kilometer pipeline to carry Soviet gas to Kouvola in Finland was started near Leningrad in January. It is expected to be operational by 1974 and will include branch pipelines to various Finnish cities.

The United States, Japan, and Sweden are currently negotiating with the U.S.S.R. for the supply of Soviet gas. A 5-year scientific and technical cooperation agreement between the State Committee for Science and Technology of the Council of Ministers of the U.S.S.R. and Occidental Petroleum Corp. was signed in July. The agreement covers five areas including exploration, production, and use of Soviet oil and natural gas.

Poland and Czechoslovakia already receive Soviet gas, and beginning in 1974, gas will also be imported from the Soviet Union by Bulgaria and East Germany. At the end of the current 5-year period the Soviet Union is to deliver about 10 billion cubic meters of natural gas annually to COMECON countries.

Petroleum.—The U.S.S.R. continued to be the second largest petroleum-producing country in the world, surpassed only by the United States. The total production of crude oil in 1972 amounted to 393.8 million tons,[60] an increase of 21.8 million tons over that of 1971, but below the planned level of 396.7 million tons. The country has continued to increase its exports of crude oil and petroleum products even though the quantities available for internal consumption have been inadequate. Exports rose to 95.8 million tons in 1970, to 105.1 million tons in 1971, and to 107 million tons in 1972. More than 56% of the total exports were sent to other Communist countries. The oil exports provide the U.S.S.R. with much of their convertible currency earnings, and it is likely to wish to increase these, to pay for continuing imports of Western machinery and equipment. Soviet imports of crude oil and petroleum products increased from 4.6 million tons in 1970 to 6.6 million tons in 1971.

In 1972, over 500 (including 36 large) oil and gas condensate fields were in operation, with a total of about 60,000 wells. Among the Union Republics, the largest producer was the Russian Soviet Federated Socialist Republic (R.S.F.S.R.) with 325 million tons, or 80.7% of the U.S.S.R. output in 1972. The Urals-Volga region continued to be the largest oil-producing region, followed by West Siberia, North Caucasus, Kazakhstan, and Azerbaydzhan.

Production of crude oil by union republics, in percentage of the total, was as follows:

R.S.F.S.R.	80.7
Kazakh S.S.R.	5.1
Azerbaydzhan S.S.R.	4.7
Turkmen S.S.R.	3.9
Ukrainian S.S.R.	3.7
Belorussian S.S.R.	1.4
Uzbek S.S.R.	.4
Kirghiz S.S.R.	.1

Source: Neftyanoye khozyaystvo (Oil Economy) Moscow. No. 11, November 1972, p. 3.

Several contracts for the delivery of Japanese, U.S., and West European equipment for oil refineries to be built in the Soviet

[59] Sovetskaya Rossiya (Soviet Russia), Moscow. Sept. 17, 1972, p. 3.

[60] 50 metric tons per year is equal to 1 barrel per day.

Union were signed in 1972. One of the U.S. firms completed a Soviet designed, engineered, and financed petroleum refinery at Aliaga, Turkey.

Exploration and Reserves.—According to Soviet sources, 70 crude oilfields were discovered in the U.S.S.R. in 1971–72, of which about one half were put into production. However, despite the new discoveries, the 1971–72 plan for increments to oil reserves was not met. At these discovered deposits proved oil reserves represent only a small percent of the gross reserves. The proved reserves of crude oil in the country are insufficient to provide for a growing oil extraction industry. It will be necessary to speed up geological prospecting in the second stage, which includes detailed exploration on a scale satisfying the required level of investigation of the fields, and the preparation of commercial category reserves.

New small oilfields were discovered in the old oil-producing regions of the North Caucasus, Azerbaydzhan, the Ukraine, Kazakhstan, and Turkmen. Exploration in these regions was connected largely with the drilling of wells 4 to 6 kilometers deep. Difficulties in drilling included shortages of casing pipe of particular diameters, shortages of barite, shortage of spare parts, inadequate drilling pumps, and so forth.

Oilfields and Crude Oil Production.—Production of crude oil by major areas in million tons was as follows:

Area	1970	1972	1973 (planned) [1]
Tatar A.S.S.R.	100.4	102.1	103.2
West Siberia	31.4	62.7	86.5
Bashkir A.S.S.R.	40.7	40.1	40.6
Kuybyshev Oblast'	34.9	35.5	35.9
North Caucasus	20.3	19.9	16.5
Mangyshlak Peninsula (Kazakhstan)	10.4	15.1	17.1
Perm Oblast'	16.1	17.8	19.2
Turkmen S.S.R.	14.4	15.8	16.0
Ukrainian S.S.R.	13.5	13.9	13.3
Azerbaydzhan (offshore)	12.9	11.8	11.9
Orenburg Oblast'	7.4	9.4	10.5
Lower Volga Area	7.0	7.7	7.6
Stavropol Kray	6.4	6.9	7.0
Komi A.S.S.R.	5.6	6.3	6.8
Azerbaydzhan (onshore)	7.3	6.6	6.3
Belorussian S.S.R.	4.2	5.9	7.0
Krasnodar Kary	5.3	5.5	5.6
Emba Area	2.7	3.0	3.2
Sakhalin Island	2.5	2.4	2.4
Dagestan Area	2.2	2.0	1.8
Udmurt A.S.S.R.	.5	1.3	2.3

[1] Including additional assigned output.

Source: Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 5, January 1973, p. 2.

The largest increase in crude oil production occurred in West Siberia and Kazakhstan. West Siberia produced 2.2 million tons of crude oil above the plan. In 1 year, the extraction of crude oil here increased by 40%. In the Samotlor field the average daily extraction had more than doubled. At Mangyshlak Peninsula (Kazakhstan), 2.5 million tons less crude oil was extracted than was called for by the 1972 plan.

Among the old oil-producing regions Tatar A.S.S.R. holds the leading place. Turkmen S.S.R., Perm Oblast', Bashkir A.S.S.R., Kuybyshev Oblast', Azerbaydzan S.S.R. (onshore), and some other regions also overfulfilled the production plan for 1972.

At the same time, Azerbaydzhan S.S.R. (offshore), North Caucasus, and the Ukraine extracted several million tons of crude less than called for by the plan.

An installation for removing water from crude oil prior to transportation by pipeline, with an annual capacity of 8 million tons of crude, was completed at Nefteugansk in Tyumen Oblast' in October. Ten oilfields were in operation in this region in 1972.

In 1972, the offshore production in Azerbaydzhan accounted for 65% of the Republic's crude output. Offshore oil was also produced from three wells at the Zhdanov Bank field in Turkmenistan. The pipeline to Cheleken, which carries the oil to the shore, is to be linked to two more wells.

Refining.—Soviet crude oil is treated both at the fields and at refineries. However, the problem of preparing crude for refining has not been solved.[61] The crude obtained at field dewatering installations contains up to 1.5% water and a substantial amount of salt. It is estimated by the Soviet specialists that if, in treating crudes, salt content is reduced from 10 to 20 down to 5 milligram per liter, the country can obtain in 1975 an economic effect of 140 to 150 million rubles in preparing intensively desalinated crude.

The following refining facilities were put into operation in 1972: the second section at Kremenchug, increasing the refinery's capacity by 30%; a new plant for production of petrol and diesel fuel at Angarsk; a catalytic cracker at Omsk that will produce

[61] Khimiya i tekhnologiya topliv i masel (Chemistry and Technology of Fuels and Lublicants), Moscow. No. 8, August 1972, pp. 1–5.

high-octane gasoline for the Zhiguli cars; and a new installation for primary processing of crude oil at Fergana, increasing the capacity of the refinery by one-third.

Transportation.—About 52% of the total tonnage of crude oil and refinery products moved in the Soviet Union in 1972 was shipped by rail. Trunk pipeline mileage has been increased in recent years and as of January 1, 1972, totaled 41,000 kilometers, including some 33,000 kilometers of crude oil lines and 8,000 kilometers of oil product lines. The average distance of oil delivery by pipeline in 1972 was over 800 kilometers, and only about 70% of total pipeline capacity was utilized.

The network of crude oil and petroleum product lines increased by about 2,500 kilometers in 1972. It had been planned to increase the network by 6,500 kilometers. Lags in pipeline development have hampered oilfield operation. Because of such a lag, crude oil production on the Mangyshlak Peninsula and other regions has been held back. Over a period of years, great difficulty in shipment of crude oil has been encountered in the Ukraine, Turkmenia, West Siberia, and elsewhere.

In 1972, the following crude oil pipelines were completed: Aleksandrovskoye-Anzhero-Sudzhensk (818 kilometers); U.S.S.R.-Hungary (a new section of the Friendship 2 pipeline, 300 kilometers); Mozyr-Brest (the last 50-kilometer section of the Friendship 2 pipeline); Martyshi and Kamyshitov oilfields to Guryev-Astrakhan railroad (83 kilometers). Two product pipelines were also completed: Kirishi-Leningrad (114 kilometers) and Polotsk-Ventspils. Construction continued on the following trunk crude oil pipelines: Ust-Balyk-Tyumen-Ufa-Almetyevsk (1,844 kilometers); Anzhero-Sudzhensk-Krasnoyarsk-Irkutsk (about 1,500 kilometers); Kuybyshev-Tikhoretsk (1,300 kilometers); Usa-Inta (409 kilometers); and West Siberia-South Kazakhstan.

Trade.—Soviet exports of crude oil and petroleum products totaled 107 million tons in 1972, a 1.9% increase over that of 1971, and comprised some 70% crude oil and 30% oil products. Of the 1972 total, 46.8 million tons of crude oil and products were shipped to non–Communist countries and the rest went to other Communist countries, including 56.2 million tons to COMECON nations. As usual, the non-Communist world market for Soviet oil is centered in Westerns Europe and Japan. Finland was the largest buyer of Soviet oil (8.6 million tons), followed by Italy (8.4), West Germany (6.2), Sweden (4.4), France (3.1), Belgium (2.5), Netherlands (2.4), and Japan (over 1 million tons).

Crude oil and product exports from the U.S.S.R. will continue to grow. It is very probable that the Soviet Union will become an exporter of crude oil to the United States in 1973.

Discussion on development of the Tyumen oilfields in West Siberia by the American and Japanese firms continued in 1972.

Imports of crude oil and petroleum products (mainly from non–Communist countries in Africa and the Middle East) increased from 4.6 million tons in 1970 to 6.6 million tons in 1971.

Iraq and the U.S.S.R. have signed a contract for the delivery to the Soviet Union of crude oil produced at the first national oilfield in Iraq, at Northern Rumelia. This oilfield was equipped with the economic and technical cooperation of the U.S.S.R. In accordance with the contract, Iraq was to deliver 1 million tons of crude oil in 1972. In the subsequent 3 years, delivery will be 2 million tons per year.

The Soviet Union has agreed to buy "large quantities" of Libya's nationalized oil.

Soviet specialists continued to search for crude oil and natural gas in Algeria, Syria, Peru, Cuba and other countries.

Other Fuels and Energy.—Among the Soviet sources of fuels and energy of lesser significance in the energy economy in 1972 are hydroelectric power, nuclear energy, oil shale, peat, and fuelwood.

Hydroelectric Power.—In the overall energy economy of the Soviet Union, waterpower is of relatively small significance. Hydroelectric powerplants supplied 123 billion kilowatt-hours or 14.4% of all electric power generated in 1972, compared with 15.6% during 1971. At the end of 1972, the total capacity of electric powerplants reached 186 million kilowatts, of which some 35 million kilowatts represented hydroelectric capacity.

Thirty-eight hydroelectric power stations with the total capacity of 27 million kilowatts were under construction in the U.S.S.R. in 1972. Among them were nine plants with capacities exceeding 1 million kilowatts each. The construction of the

Krasnoyarsk hydropower plant, the largest in the country, was completed in July.

Exports of electric power rose from 7 billion kilowatt hours in 1971 to 7.5 billion in 1972, mainly to COMECON countries. Smaller amounts of electric power are exported to the non-Communist world, namely, to Finland and Norway.

Nuclear Power.—Nuclear power stations generated over 7.7 billion kilowatt hours, or 0.9% of all electric power supplied in 1972. The Soviet Union operated four atomic powerplants with a total capacity of 1,810,000 kilowatts or about 1% of the capacity of all electric powerplants in the country on December 31, 1972. The fourth unit (capacity of 440 megawatts) of the Novo-Voronezh plant was put into operation on December 31. All the existing Soviet atomic powerplants are using uranium 235 for fuel. The U.S.S.R. provides technical assistance in the construction of small atomic powerplants in some of COMECON countries.

Oil Shale.—The production of oil shale increased from 26.3 million tons in 1971 to an estimated 27 million tons in 1972. The main center of production, as in prior years, was the Estonian S.S.R., where output totaled 22.5 million tons. Over two-thirds of the extracted shale in the U.S.S.R. is burned at thermal electric powerplants. The remainder is processed into furnace oil, gasoline, fuel gas, phenols, and aromatic hydrocarbons.

The renovation of the Vivikonna open pit in Estonia was completed in October; its output is to reach 2,000,000 tons of oil shale annually. Completion of the No. 9 mine was rescheduled for 1973.

Peat.—The Soviet Union produced 82.5 million tons of peat in 1972. Of this quantity, 61.2 million tons consisted of fuel peat. The R.S.F.S.R. occupied first place in the production of peat in the U.S.S.R. and produced 51.4 million tons. Belorussian S.S.R., with an output of 15.5 million tons, was the second largest peat producing region. It is planned to produce 83.8 million tons of peat in 1973.

Production of fuel peat by Union Republic in million tons was as follows:

Republic	1960	1972
R.S.F.S.R.	36.8	42.2
Ukrainian S.S.R.	4.7	4.6
Belorussian S.S.R.	8.3	10.6
Lithuanian S.S.R.	2.9	1.0
Latvian S.S.R.	3.3	2.0
Estonian S.S.R.	.3	.8
Total U.S.S.R.	56.3	61.2

Over 50 Soviet electric powerplants, with a total capacity of about 3,000 megawatt, were fueled by peat.

Greece and the U.S.S.R. signed an agreement on April 18, 1972, for development of the Philippi peat deposits and construction of three Soviet 125-megawatt peat-fired thermal powerplants.

The Mineral Industry of the United Kingdom

By Horace T. Reno [1]

The entire industrial sector of the United Kingdom was crippled by a labor strike at coal mines in the first 2 months of the year. The resulting fuel shortage at the Nation's powerplants effectively shut down more than one-half of the industrial plants and effectively stopped the iron and steel and other metal producing operations. The coal strike was ended on February 27 by granting an average 20% pay raise to the miners.

High pay raises granted the coal miners instigated strikes by other crafts to obtain some degree of parity. In the first 6 months of the year, therefore, the economy was plagued by labor strikes, inflation, and record unemployment. However, the economy recovered in the last 6 months of the year. Unemployment peaked in March, but by the end of the year it was down to 3.3% of all employees. Industrial production for the year was up 3% compared with that of 1971. However, mining and quarrying was down 10%, mostly because of the time lost in January and February by the coal and ferrous metals industries. The value of exports increased 4.5%, but the value of imports increased 13.5% compared with those of 1971. Payments were essentially in balance in 1972, compared with a surplus of $2,470 million[2] at the end of 1971.

The year 1972 was marked by a decided change in the Conservative Government. A new Ministry for Industrial Development was established. In contrast to its previous policy, the Government actively intervened in the industrial sector of the economy to aid regional development, moderate unemployment, and assist selected declining industries. Parliament passed the Conservative-sponsored Mineral Exploration and Investments Grants Act for 1972 to finance up to 35% of the cost of exploring for and evaluating deposits of nonferrous metal ores, fluorspar, potash, and various other minerals. Furthermore, the Government announced massive support for the coal industry for over a 3-year period.

The Government's concern for industrial and regional development moderated its actions on pollution control to avoid distortions in trade that could be caused by antipollution standards. It set up an inquiry into the operation of planning control as it affected mineral operations. The inquiry was to be undertaken jointly by the Secretary of State for Environment and the Secretary of State for Scotland and Wales, after consultation with the Secretary of State for Trade and Industry. It was to examine the operation of the statutory provisions (except the provisions of the Opencast Coal Act of 1958) under which planning control is exercisable over mineral exploration, over surface mine workings and installations, over the deposit on the surface of spoil or waste from mineral workings and the after treatment of surface land worked for minerals.

The Secretary of State for Environment announced a research program to be commissioned at the Royal School of Mines into the environmental applications of large-scale stone quarrying and opensite mining.

[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from United Kingdom pounds (UK£) to U.S. dollars at the rate of UK£1 = US$2.60.

PRODUCTION

Production indexes for the mining and quarrying and manufacturing branches of the mineral industry were as follows (1963=100):

	r 1971	1972
Mining and quarrying	79.8	71.8
Manufacturing:		
Ferrous metals	104.7	99.9
Nonferrous metals	102.4	105.3
Bricks, pottery, glass, etc	130.3	140.3
Chemicals	160.1	169.3
Coal and petroleum products	157.8	156.1
All industry	124.9	128.2

r Revised.

Source: Central Statistical Office (London). Monthly Digest of Statistics. No. 327, March 1973, pp. 32–33.

Table 1.—United Kingdom: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Aluminum:			
Alumina	107	99	116
Metal:			
Primary	40	119	171
Secondary	214	189	197
Antimony, primary smelter—metric tons	7,400	4,800	7,200
Cadmium metal including secondary—do	318	262	240
Copper, refined:			
Primary—do	49,437	49,516	59,579
Secondary—do	156,807	138,070	121,132
Iron and steel:			
Iron ore	12,018	10,228	9,048
Pig iron	r 17,501	15,268	15,164
Ferroalloys, blast furnace:			
Ferromanganese	159	135	141
Spiegeleisen	12	18	11
Total	171	153	152
Steel, crude	28,316	24,174	25,321
Steel semimanufactures:			
Sections	5,656	5,167	5,188
Wire rods	2,211	1,465	1,451
Plates and sheets	10,304	8,742	9,226
Strip	1,934	1,411	1,490
Pipe tube and stock	891	720	813
Railway track material	303	307	246
Other rolled [1]	881	1,265	1,343
Castings and forgings	423	393	349
Total	22,603	19,470	20,106
Lead:			
Mine output, metal content [2]—metric tons	r 4,062	r 4,973	4,500
Metal:			
Bullion, from imported ores and concentrates—do	43,768	38,628	25,052
Refined:			
Primary [3]—do	140,291	120,821	121,000
Secondary [4]—do	146,693	142,771	149,621
Total—do	r 286,984	263,592	270,621
Magnesium metal including secondary—do	r 2,800	2,500	2,700
Nickel metal refined including ferronickel—do	36,700	38,700	31,900
Tin:			
Mine output, metal content—long tons	1,695	1,787	3,274
Metal:			
Primary—do	21,687	22,787	20,996
Secondary—do	2,427	2,035	4,892
Tungsten, mine output, metal content—metric tons	11	5	2
Zinc, smelter—do	146,598	116,464	73,826

See footnotes at end of table.

Table 1.—United Kingdom: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NONMETALS			
Barite and witherite	19	r 22	16
Bromine metric tons	24,700	23,800	30,000
Calcite	r 25	28	20
Cement, hydraulic	r 17,171	17,697	18,048
Chalk [5]	r 15,982	17,758	19,491
Clays:			
Fire clay	r 1,967	2,230	2,282
Fullers earth	176	e 180	e 180
Kaolin (china clay)	r 3,199	2,736	3,005
Potters' and ball clay	837	732	687
Other including clay shale	r 32,083	31,680	32,162
Diatomite metric tons	13,762	14,559	9,000
Feldspar (china stone) do	33,667	62,861	53,000
Fertilizers, manufactured: [6]			
Nitrogenous (N content)	710	748	772
Phosphatic (P_2O_5 content)	445	540	441
Other, gross weight	2,702	3,005	2,953
Fluorspar: [7]			
Acid grade	115	144	141
Metallurgical grade	73	63	57
Ungraded	5	4	1
Total	193	211	199
Gypsum and anhydrite	4,276	4,173	4,164
Refractory products: [8]			
Bricks	1,273	1,119	936
Cement	85	69	41
Other	97	74	122
Salt:			
Rock	r 1,598	1,807	1,178
Brine	1,733	e 7,400	e 7,600
Other	5,698		
Stone, sand and gravel:			
Chert and flint	23	16	(9)
Igneous rock and perlite	r 36,108	37,327	40,753
Limestone and dolomite including marble	89,948	94,459	95,516
Sandstone, including ganister	r 13,473	11,734	12,243
Slate	r 60	60	59
Sand and gravel:			
Building sand	r 18,400	19,700	21,300
Concrete sand	r 33,500	33,300	33,200
Silica refractory and molding sands	5,782	5,645	5,478
Gravel	r 57,400	58,800	62,900
Strontium minerals metric tons	9,501	9,700	4,400
Sulfur:			
Elemental	r 32	44	41
Sulfuric acid	3,352	3,459	3,449
Talc, soapstone, and pyrophyllite metric tons	r 11,000	12,100	16,100
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	211	218	204
Coal:			
Anthracite	3,684	4,124	3,114
Bituminous	r 140,885	142,979	116,403
Other	2,500	2,300	2,300
Coke:			
Metallurgical	r 16,592	15,368	13,412
Gashouse	r 1,879	769	224
Coke, breeze, all types	r 2,008	1,654	1,239
Fuel briquets, all grades	1,204	1,360	1,253
Gas:			
Manufactured [10] million therms	2,390	1,365	4,532
Natural million cubic feet	391,958	655,758	948,352
Petroleum:			
Crude thousand 42-gallon barrels	607	606	[11] 2,628

See footnotes at end of table.

Table 1.—United Kingdom: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971	1972 p
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products:				
Gasoline, aviation	thousand 42-gallon barrels	434	524	721
Gasoline, motor	do	96,483	106,479	116,185
Jet fuel	do	27,317	30,650	36,585
Kerosine	do	20,769	19,675	20,517
Distillate fuel oil	do	167,965	182,435	190,508
Residual fuel oil	do	285,565	287,664	273,203
Lubricants	do	9,264	10,004	9,328
Other	do	87,231	84,213	79,429
Refinery fuel and losses	do	46,744	45,103	52,916
Total	do	741,772	766,747	778,942

e Estimate. p Preliminary. r Revised.
[1] Includes wheels, tires, and axels, and semis for sale.
[2] May include some zinc.
[3] Lead refined from imported bullion.
[4] Lead refined from scrap materials and domestic ores.
[5] Includes chert and flint in 1972.
[6] Year ending May 31 of that stated.
[7] Includes fluorspar recovered from old mine dumps.
[8] Consists of bricks, retorts, molds, and other refractory products made from clays, silica, siliceous material, magnesite, alumina and chrome materials.
[9] Included in figure for chalk in 1972.
[10] Gas made at gasworks plus purchased coke oven and refinery gas.
[11] Includes condensate.

TRADE

Trade in mineral commodities in 1972 accounted for approximately 13% of the value of all exports and 23% of the value of all imports by the United Kingdom. A trade deficit of approximately $3.4 billion could be attributed to mineral commodities. Compared with trade in 1971, the total value of United Kingdom trade increased by approximately $3.4 billion in imports and $1.6 billion in exports.

The approximate values of major mineral commodities traded in 1972 were as follows:

	Million dollars	
	Export	Import
Petroleum, crude	62	2,465
Diamond, gem	1,185	1,264
Iron and steel	980	[1] 936
Copper	213	540
Refined gold bullion	797	779
Petroleum products	508	573
Silver and platinum-group metals [1]	302	65
Aluminum	92	[1] 258
Nickel	149	[1] 201
Lead and zinc	60	[1] 189
Tin	62	[1] 88

[1] Including ores and concentrates.

Source: Overseas Trade Accounts of the United Kingdom (December 1972).

Table 2.—United Kingdom: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide and hydroxide	r3,402	18,739	NA.
Metal including alloys:			
Unwrought	r26,084	43,195	West Germany 12,047; United States 8,297; Canada 5,489.
Semimanufactures	r41,638	32,247	Ireland 3,856; Nigeria 1,340; Iran 1,066.
Bismuth	r314	243	NA.
Chromium	r1,612	1,289	NA.
Cobalt oxide and hydroxide	346	381	Poland 76.
Copper including alloys:			
Unwrought	91,058	68,295	Italy 12,772; West Germany 9,746; Netherlands 8,128.
Semimanufactures	99,616	105,564	Switzerland 17,982; Poland 14,018.
Gold, unworked or partly worked:			
Bullion, refined thousand troy ounces	18,173	20,041	NA.
Other including leaf do	296	245	NA.
Iron and steel:			
Scrap thousand tons	409	1,024	Spain 673; Italy 89; West Germany 41.
Pig iron, ferroalloys and similar materials do	104	55	West Germany 6; Sweden 5; Netherlands 3.
Steel, primary forms do	277	444	Spain 246; United States 86; Italy 18.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod do	141	321	United States 139; Netherlands 46.
Other bars and rods do	534	479	United States 152; India 32; Republic of South Africa 32.
Angles, shapes, and sections do	478	554	United States 207; Hong Kong 39; Canada 39.
Universals, plates and sheets:			
Universals and heavy plates, uncoated do	328	452	United States 119; India 57; Norway 28.
Medium plates and sheets, uncoated do	69	64	India 13; Norway 4.
Light plates and sheets, uncoated do	623	968	United States 368; Sweden 74; India 71.
Tinned plates and sheets, uncoated do	372	355	United States 46; Argentina 40; India 27.
Other coated plates and sheets do	226	254	United States 42; Norway 30; Sweden 17.
Hoop and strip do	187	160	India 51; Sweden 10; Finland 9.
Rails and accessories do	178	220	France 52; Italy 38; Pakistan 9.
Wire do	144	109	United States 19; Canada 17.
Tubes, pipes and fittings do	635	624	United States 59; Netherlands 34; Denmark 30.
Castings and forgings, rough do	36	42	United States 4; Netherlands 4; Norway 4.
Total do	3,951	4,602	
Lead:			
Oxides	7,369	6,329	Ireland 1,917; Norway 310.
Metal, including alloys:			
Unwrought	r153,105	151,571	West Germany 51,867; Netherlands 24,418; Norway 6,693.
Semimanufactures	2,358	2,619	NA.
Magnesium including alloys, all forms	922	911	France 319; West Germany 67; United States 63.
Nickel including alloys:			
Unwrought	33,448	31,696	West Germany 8,179; France 6,139; Sweden 4,156.
Semimanufactures	11,660	12,139	United States 1,484; France 1,243; West Germany 1,093.
Silver and platinum group including alloys:			
Platinum group thousand troy ounces	1,225	1,101	United States 535; Japan 157; West Germany 148.
Silver do	r32,165	48,281	NA.
Tin:			
Oxides long tons	341	290	Spain 69; Mexico 36.
Metals including alloys:			
Unwrought do	15,493	11,698	Netherlands 1,698; Poland 1,674; U.S.S.R. 1,413.
Semimanufactures do	1,002	828	Norway 370.

See footnotes at end of table.

Table 2.—United Kingdom: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Zinc:			
Oxide and peroxide	5,447	5,636	Belgium-Luxembourg 1,195.
Metal including alloys:			
Unwrought	15,861	11,099	Ireland 3,237; Switzerland 1,444; Greece 993.
Semimanufactures	6,510	6,355	Denmark 1,621; Netherlands 409.
Other:			
Nonferrous base metal ores and concentrates (excluding radioactive ores and concentrates)	23,341	17,576	Belgium-Luxembourg 6,076; Italy 2,112.
Nonferrous base metal scrap, ores, concentrates and waste of precious metals, and uranium and thorium ores	r 67,904	50,207	Canada 17,301; Belgium-Luxembourg 10,145; Netherlands 7,995.
NONMETALS			
Abrasives, natural n.e.s.:			
Crude	8,523	8,989	United States 1,894; Austria 1,431.
Grinding and polishing wheels and stones	6,867	6,069	Sweden 997; Finland 445; Poland 380.
Asbestos, crude and waste	4,745	2,522	NA.
Cement—thousand tons	819	747	Canary Islands 163; Republic of South Africa 103; Ivory Coast 100.
Clays and products (including all refractory brick):			
Crude including china and others—do	2,700	2,387	Italy 341; West Germany 333; France 265.
Products:			
Refractory (including nonclay bricks)—do	187	228	Sweden 32; Netherlands 23; Australia 12.
Nonrefractory—do	80	82	United States 16; Canada 11; Australia 8.
Fertilizer materials:			
Crude:			
Nitrogenous	868	77	NA.
Phosphatic	4,810	3,384	NA.
Potassic	1,232	28	NA.
Other	1,335	1,013	NA.
Manufactured:			
Nitrogenous	NA	NA	
Phosphatic	46,305	33,013	Ireland 16,954.
Potassic	11,019	1,487	NA.
Other	54,016	57,864	Ireland 38,275; Portugal 8,709.
Lime	r 41,100	37,600	NA.
Mineral pigments, natural	2,982	2,799	NA.
Salt—thousand tons	582	472	Sweden 135; Nigeria 112; Finland 44.
Stone, sand and gravel—do	4,103	3,274	France 1,390; Belgium-Luxembourg 552; West Germany 534.
Strontium minerals, celestite	5,850	5,635	NA.
Other n.e.s.: Crude including metallurgical waste not containing recoverable metals—thousand tons	r 153	153	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	10,677	8,636	NA.
Carbon black	41,459	43,090	Sweden 5,965; Ireland 5,940; France 5,879.
Coal including briquets, all grades—thousand tons	3,492	2,831	West Germany 1,494; France 559; Norway 245.
Coke—do	1,047	614	Norway 278; Sweden 133.
Gas, natural and manufactured—do	89	124	Portugal 41; Ireland 35.
Petroleum:			
Crude and refined—thousand 42-gallon barrels	r 8,761	12,911	Ireland 3,175; Belgium-Luxembourg 2,082; Sweden 1,927.
Refinery products: [1]			
Gasoline, aviation and motor—do	8,727	9,966	Sweden 3,088; Denmark 2,783; Ireland 2,597.
Kerosine—do	8,760	10,320	Ireland 2,692; Norway 1,940; Sweden 1,631.
Distillate fuel oil—do	46,327	48,318	Sweden 15,644; Denmark 13,743; Netherlands 5,427.
Residual fuel oil—do	52,048	42,870	Denmark 12,361; Sweden 9,049; Ireland 6,187.
Lubricants—do	4,956	5,187	Belgium-Luxembourg 506; Sweden 473; Denmark 354.
Mineral jelly and wax—do	64	65	NA.
Other including bitumen and other residues—do	4,730	7,242	Ireland 126.

r Revised. NA Not available.

[1] Series revised to reflect thousand 42-gallon barrels. Previous year's table reported quantities in metric tons.

Table 3.—United Kingdom: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	420	447	Ghana 300; Greece 62.
Metal including alloys:			
Scrap do	15	12	NA.
Unwrought do	r 379	270	Norway 107; Canada 97; Ghana 19.
Semimanufactures do	r 77	80	Norway 19; Belgium-Luxembourg 12; United States 10.
Bismuth metal including alloys:			
Metal	318	237	NA.
Alloys	185	95	NA.
Cadmium metal including alloys, all forms	1,179	864	NA.
Chromite thousand tons	165	207	Philippines 96; Republic of South Africa 94.
Cobalt:			
Oxide and hydroxide	1,463	983	Mainly from Canada.
Metal including alloys, all forms	2,357	1,977	NA.
Copper:			
Ore and concentrate	6,240	3,670	Australia 2,791; United States 864.
Metal including alloys:			
Scrap	12,519	11,473	Ireland 1,509; United States 984.
Unwrought, unrefined and refined blister thousand tons	450	400	Zambia 114; Canada 100; Chile 93.
Semimanufactures	12,713	11,800	Finland 1,679; Canada 1,131; Denmark 1,080.
Gold:			
Metal unworked and partly worked, fine basis:			
Refined thousand troy ounces	29,387	31,196	NA.
Unrefined do	1,067	1,000	NA.
Iron and steel:			
Ore and concentrate except roasted pyrite thousand tons	19,915	17,473	Canada 4,980; Sweden 2,133; Venezuela 1,752.
Roasted pyrite do	274	282	Sweden 180; Spain 14.
Scrap do	266	294	Mainly from United States.
Pig iron including cast iron, power and shot do	449	436	Norway 46; Canada 35.
Ferroalloys:			
Ferromanganese do	75	78	Norway 47; Republic of South Africa 21.
Other do	256	197	NA.
Steel, primary forms do	1,205	609	Spain 299; U.S.S.R. 22.
Semimanufactures:			
Bars, rods, angles, shapes and sections:			
Wire rod do	50	52	Sweden 25; Canada 4.
Other bars and rods do	334	346	Netherlands 101; Sweden 64; Norway 50.
Angles, shapes, and sections do	40	66	Belgium-Luxembourg 17; Sweden 9.
Universals, plates, and sheets:			
Heavy and medium plates and sheets, uncoated do	80	133	Austria 10; West Germany 9; Sweden 6.
Light plates and sheets, uncoated do	307	418	Netherlands 155; West Germany 63; Belgium-Luxembourg 44.
Coated plates and sheets do	22	74	Japan 11; Austria 3.
Hoop and strip do	31	50	West Germany 11; Belgium-Luxembourg 7; United States 7.
Wire do	12	13	Sweden 4; Norway 2; Belgium-Luxembourg 2.
Tubes, pipes, and fittings do	126	217	Italy 36; Japan 36; Sweden 19; Austria 16.
Castings and forgings, rough do	4	4	NA.
Total	1,006	1,373	
Lead:			
Ore and concentrate do	66	75	Australia 25; Peru 22; Ireland 14.
Metal including alloys:			
Scrap	r 3,821	2,776	Belgium-Luxembourg 435; Netherlands 259.
Unwrought thousand tons	256	231	Australia 188; Canada 43.
Semimanufactures	939	934	NA.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Magnesium including alloys:			
Scrap	r 438	930	NA.
Unwrought	5,447	4,312	Norway 2,197; Canada 689.
Manganese ore and concentrate thousand tons	522	429	Republic of South Africa 136; Brazil 112.
Mercury 76-pound flasks	10,018	12,318	Mexico 1,740; Spain 1,562; Ireland 1,462.
Molybdenum ore and concentrate	11,716	7,824	NA.
Nickel:			
Matte, speiss, and similar materials	73,423	75,194	Mainly from Canada.
Metal including alloys:			
Scrap	4,964	2,858	United States 1,169; Netherlands 339.
Unwrought	35,057	46,030	Canada 25,457; U.S.S.R. 10,496.
Semimanufactures	1,363	3,369	Mainly from United States.
Platinum group including alloys, all forms thousand troy ounces	r 190	149	Republic of South Africa 60; U.S.S.R. 34; France 19.
Selenium, elemental	184	140	NA.
Silicon, elemental	r 14,649	14,647	NA.
Silver bullion, fine basis:			
Refined thousand troy ounces	38,021	16,410	NA.
Unrefined do	11,933	15,509	NA.
Titanium ore and concentrate:			
Ilmenite thousand tons	346	361	NA.
Other do	50	36	NA.
Tin:			
Ore and concentrate long tons	68,939	58,801	Bolivia 38,827; Australia 4,963.
Metal including alloys:			
Scrap do	1,112	821	United States 169; Netherlands 44.
Unwrought and semimanufactures do	r 6,449	7,934	Nigeria 5,509; Malaysia 1,440.
Tungsten ore and concentrate	r 10,579	7,145	Bolivia 2,284; Portugal 866; Thailand 729.
Zinc:			
Ore and concentrate thousand tons	301	292	Australia 192; Canada 48; Ireland 24.
Metal including alloys:			
Scrap	438	786	NA.
Unwrought thousand tons	164	174	Canada 72; Australia 32.
Semimanufactures	501	587	West Germany 102.
Zirconium ore and concentrate	27,427	39,889	NA.
Other:			
Ore and concentrate thousand tons	r 398	399	NA.
Ash and residues containing nonferrous metals do	74	65	Canada 32; West Germany 8; United States 6.
Base metals including tungsten, molybdenum, and tantalum do	11	7	Zambia 2; Republic of South Africa 1; Japan 1.
NONMETALS			
Abrasives, natural excluding diatomite thousand tons	69	151	Italy 117.
Asbestos, crude do	154	168	Canada 113; Republic of South Africa 27.
Barite and witherite do	66	60	Morocco 35; Spain 11; Ireland 7.
Borax do	13	12	NA.
Cement do	103	114	NA.
Clays and products (including all refinery brick):			
Crude n.e.s do	168	155	United States 71; Republic of South Africa 50.
Products:			
Refractory (including nonclay bricks) do	80	81	Austria 24; Denmark 12; Ireland 12.
Nonrefractory do	13	15	West Germany 2; Portugal 2; Italy 1.
Diatomite and other infusorial earths do	34	16	Denmark 8; United States 3.
Feldspar and fluorspar do	162	182	Norway 133; Finland 30.
Fertilizer materials:			
Crude:			
Nitrogenous do	12	12	Chile 10.
Phosphatic do	1,597	1,729	Morocco 1,214; Senegal 287.
Potassic do	24	35	NA.
Other do	4	2	NA.
Manufactured:			
Nitrogenous do	247	328	NA.
Phosphatic do	77	120	NA.
Potassic do	815	874	East Germany 289; West Germany 141; France 110.
Other including mixed do	231	231	Netherlands 89; West Germany 41; France 16.

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Graphite, natural	11,944	10,196	Malagasy Republic 4,730; Norway 1,734.
Gypsum and plasters—thousand tons	144	136	Ireland 91.
Magnesite—do	120	129	Spain 42; Greece 40.
Mica, crude including splittings and waste—do	13	15	Republic of South Africa 7; India 4.
Pigments, mineral, crude, natural	5,262	5,776	NA.
Pyrite (gross weight)—thousand tons	170	214	Cyprus 82; Sweden 40.
Salt—do	140	126	West Germany 28.
Stone, sand, and gravel:			
Dimension stone:			
Crude and partly worked—do	32	29	Italy 14; Sweden 4.
Worked—do	20	25	Portugal 16; Italy 3.
Dolomite—do	22	24	NA.
Gravel and crushed rock—do	226	188	Ireland 82; Norway 42; Italy 33.
Quartz and quartzite—do	14	12	NA.
Sand excluding metal bearing—do	203	171	Belgium-Luxembourg 134.
Sulfur, elemental—do	821	966	France 339; Poland 268; Mexico 203.
Talc, steatite, soapstone, and pyrophyllite—do	58	57	Norway 19; France 13; People's Republic of China 10.
Other n.e.s.:			
Crude—do	--	363	Italy 79; Norway 64; Netherlands 40.
Slat, dross, and similar waste, not metal bearing	r 9,437	19,101	Netherlands 2,343.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural—thousand tons	52	42	Trinidad and Tobago 31; United States 3.
Carbon black—do	12	9	United States 3; East Germany 2.
Coal and coke including briquets—do	231	4,681	France 148.
Gas, natural and manufactured—do	929	872	Algeria 653; Netherlands 62; Sweden 60.
Petroleum:			
Crude and partly refined—thousand 42-gallon barrels	r 743,301	789,356	Kuwait 159,233; Libya 156,349; Saudi Arabia 156,052.
Refinery products: [1]			
Gasoline, aviation and motor—do	34,893	33,116	Italy 14,045; Netherlands 13,013.
Kerosine and jet fuel—do	9,008	12,356	Netherlands 3,926; Belgium-Luxembourg 2,189; Iran 1,459.
Distillate fuel oil—do	14,084	14,584	Netherlands 3,915; Italy 2,986; Kuwait 2,056.
Residual fuel oil—do	58,002	54,645	Netherlands 26,833; Ireland 5,260; France 4,056.
Lubricants—do	3,360	3,269	Netherlands 989; Antilles 680; France 436.
Mineral jelly and wax—do	1,140	1,185	Antilles 730; France 133; United States 121.
Petroleum coke—do	622	788	United States 460; West Germany 88; Belgium-Luxembourg 57.
Other—do	890	718	Belgium-Luxembourg 511.
Total—do	121,999	120,661	

r Revised. NA Not available.
[1] Series revised to reflect thousand 42-gallon barrels. Previous year's table reported quantities in metric tons.

COMMODITY REVIEW

METALS

Aluminum.—Primary aluminum production in 1972 was about one-third more than in 1971. Secondary production was 197,000 metric tons, about 15% more than primary. The Anglesey Aluminium Ltd. 100,000-ton-per-year-capacity plant at Holyhead, Wales, officially opened in June. This is the last of three new primary aluminum plants constructed in the United Kingdom since 1969. The others in England, were the British Aluminium Co. Ltd. plant at Ivergordon and the Alcan Aluminium Ltd. plant at Lynemouth. None of the three plants operated at capacity in 1972 because of the power shortage caused by the coal strike, and the excess smelter capacity was apparent in view of the depressed state of the economy in the first half of the year.

In 1972, the United Kingdom imported 353,161 tons of aluminum alloys, unwrought and in various structural shapes, compared with 350,000 tons imported in 1971. Aluminum exports of similar material totaled 120,345 tons in 1972, compared with 75,442 tons exported in 1971.

The increase in exports again took care of most of the United Kingdom's increased production of primary aluminum. Most of the aluminum exported went to the European Economic Community (EEC), but the United States received 18,279 tons, and Canada received 10,174 tons.

The pattern of aluminum consumption was about the same as that in 1971 and 1970. Vehicles received 28% of the total, electrical engineering 13%, building construction 8%, and the remainder was divided among packaging, mechanical engineering, and the chemical, food, and iron and steel industries.

Copper.—Rio Tinto Finance and Exploration Ltd., a wholly owned subsidiary of the Rio Tinto Zinc Corp. Ltd., completed its preliminary evaluation of the results of recent drilling in the Coed-y-Brenin areas of northern Wales in the Snowdonia National Park where its mining studies indicated potential ore of 200 million tons, with an average grade of 0.3% copper. The corporation decided that considering the environmental factors it was extremely doubtful that a mining operation in the park could be profitable in the foreseeable future.[3]

Iron Ore.—Phasing out of the domestic iron ore producing industry continued as output in 1972 was about 10% less than that of 1971. In terms of gross weight domestic ores provided 4% of the total iron ore consumed in 1972; in terms of iron content, however, the percentage was much less. The pattern of iron ore supply continued to change reflecting increased dependence upon imports, completion of new deep water ports, and use of diversified resources. Canada, Sweden, Brazil, Mauritania, and Venezuela, in that order, were the principal suppliers of iron ore.

The changing pattern of iron ore supply and consequent use of higher grade materials in the iron and steel industry was reflected in the decreased use of fuel per unit of steel production in all categories, coal, coke, liquid fuels, electricity, and gas. However, the use of electricity and gas per unit of pig iron produced was about the same in 1972 as it was in 1971. The sinter to pig iron ratio was 1.20:1 in 1972, compared with 1.15:1 in 1971. The pig iron to scrap ratio was 1.05:1, compared with 1.12:1 in 1971.

Lead and Zinc.—Small quantities of lead concentrate were produced as a byproduct of fluorspar mining in Derbyshire in 1972. Refined lead production from domestic ores, scrap, and imported bullion totaled 270,621 tons; 263,592 tons were refined in 1971. Most end uses of lead were changed little from the pattern of the last few years. Use of lead as an additive to gasoline, which had increased 10% between 1970 and 1971, was to be decreased by almost one-half from August 1972 to the end of 1975 by government decree.

The Avonmouth lead-zinc smelter, which was reorganized in 1971 by the parent company, Rio Tinto Zinc Corp., was cited for air pollution. According to a report by Sir Adrian Windire and his staff of investigators, the lead in air levels at the smelter was above the accepted limit in a considerable number of working areas for substantial periods over 4 years.[4] The smelter was closed down at the end of January for 11 weeks when it was confirmed that the reports of lead poisoning were valid. According to the Rio Tinto Zinc Corp. annual report, modifications and alterations at the smelter alleviated the health hazard. The corporation reported that there had been no lasting damage to the health of the persons affected.

Steel.—The steel industry, nationalized in 1966, apparently hit bottom in 1971 as it produced 5% more steel in 1972 than in 1971 despite the time lost the first part of the year during the coal strike.

The Government's Iron and Steel Act of 1972, provided capital reconstruction and enlargement of the borrowing powers of British Steel Corp. The Act provided for reduction in capital by up to $910 million, and increased borrowing powers from $1,690 million to $3,250 million. The Government also approved a plan to invest the equivalent of $7 billion over the next 10 years to modernize the nationalized steel industry and to achieve an annual production capacity of 33 million tons by 1980.

The foregoing government actions are

[3] Rio Tinto Zinc Corp. Ltd. Annual Report and Accounts, 1972, p. 35.

[4] American Metal Market. Avonmouth Smelter Guilty in Lead Pollution Probe. V. 79, No. 138, pp. 2, 6.

the extension of a steel expansion plan begun when the British Government took over the steel industry to combine and modernize it into large productive units to take advantage of the economy of scale. In 1972 expenditures on this program totaled more than $689 million, most of the expenditures were at five big projects: 1) the Anchor project at Scunthorpe adjacent to the Redbourn and Appleby-Frodingham works, 2) the Teesside development in the northeast of England, 3) the Llawern Strip Mills Division near Newport, Wales, 4) the strip mill division at Ravenscraig, Scotland, and, 5) the strip mills division at Shotton, Wales.

The British Steel Corp. continued to make large expenditures to improve the environment and reduce air and water pollution from existing operations and in the new plants being built. The corporation has expended more than $24.7 million in pollution control since it came into existence in 1967. In the fiscal year 1971, expenditures on individual schemes to improve the environment totaled $390,000 and on those relating specifically to the reduction of air and water pollution from existing operations expenditures totaled $5.7 million.

Tin.—The tin mines of the United Kingdom produced 3,274 long tons in 1972 as the two mines, which began production in October of 1971, contributed substantially to the total.

Production of refined tin totaled 25,858 long tons; 20,966 long tons from primary materials, and 4,892 long tons from secondary material.

Imports of tin and tin alloys in 1972 totaled 6,421 long tons valued at $25,405,000. Nigeria contributed 5,047 long tons, and Malaysia contributed 603 long tons to the total. Imports from other countries were not significant.

Exports of tin and tin alloys totaled 16,184 long tons valued at $62,254,000 in 1972. Exports were sent principally to the Netherlands, West Germany, Poland, U.S.S.R., and France, in that order.

NONMETALS

Barite.—The United Kingdom has not been self-sufficient in barite in the last decade. Dwindling domestic production and the use of barite in drilling muds during exploration for natural gas and oil in the North Sea has led to a marked increase in usage. However, only about one-half the total of barite used in the United Kingdom is for drilling muds, whereas barite use in the United States in drilling muds is normally more than three-quarters of the total.

Clays.—The clay producing industry of the United Kingdom was unusually active in 1972 compared with the depressed state of the industry in the last 3 years, 1969 to 1971. As the industry solved some of its production and pollution problems in 1972, it moved to recapture markets lost to U.S. producers during the depressed period.

Production of china clay and china stone in 1972 totaled 3,005,000 tons, compared with 2,736,000 tons produced in 1971. Production of fire clay totaled 2,282,000 tons, compared with 2,230,000 tons produced in 1971. Production of potters clay and clay shales totaled 32,849,000 tons, compared with 32,412,000 tons produced in 1971.

Fluorspar.—There was a great deal of activity in the fluorspar industry of the United Kingdom in 1972, and, although its potential for output was at a record high, marketing problems caused by the coal strike in the first part of the year resulted in about 10% less output compared with that of 1971.

Exploration in 1972 delineated a number of fluorspar ore deposits. Details were not available, but it was established without much doubt that the reserves of fluorspar in the United Kingdom are large. Exsud Ltd., a United Kingdom subsidiary of South American Consolidated Enterprises, Alcoa and Reynolds Metal Co. of the United States, and Acmin Exploration Ltd., Ataka and Co. Ltd., and Imperial Chemical Industries Ltd. (ICI) conducted comprehensive exploration projects.

Clay Cross Ltd. (land and minerals), a subsidiary of the Clay Cross Co. Ltd. completed a 250-ton-per-week fluorspar heavy medium separation plant at Milltown in Derbyshire. The new plant was designed to produce an 80% to 85% fluorspar concentrate depending on grade of feed and will produce barites as a byproduct.

Sand and Gravel.—The United Kingdom produced 113,804,000 tons of silica sand in 1972, compared with 107,833,000 tons in 1971. Most of the output came from land-based operations, but at least 15 companies

operated 60 to 70 vessels of varying capacity for under water sand dredging. Environmental restrictions became an increasingly significant element in determining the course of the sand and gravel industry as restoration methods governed release of land for sand and gravel extraction.

MINERAL FUELS

Coal.—Labor strikes which have plagued the United Kingdom coal producing industry for the last 3 years culminated in a Nationwide strike, which started on January 9 and did not end until February 27 when labor was granted an average pay raise of 20%. Inasmuch as the United Kingdom is dependent on coal for almost one-half of its primary energy needs and almost three-quarters of its electricity, the unions had terrific leverage in forcing a liberal settlement. Government officials sought ways to assure that such an industry crippling strike could not reoccur. However, late in the year the Government announced massive monetary support for the coal industry so that it could reestablish itself on a competitive basis and avoid accelerated rundown. The Government's plan would provide $1,365 million, an average of $455 million per year over a 3-year period, to take care of an estimated sales loss of a $260 million per year and $195 million per year to maintain and modernize deteriorating plants.

The United Kingdom exported 1.7 million tons of coal valued at $25.2 million in 1972. It imported 5 million tons valued at $127.4 million, compared with 4.2 million tons valued at $102.4 million imported in 1971. The National Coal Board continued its mining research activities, balancing its program between short- and long-term items. For the short term, the emphasis was on improving the reliability and efficiency of existing machines and systems. For the long term, effort was directed at seeking new systems of mining that would depend on inducing extra stata yield to relieve the stress of mining at increased depths. The Board was seeking a fundamentally more productive mining system that would be completely automated with no men at the mining face. It was also active in research to enable metallurgical coke to be made from lower grade coals, which heretofore have been regarded as unsuitable. The British Steel Corp., with FMC Corp. of the United States, conducted a blast furnace test of form coke made by the FMC coking process. The United Kingdom has ample reserves of lower grade coals that might be used advantageously as raw material for the FMC process.[5]

Natural Gas.—Discovery and production of natural gas in the North Sea continued to increase at the high rate of the last 3 years. The United Kingdom produced 948 billion cubic feet of natural gas in 1972, compared with 656 cubic feet in 1971. The Gas Council sold 8,040 million therms of gas in 1972, 30% more than that of 1971. The Council converted the appliances of 2.4 million of its customers to natural gas, and, by the end of the year, nearly one-half of the customers' appliances had been converted to use of natural gas. The national gas transmission system was extended 153 miles, and significantly the Gas Council accounts showed an earned surplus of $39.3 million for the year.

The following tabulation shows the sources of gas available in the United Kingdom for fiscal years ending 1971 and 1972.

	Million therms	
	1970–71	1971–72
Gas (manufactured):		
Coal gas	238	65
Oil gas	1,207	595
Water gas and other gases	32	20
Gas (purchased):		
Refinery gas	134	119
Liquefied petroleum gas	206	165
Coke oven gas	279	153
Other (including natural gas used in gas manufacture)	2,487	2,728
Total	4,583	3,845
Natural gas direct to consumers	2,157	4,904
Total gas available	6,740	8,749

Source: The Gas Council Annual Report and Accounts 1971–72.

The Gas Council studied the possibility of storing large quantities of natural gas in salt cavities 1 mile underground in Yorkshire.

Petroleum.—Exploration drilling in the British sector of the North Sea added one certain and three possible major fields to Britain's oil discoveries. The positive discovery and the most significant find was

[5] World Mining. British Steel Corp. to Run FMC Form Coke Test. V. 8, No. 2, February 1972, pp. 50–51.

made by the joint venture of the Royal Dutch Shell Group and Standard Oil Co. of New Jersey. It is the northern most find in the British sector and apparently ranks in size with the largest of the other discoveries to date. The three possible fields indicated by exploration in 1972 included a Shell Standard Oil well near the Brent field, Mobile Oil Co.'s discovery in the Beryl structure southeast of the Shetlands, and the Hamilton Brothers' discovery east of Dundee, Scotland. The new discoveries raised the estimated reserve of petroleum to nearly 20 billion barrels and indicated a production potential of 2 million barrels per day from the British sector.[6]

The Government actively sought ways that would assure maximum participation of British firms in North Sea exploration and subsequent production activities. All government actions in favor of British firms during the year were in the free enterprise concept.

Apart from the Government, there seemed to be an awakening in opportunities presented by the North Sea oil and gas resources. The Harriet Watt University of Edinburg planned a new offshore engineering research institute. A 73-man delegation including architects, engineers, and economic consultants, visited U.S. contractors, drillers, oil firms, and fabricators to discuss joint ventures, subcontracting, and licensing agreements. The delegation met with U.S. companies that have dominated offshore construction in support of oil and gas exploration in the North Sea.[7] The delegation's visit was sponsored by Business Missions International, a London-based agency, and the Northeast Scotland Development Authority, an agency promoting manufacture of oil-related equipment in Aberdeen, Scotland.

[6] U.S. Embassy, London, England. State Department Airgram A-1583, Oct. 27, 1972, p. 4.

[7] UK Wants Big Share of North Sea Boom. Engineering News Record. V. 190, No. 2, Jan. 11, 1973, p. 14.

The Mineral Industry of Venezuela

By Gordon W. Koelling [1]

The value of Venezuela's crude minerals output was adversely affected in 1972 by decreased production of crude oil and iron ore. Approximately 94% of the crude minerals output value was accounted for by the petroleum industry (including natural gas) which also was responsible for approximately 22% of the gross national product (GNP), provided about 67% of the Government's ordinary revenues, and was responsible for 92% of the country's total export receipts. About 5% of the value of Venezuela's crude minerals output was accounted for by iron ore.

Despite a 9% decline in crude oil output, Venezuela retained sixth place among the world's crude oil producing nations and remained the world's third leading petroleum exporting country behind Saudi Arabia and Iran. This drop in production reflected some of the basic problems of the Venezuelan petroleum industry. Reserves of crude oil, which had declined for 6 consecutive years, rose only slightly, and costs of production remained high in comparison with those in other major petroleum-exporting countries. A number of actions taken by the Government to increase its income from the petroleum industry resulted in a rise in the price of Venezuelan petroleum exports, which were generally uncompetitive in Europe, and tended to make additional investment in exploratory activity less attractive to most private companies.

In accordance with provisions of the Law for Partial Reform of the Income Tax Law enacted in December 1970, the Venezuelan Government revised the petroleum export price to be used for tax calculations (these arbitrarily determined prices are called tax reference values) in October 1972. The revisions, which were effective at the beginning of 1973, raised the tax reference value of petroleum products and crudes an average $0.12 per barrel.

During 1972, the Ministerio de Minas e Hidrocarburos made an inventory of petroleum concessionaire plants and equipment in accordance with the Law Concerning Property Subject to Reversion in Hydrocarbons Concessions. This law declares that essentially all facilities for exploration, production, refining, and transportation within petroleum concessions, or existing for the fulfillment of the obligations derived from such concessions, are to revert to the Government upon the expiration of petroleum concession agreements. It also requires the maintenance of a guaranty fund to which concessionaires are to make contributions consisting of up to 10% of the cost accepted by the Income Tax Administration for the depreciation of the assets subject to reversion. These contributions are to be made over a 5-to 10-year period.

In January 1972, the Liquid Natural Gas Office was established as a part of the Government petroleum entity, Corporación Venezolano de Petróleo (C.V.P.) in response to a law reserving the natural gas industry to the State. This law requires, among other things, that the liquefaction of natural gas must be carried out directly by C.V.P. The law also specifies that only dissolved and associated gas not used for field injection or other ends suitable to the public interest may be liquefied. In effect, this limits the gas available for liquefaction to those quantities being flared.

During 1972, a geologic exploration program was initiated in the largely unexplored Cedeno District of the State of Bolívar and in the Amazonas Federal Territory. Aerial geological surveying of approximately 70,000 square kilometers was

[1] Geographer, Division of Fossil Fuels—Mineral Supply.

performed during the year in connection with this program. Surface exploration was begun during November in the Cerro Impacto vicinity where a complex deposit of radioactive minerals and rare-earth elements has been discovered.

PRODUCTION

The performance of the various sectors of Venezuela's mineral industry during 1972 was mixed. Significant declines were registered by crude oil, total refinery output, natural gas, iron ore, coal, and diamond. Manufactured fertilizer materials, natural gas liquids, and crude steel registered sharp increases in production; output of aluminum, gold, and cement rose moderately.

Table 1.—Venezuela: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum, unalloyed ingot	22,900	22,400	24,000
Gold, mine output, troy ounces	[r] 22,320	18,567	19,776
Iron and steel:			
Iron ore and concentrate, thousand tons	[r] 21,100	20,200	18,465
Pig iron, do.	510	515	537
Crude steel, do.	[r] 928	924	1,127
NONMETALS			
Cement, hydraulic, do.	2,650	2,800	2,982
Diamond:			
Gem, carats	131,106	113,700	141,100
Industrial, do.	377,555	385,300	315,200
Total, do.	508,661	499,000	456,300
Fertilizer materials:			
Crude, phosphate rock, marketable	30,983	26,000	[e] 30,000
Manufactured, nitrogenous, gross weight	201,909	134,189	224,879
Gypsum [e]	100,000	100,000	100,000
Salt, all types	265,396	[e] 260,000	[e] 260,000
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	7,348	[e] 7,500	[e] 7,500
Coal, bituminous	39,985	43,400	40,359
Gas, natural:			
Gross production, million cubic feet	1,710,200	1,680,252	1,625,196
Marketable production, do.	[r] 348,600	368,230	387,723
Natural gas liquids:			
Condensate, thousand 42-gallon barrels	1,899	1,710	1,435
Natural gasoline, do.	3,882	5,898	7,244
Liquefied petroleum gas, do.	11,141	16,392	20,819
Total, do.	16,922	24,000	29,498
Petroleum:			
Crude, do.	1,353,420	1,295,406	1,178,487
Refinery products: [2]			
Aviation gasoline, do.	185	214	194
Motor gasoline, do.	26,317	27,625	30,635
Naphtha, do.	38,856	40,393	35,747
Jet fuel, do.	26,803	15,485	13,820
Kerosine, do.	4,301	4,338	4,163
Distillate fuel oil, do.	55,149	57,829	54,156
Residual fuel oil, do.	297,531	284,145	248,244
Liquefied petroleum gas, do.	3,945	3,569	3,772
Lubricants, do.	3,852	3,855	3,641
Asphalt and bitumen, do.	5,136	5,970	7,587
Refinery gas [3], do.	6,211	6,026	7,556
Other, do.	2,578	3,087	3,148
Total, do.	470,864	452,536	412,663

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

[1] In addition to the commodities listed, lime, sand and gravel, clays, and stone are produced, but information is inadequate to make reliable estimates of output levels.

[2] Includes refinery fuels.

[3] Liquid equivalent.

TRADE

Exports of mineral commodities continued to dominate Venezuela's overall foreign trade. The United States was the principal destination of direct petroleum shipments, followed by the Netherlands Antilles. However, almost all of the petroleum shipments to the Netherlands Antilles consisted of crude and unfinished oils destined for processing at two large refineries owned by the parent companies of Creole Petroleum Corp. and Shell de Venezuela, Ltd., Venezuela's first and second ranking crude oil producers, respectively. These refineries export their output and are, in a sense, an integral part of Venezuela's petroleum industry.

Exports of Venezuelan petroleum from Venezuela and the Netherlands Antilles by principal areas of destination during 1970–72 follow:

Destination	Exports (thousand 42-gallon barrels)		
	1970	1971	1972
Western Hemisphere:			
Canada	174,799	156,042	152,124
Puerto Rico	74,997	89,499	97,864
Trinidad and Tobago	51,768	26,215	14,533
United States	575,294	559,193	543,775
Other	174,989	172,078	160,932
Total	1,051,847	1,003,027	969,228
Eastern Hemisphere:			
Western Europe:			
European Community (EC)	73,859	55,901	49,014
Spain	18,820	13,926	12,854
United Kingdom	65,571	75,997	49,103
Other	31,260	28,329	25,339
Total	189,510	174,153	136,310
Other	24,583	20,861	23,186
Total	214,093	195,014	159,496
Grand total	1,265,940	1,198,041	1,128,724

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1970, 1971, 1972. Caracas, Venezuela, March 1971, March 1972, and March 1973.

Table 2.—Venezuela: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys:			
Unwrought	11,722	10,594	Colombia 8,804; Peru 1,569; France 100.
Semimanufactures	42	514	Colombia 503; Netherlands Antilles 5; Dominican Republic 5.
Copper metal, including alloys:			
Scrap	521	--	
Semimanufactures	15	9	Canada 5; Trinidad and Tobago 3.
Iron and steel:			
Ore and concentrate--thousand tons	21,089	19,162	United States 12,944; West Germany 2,287; United Kingdom 1,683.
Metal:			
Pig iron, ferroalloys, and similar materials	698	--	
Steel, primary forms	165,584	84,545	Mexico 36,074; Colombia 28,979; Argentina 17,102.
Semimanufactures	18,481	4,982	United States 2,022; Dominican Republic 1,270; Netherlands Antilles 582.
Zinc metal, including alloys:			
Unwrought	71	222	West Germany 109. France 113; mainly to Belgium-Luxembourg.
Semimanufactures		68	

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS			
Barite and witherite	2,531	138	All to Colombia.
Cement	204,653	311,865	Surinam 44,339; Guyana 43,378; Netherlands Antilles 42,605.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	129	2	All to West Germany.
Kaolin		102	All to Ecuador.
Other, n.e.s		249	Ecuador 128; Italy 121.
Products:			
Refractory	695	160	All to Ecuador.
Nonrefractory		83	Netherlands Antilles 53; Puerto Rico 30.
Gypsum and plasters	13,350	21,950	Trinidad and Tobago 19,750; Surinam 2,200.
Lime	24	7	Mainly to Netherlands Antilles.
Magnesite	6	--	
Precious and semiprecious stones, except diamond—kilograms	151	165	Netherlands 74; United States 69.
Salt	126,317	56,253	United States 36,443; Jamaica 10,160; Colombia 5,500.
Stone and sand:			
Dimension stone	493	1,107	Netherlands Antilles 854; Trinidad and Tobago 192.
Crushed and broken stone for cement and lime manufacture	NA	4,500	Mainly to Dominican Republic.
Sand	2,547	1,280	Colombia 552; Puerto Rico 455; Netherlands Antilles 273.
Sulfur:			
Elemental	NA	84,903	Trinidad and Tobago 43,824; Brazil 29,430; Colombia 5,864.
Sulfuric acid	NA	1,200	All to Dominican Republic.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	1,131	760	Ecuador 592; Chile 104.
Coal and coke, including briquets	2	--	
Natural gas liquids:			
Natural gasoline—thousand 42-gallon barrels	2,781	4,608	United States 2,942; Brazil 1,151.
Liquefied petroleum gas—do	r 7,631	12,440	United States 3,527; Brazil 2,300; Argentina 1,381.
Petroleum:			
Crude and partly refined—do	888,637	844,575	Netherlands Antilles 248,545; United States 146,689; Canada 122,846.
Refinery products:			
Gasoline—do	1,819	1,639	France 712; United Kingdom 241.
Naphtha—do	32,005	35,875	Puerto Rico 16,744; United States 11,428; United Kingdom 2,036.
Kerosine—do	150	--	
Jet fuel—do	24,425	13,353	United States 10,662; France 798; United Kingdom 713.
Distillate fuel oil—do	39,055	34,168	United States 14,879; Canada 3,380; Sweden 3,269.
Residual fuel oil—do	272,148	267,852	United States 215,598; Canada 14,846; Panama Canal Zone 6,613.
Lubricants—do	2,903	2,833	United Kingdom 1,476; Sweden 610; Peru 129.
Asphalt—do	2,557	3,492	United States 3,059; Dominican Republic 91; Costa Rica 72.
Other—do	2,707	2,112	Argentina 567; United Kingdom 307; Brazil 256.

r Revised. NA Not available.

Table 3.—Venezuela: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide (alumina) and hydroxide	45,285	31,015	Jamaica 15,450; United States 15,408.
Metal, including alloys:			
Unwrought	10	38	United States 23; United Kingdom 11.
Semimanufactures	2,763	3,420	United States 2,088; West Germany 444; France 220.
Antimony metal, including alloys, all forms	141	50	Belgium-Luxembourg 14; Turkey 11; Japan 11.
Arsenic trioxide, pentoxide and acids	54	74	West Germany 40; Belgium-Luxembourg 16; People's Republic of China 13.
Chromite	3,866	6,972	Finland 5,013; Philippines 1,020; United States 939.
Copper:			
Copper sulfate	38	209	West Germany 120; Belgium-Luxembourg 50; Colombia 25.
Metal, including alloys:			
Scrap	219	54	United States 30; Colombia 24.
Unwrought	118	724	West Germany 510; Belgium-Luxembourg 80; Chile 79.
Semimanufactures	6,611	6,986	United States 3,292; Canada 1,481; Chile 731.
Gold metal, worked or partly worked troy ounces	11,253	2,347	United States 1,318; West Germany 1,029.
Iron and steel:			
Ore and concentrate	24	30	All from United States.
Metal:			
Scrap	151,585	202,406	United States 193,824; Netherlands Antilles 7,027; Trinidad and Tobago 1,554.
Pig iron, ferroalloys, and similar materials	10,353	16,722	Brazil 10,300; Norway 2,904; Japan 1,928.
Steel, primary forms	6,467	9,824	West Germany 2,547; United States 2,217; Japan 2,038.
Semimanufactures:			
Bars, rods, angles, shapes, sections	30,825	34,193	Belgium-Luxembourg 10,952; West Germany 9,388; United States 6,107.
Universals, plates and sheets:			
Uncoated	293,582	317,200	Japan 296,469; United States 9,079; West Germany 4,953.
Coated	122,426	105,392	Japan 55,829; France 21,404; Canada 12,269.
Hoop and strip	3,310	3,493	Japan 1,101; United Kingdom 836; United States 602.
Rails and accessories	1,131	2,621	United States 2,554; Switzerland 29; Italy 15.
Wire	28,333	39,863	Japan 22,370; West Germany 6,070; Belgium-Luxembourg 4,602.
Tubes, pipes, and fittings	77,105	75,801	Japan 21,308; United States 19,669; France 8,748.
Other	r1,102	1,846	United States 1,064; West Germany 274; Japan 189.
Lead metal, including alloys, all forms	3,153	4,142	Mexico 2,789; Belgium-Luxembourg 474; United Kingdom 315.
Mercury 76-pound flasks	189	207	Mexico 82; United States 78; West Germany 22.
Nickel metal, including alloys, all forms	70	95	United States 46; West Germany 17; United Kingdom 11.
Platinum-group metals, including alloys, all forms troy ounces	1,640	3,022	West Germany 2,122; United States 579.
Silver metal, including alloys do	189,368	193,708	United States 75,297; West Germany 67,838; Italy 34,755.
Tin metal, including alloys, all forms long tons	167	183	United Kingdom 64; United States 35; Malaysia 14.
Titanium oxide	5,759	6,303	United Kingdom 1,824; Belgium-Luxembourg 1,415; Finland 896.
Zinc:			
Unwrought	7,713	9,727	Canada 4,525; Mexico 2,920; France 1,022.
Semimanufactures	1,280	189	United States 89; Japan 72; Belgium-Luxembourg 12.
Other:			
Ore and concentrate	267	400	United States 399.
Ash and residue containing nonferrous metals	218	31	Mainly from New Zealand.
Metals, including alloys, all forms	76	274	United States 85; United Kingdom 82; Norway 62.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	473	444	West Germany 261; Austria 122; Italy 38.
Grinding and polishing wheels and stones	NA	548	Italy 172; West Germany 117; Switzerland 99.
Asbestos	6,662	8,022	Canada 5,760; Brazil 52; United States 46.
Barite	20,656	8,929	Brazil 6,096; Canada 2,823.
Boron materials, salts	1,149	1,674	Belgium-Luxembourg 736; United Kingdom 474; United States 270.
Cement	1,006	1,062	West Germany 500; United States 319; France 222.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	14,411	11,774	Mainly from United States.
Fuller's earth	NA	176	United States 105; West Germany 71.
Kaolin	12,668	8,882	United States 8,594; United Kingdom 165; Spain 43.
Other clays and earth	15,816	12,446	United States 6,383; Guyana 5,800.
Products:			
Refractory (including nonclay bricks)	NA	3,150	United States 1,917; United Kingdom 535; Italy 498.
Nonrefractory	NA	463	Japan 146; Spain 140; Italy 108.
Cryolite and chiolite	871	631	United States 622; West Germany 8.
Diamond, industrial—thousand carats	65	5,050	All from United States.
Diatomite and other infusorial earth	2,646	2,373	United States 1,187; Mexico 1,139.
Feldspar	2,201	1,366	United States 1,338; Canada 28.
Fertilizer materials, manufactured:			
Nitrogenous	68,568	121,523	West Germany 76,415; Italy 22,157; Belgium-Luxembourg 11,106.
Phosphatic	14,234	19,153	Mainly from United States.
Potassic	26,918	32,396	United States 13,616; Spain 11,555; West Germany 7,225.
Other, including mixed	31,090	5,007	Mainly from Dominican Republic.
Fluorspar	1,685	4,293	Mexico 2,167; Other countries of Africa 2,096.
Graphite, natural	102	242	United States 173; West Germany 56.
Gypsum and plasters	208	357	West Germany 186; United States 112; United Kingdom 58.
Iodine	NA	5	United Kingdom 2.
Lime	NA	16	United States 15.
Magnesite	1,375	285	United States 283; Netherlands 2.
Mica:			
Crude, including splittings and waste	340	385	United States 354; West Germany 26.
Worked, including agglomerated splittings	NA	15	United States 12.
Pigments, mineral:			
Natural, crude—kilograms	NA	1,237	Italy 886; United States 332.
Iron oxides, processed	NA	149	United Kingdom 107; United States 34.
Precious and semiprecious stones, except diamond, natural and synthetic:			
Uncut—kilograms	NA	13	Japan 4; West Germany 2.
Cut—do	NA	309	Austria 67; Brazil 47; Italy 38.
Salt	32	32	United States 28; West Germany 3.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	63,642	28,558	United States 23,595; Spain 2,891.
Caustic potash, sodic and potassic peroxides		38,184	United States 37,492; United Kingdom 414.
Stone, sand and gravel:			
Dimension, crude and worked	4,021	5,189	Italy 2,314; Norway 1,613.
Gravel and crushed stone	46,365	43,976	United States 43,866.
Quartz	(1)	233	Sweden 121; France 104.
Sand	[1] 3,530	1,641	United States 1,531; France 83.
Sulfur:			
Elemental:			
Other than colloidal	26,052	15	Belgium-Luxembourg 10; West Germany 5.
Colloidal		22,838	Poland 22,018; Belgium-Luxembourg 438; United States 173.
Sulfuric acid	NA	43	West Germany 20; United States 6; United Kingdom 5.
Talc and steatite	10,120	7,904	United States 4,548; Italy 2,111; People's Republic of China 483.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Other nonmetals, n.e.s.:			
Crude:			
Vermiculite	r 425	488	United States 354; Japan 23.
Mineral substances, n.e.s	1,040	2,318	Canada 1,595; United States 497; Mexico 134.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	NA	2,921	United States 1,373; Japan 407; Denmark 368.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	195	50	United States 31; West Germany 17.
Carbon black	553	658	United States 453; Japan 117.
Coal, all grades, including briquets	28,761	74,815	Japan 72,752 ; United States 1,916; West Germany8 1.
Coke and semicoke of coal and of lignite	314,543	157,626	United States 92,724; Norway 26,000; Colombia 13,890.
Natural gas liquids:			
Natural gasoline—42-gallon barrels	--	961	All from United States.
Other—do	r 93	23	Mainly from Sweden.
Petroleum:			
Crude and partly refined—do	NA	14	Mainly from West Germany.
Refinery products:			
Gasoline—do	318,000	45,815	United States 35,657; United Kingdom 10,157.
Kerosine—do	(2)	853	Netherlands 620; United States 233.
Lubricants—do	35,000	39,520	United States 33,812; United Kingdom 2,421; Netherlands 2,016.
Mineral jelly and wax (including petrolatum)—do	13,000	32,031	United States 28,726; Netherlands 1,566; West Germany 952.
Other:			
Solvents—do	NA	157,661	United States 157,016.
Other—do	388,000	78,694	United States 74,158; Canada 2,716.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	499	10,976	United States 8,278; Puerto Rico 1,050; Colombia 1,042.

r Revised. NA Not available.
1 Quartz included with sand and gravel.
2 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—Work was in progress to increase the production capacity of Venezuela's only aluminum reduction plant from 25,000 tons per year to 45,000 tons per year. This plant, located at Matanzas just outside of Puerto Ordaz, is operated by Aluminio del Caroni, S.A. (ALCASA), a joint venture of Reynolds Metals Co. and Corporación Venezolana de Guayana (C.V.G.), a Venezuelan Government entity.

In June 1972, national responsibility for bauxite development was formally given to C.V.G. The area of most interest is in the State of Bolívar, in the Amacuro Delta Region. C.V.G. will have the task of exploring for bauxite, and it is likely that Reynolds Metals Co. will participate in this and later phases of the work.

Gold.—Rehabilitation of the El Callao mines in the State of Bolívar is to be carried out by Compañia General de Minería de Venezuela, C.A. (MINERVEN), a joint-venture company in which the Government and foreign private investors (probably the United Kingdom) each are to have 40% interest, and private local investors are to hold a 20% share. The El Callao workings were once the site of large-scale gold mining before rising costs resulted in the decline of operations during the late 1940's and the cessation of all significant activity in the early 1950's.

Fairway Explorations and Nor-Acme Gold Mines have completed the first phase of development work on their alluvial gold property in Venezuela. According to the project's consulting engineer, a 1.5- to 2.0-million-cubic-yard-per-year operation is viable. Inferred reserves have been reported at over 7.3 million cubic yards.

Iron and Steel.—Venezuela's iron ore production declined almost 9% during

1972. This decrease occurred largely as a result of the decline of world demand for iron ore during the first half of the year.

Almost all of the country's output was accounted for by the Orinoco Mining Co., a subsidiary of the United States Steel Corp., which produced 15.7 million tons, and Iron Mines Co. of Venezuela, a subsidiary of Bethlehem Steel Corp., which produced 1.7 million tons. The remaining 1.1 million tons of 1972 output was produced in conjunction with evaluation activities at the San Isidro deposits near Ciudad Piar. Most of the iron ore produced was exported, 68% of these shipments went to the United States. All domestic consumption was accounted for by Siderúrgica del Orinoco, S.A., (SIDOR), a subsidiary of the Government-owned C.V.G., which obtained the bulk of its ore supply from the San Isidro deposits.

Construction of Orinoco Mining's 1-million-ton-per-year iron ore briqueting plant was completed during the first half of 1972. The plant, at Puerto Ordaz, uses a natural gas reduction process to upgrade ore to 86.5% iron content. Full-scale production was expected to begin, after several trial runs, by early 1973.

During 1972 the Ministerio de Minas e Hidrocarburos continued its evaluation of the projected development of the San Isidro iron ore deposits. Plans being considered included construction of a 2.5-million-ton-per-year pelletizing plant adjacent to the mine. Indications were, that upon completion of its study, the Ministerio would reserve the exploitation and marketing phases of the project for itself but would call for State-private company joint venture bids for pellet plants or similar facilities.

During 1972 Orinoco Mining Co. began a program to expand its iron ore export capability by almost 50%. This program involves the installation of additional crushing facilities and a drying and screening plant in Puerto Ordaz as well as the accelerated development of the Altimara-Rondon concessions near the company's Cerro Bolívar mine. The new plant at Puerto Ordaz will have equipment for crushing ore to 1¼ inches in three steps and will utilize two natural gas-fired rotary dryers to reduce the moisture in the ore by about 5%. Accelerated development of the Cerro Altamura and Cerro Redondo sites requires the purchase and installation of additional mining equipment, the laying of 25 kilometers of railroad track, and the construction of a 5-kilometer access road.

Venezuela's output of pig iron was produced exclusively by SIDOR. This company also accounted for the bulk of the country's production of crude steel. The country's only other producer of crude steel was Siderúrgica Venezolana, S.A. (SIVENSA), a private company.

Nickel.—During 1972 the Government submitted a bill to Congress requesting authorization for the development of the nickel deposits at Loma de Hierro in the States of Aragua and Miranda. Exploitation would be by a mixed government-private industry entity in which the Government would have a 51% interest and the remaining 49% would be held by Société Le Nickel of France. Reserves at Loma de Hierro have been estimated at 38 million metric tons (dry) of laterite and serpentine ores with an average nickel content of 1.6%.

NONMETALS

Cement.—At yearend 1972, C.A. Venezolana De Cementos, Venezuela's largest cement producer, was in the process of constructing a fourth cement plant. This plant, scheduled for completion by mid-1973, will be automated and have an annual rated capacity of 5 million barrels. A deep-water berthing facility with high cargo loading capacity will be constructed adjacent to the plant. Up to 50% of the plants annual output will be exported to the United States under terms of a long-range agreement with the Ideal Cement Co.

Fertilizer Materials.—A new 600-ton-per-day ammonia plant and a 750-ton-per-day urea plant were completed during 1972 at the Morón petrochemicals complex of the Instituto Venezolano de Petroquimica (I.V.P.). Work was also in progress at Morón on facilities for the production of phosphoric acid and triple superphosphate in powder and granular form. The phosphatic rock feedstock for these I.V.P. facilities will be obtained from the Riecito phosphate mine in the State of Falcón where operations are being modernized and expanded.

Port facilities, first-stage power and steam generating facilities, and other civil

works construction were completed or nearing completion at the new El Tablazo petrochemicals complex at yearend 1972. Work was also nearing completion on the petrochemical fertilizer plant of Venezolana de Nitrogen (NITROVEN), a joint-venture firm owned 50% by I.V.P.; 40% by International Development and Investment, a United States and European consortium and 10% by Petroquímica Atlantico of Colombia. This plant is to have a capacity to produce 594,000 tons of ammonia and 792,000 tons of urea annually. Some of this plant's output has already been contracted for export to the United States, Brazil, and the People's Republic of China.

MINERAL FUELS

Coal.—Coal production during 1972 declined approximately 7% from the peak output of approximately 43,400 tons recorded in 1971. All production in 1972 was from the State of Táchira, and 75% of the total was accounted for by one company, C.A. Minas de Carbón de Lobatero.

Negotiations were in progress at yearend 1972 on a project to reopen the Naricual coal mines. The project is to be carried out by Corporación Desarrollo de la Region Nororiental (CORPORIENTE) with the assistance of private national and/or foreign capital. Plans call for development of an annual mine output capacity of at least 450,000 tons, primarily by the installation of mechanized mining equipment. A coking plant with a minimum capacity of 350,000 tons per year is also to be constructed. The output of this plant would be used primarily to supply the coke requirements of SIDOR's iron and steel mill at Ciudad Guayana.

At yearend 1972, plans for the development of the Guasare coal deposits in the State of Zulia were also in progress. Exploration and exploitation rights to these deposits were assigned to Corporación Desarrollo de la Region Zuliana (CORPOZULIA), which was negotiating with private interests for the formation of a joint-venture organization. Production from the Guasare deposits initially would be destined for export.

Petroleum and Natural Gas.—Venezuela's output of crude oil declined 9% to 3,220,000 barrels per day during 1972. Medium crudes (22.1° to 30° API) accounted for approximately 40% of total production, light crudes (over 30° API) 37%, and heavy crudes (under 21.1° API) 23%. Companies owned by U.S. firms produced almost 73% of the total with Creole Petroleum Corp., a subsidiary of Exxon Corp., alone accounting for 43%.

Natural gas production, approximately 99% of which was from oilfields, declined more than 3% to 4,440 million cubic feet per day in 1972. The output of natural gas liquids rose 23% to 81,000 barrels per day in conjunction with a large increase in the capacity of the natural gas processing facilities in the Lake Maracaibo area.

Table 4.—Venezuela: Salient statistics of the petroleum and natural gas industry

		1970	1971	1972 p
Crude oil:				
Production	thousand 42-gallon barrels	1,353,420	1,295,406	1,178,487
Processed at refineries	do	471,709	454,799	411,828
Exports [1]	do	888,637	844,575	780,471
Natural gas:				
Production	million cubic feet	1,710,200	1,680,252	1,625,196
Sales	do	136,528	134,480	142,884
Producers' fuel	do	180,989	196,281	185,792
Shrinkage due to extraction of natural gas liquids	do	31,113	37,469	59,047
Field injection	do	710,220	741,121	724,452
Flared or otherwise lost	do	651,350	570,901	513,021
Natural gas liquids:				
Production	thousand 42-gallon barrels	16,922	24,000	29,498
Exports	do	10,412	17,048	21,806
Refinery products:				
Refinery output [2]	do	470,864	452,536	412,663
Consumption	do	54,105	r 57,768	64,380
International bunkers	do	19,036	r 19,196	18,617
Exports	do	377,769	361,324	352,291

p Preliminary. r Revised.
[1] Includes refined or partly refined products blended with crude oil.
[2] Includes refinery fuel.

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1970, 1971, 1972. Caracas, Venezuela, March 1971, March 1972, and March 1973.

Following a 6-year decline, proved reserves of crude oil increased 111 million barrels to a reported total of 13,872 million barrels at yearend 1972. Natural gas reserves, as of the same date, totaled 41,134 billion cubic feet, 2,701 billion cubic feet greater than the revised 1971 yearend figure. Almost 81% of total proved gas reserves at the end of 1972 was accounted for by dissolved and associated gas; only 9% was nonassociated. The increase in crude oil and natural gas reserves resulted primarily from an upward revaluation of C.V.P.'s producing fields and the discovery, by the same company, of nonassociated gas in the central part of the State of Guarico.

Geologic and geophysical exploration and exploratory development, and injection drilling activities follow:

	1970	1971	1972
Geologic and geophysical exploration:			
Geologic surveying---party months	6.7	--	--
Gravimetric surveying---do	.4	--	3.0
Magnetic surveying---do	.4	.3	--
Seismic surveying---do	11.7	23.3	33.0
Structural drilling---do	11.9	9.7	5.2
Total---do	31.1	33.3	41.2
Drilling:			
Wells drilled:			
Exploratory:			
Oil [1]---number	64	137	117
Dry---do	38	29	53
Total exploratory wells---do	102	166	170
Development:			
Oil---do	513	424	318
Dry---do	5	12	11
Total development wells---do	518	436	329
Injection---do	12	2	27
Total wells drilled---do	632	604	526
Footage drilled---thousand feet	r 3,995	r 4,115	3,585

r Revised.
[1] May include wells which discovered both crude oil and nonassociated natural gas in separate zones.

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1970, 1971, and 1972. Caracas, Venezuelas, March 1971, March 1972, and March 1973.

During 1972 C.V.P. initiated an exploratory drilling program in the La Vela inlet between the Paraguana Peninsula and the Netherlands Antilles Island of Aruba. Shows of oil and gas were discovered in one of the three wells drilled in connection with this program. A fourth well was being drilled at yearend.

C.V.P. continued its exploratory activity in the Orinoco heavy oil belt. Included in these activities were seismic reflection surveys in the northern part of the area. Plans were announced at yearend to perform additional seismic surveying and drill 14 stratigraphic tests in order to obtain geologic information on the southern part of the belt.

The Orinoco heavy oil belt, which has not been fully explored, is estimated to contain 700 billion barrels of oil in place. A recovery rate of 10% has been estimated for this type of deposit. Pay zones in the heavy oil belt are in sand reservoirs at depths ranging from 1,000 to 4,000 feet, and the gravity of the oil ranges from 6° to 14° API. A typical crude from the area has a sulfur content of almost 4% and a vanadium content in excess of 450 parts per million.

There was considerable exploratory activity during 1972 in the service contract areas held by Occidental Petroleum Corp., Shell Sur del Lago, C.A. (Surco), and Mobil de Maracaibo. These areas cover approximately 250,000 hectares assigned to C.V.P. in the southern part of Lake Maracaibo. An exploratory well drilled by Occidental Petroleum, which holds 60% of the total area covered by the service contracts, discovered oil and gas, but additional drilling will be required to evaluate the extent of the reserves involved. All exploratory

wells drilled by Surco and Mobil de Maracaibo were dry holes, and both companies suspended drilling activities during the latter part of the year. The stoppage was to allow a revaluation of the companies' drilling programs based on the geologic data derived from the wells already drilled in the service contract areas.

The capacity of natural gas injection facilities in operation declined 42 million cubic feet daily to a total of 3,808 million cubic feet in 1972. Gas injection during the year was at an average rate of 2,012 million cubic feet daily. Water injection capacity was raised 488,000 barrels per day to a total 2,859,000 barrels per day by yearend 1972; the average injection rate during the year was 2,229,000 barrels per day.

Refinery output averaged 1,127,000 barrels per day during 1972, down 9% from that of 1971. This decline occurred in conjunction with a decrease in refined products exported. Venezuela's refineries processed approximately 35% of the country's crude oil output in 1972, the same as in the previous year.

A fifth atmospheric distillation unit was placed onstream at the Amuay refinery of Creole Petroleum Corp. during 1972. The addition of this unit increased the refinery's throughput capacity by about 40% to 630,000 barrels per day. Expansion of the plants desulfurization facilities are planned.

Design work for the C.V.P. refinery to be located near Puerto La Cruz was completed during 1972 by J. F. Pritchard and Co. of Kansas City, Missouri. However, a call for bids to construct this proposed 120,000-barrel-per-day plant were delayed pending the completion of negotiations for feedstock supply. C.V.P. needs to acquire oil from private companies not only to supplement that available from its own fields but also because C.V.P. crude oil is heavy and must be blended with lighter oil in order to achieve the average 25° API input for which the new refinery has been designed.

The total length of crude oil pipelines in service increased 83 kilometers during 1972, but the length of refined product and natural gas lines remained the same. Data on the length of pipelines in operation at yearend 1972 follow:

Type of line	Total length (kilometers)
Crude oil:	
Trunk	3,359
Secondary	2,816
Total crude oil	6,175
Refined products	512
Natural gas	2,900
Grand total	9,587

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1972. Caracas, Venezuela, March 1973.

A total of 15 petroleum tanker terminals were active in the exportation of crude oil and refined products during 1972. Of these, the three operated by Creole Petroleum Corp. accounted for 41% of all shipments and the three operated by Cia. Shell de Venezuela, Ltd., loaded 30% of the total.

Several petrochemical projects in addition to those summarized previously under "Fertilizer Materials" were completed, under construction, or in the planning stage during 1972. A program to expand the capacity of the 3,000-metric-ton-per-year phthalic anhydride plant at Valencia to 10,000 tons annually was completed. This plant is operated by Oxidaciones Organica, which is owned by the Montana Group, comprised of Venezuelan investors; Sherwin-William Co.; and I.V.P.

A 12,000-ton-per-year polystyrene plant was under construction at the El Tablazo petrochemicals complex at yearend 1972. This plant, which is to be operated by Estireno del Zulia (I.V.P., Grupo Del Zulia, C.A., and Dart Industries of the United States), was scheduled for completion during the first half of 1973.

During 1972 work commenced on the contracts signed previously by I.V.P. for the design, engineering, and construction of olefins and chloro-soda plants at El Tablazo. The contract covering the olefins plant was the responsibility of M. W. Kellog Co. and that for the chloro-soda plant was with Oronzio de Nora of Italy. The latter plant is to have a capacity of 35,000 tons of chlorine and 39,200 tons of caustic soda per year. Both plants are scheduled for completion during 1974.

Other petrochemical plants to be located at El Tablazo were in the planning stage at yearend 1972. Details were being negoti-

ated for the construction of a 50,000-ton-per-year, low-density polyethylene plant by Polimeros del Lago (I.V.P., Grupo Zuliano, and Ethylene Plastique of France). Another joint venture under consideration for El Tablazo was a plant for the annual production of 50,000 tons of vinyl chloride monomer and 20,000 tons of polyvinyl chloride. This installation would by operated by Plásticos Petroquímica, C.A., a joint venture involving I.V.P., local investors, and B. F. Goodrich Co.

Construction was initiated during 1972 on a 6,000-ton-per-year fluoromethane plant at the Morón pethrochemicals complex. This plant is to be operated by Productos Halogenos de Venezuela, C.A., a joint venture involving Ugine Kuhlmann and I.V.P. Completion of the project was scheduled for 1974.

Table 5.—Venezuela: Distribution of landholdings, crude oil production, and refining capacity, by company, 1972

Company	Principal ownership or affiliation	Nationality of ownership	Concessions [1] and assignations [2] as of Dec. 31, 1972 (hectares)	Crude oil production (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1972 (thousand 42-gallon barrels daily)
PRIVATE					
Amoco Venezuelan Oil Co.	Standard Oil Co. (Indiana).	United States	5,500	11,739	--
Caracas Petroleum, S.A.	Ultramar Co., Ltd.	British	29,883	2,467	--
Charter Venezuelan Petroleum Co.	Charter Oil Co.	United States	7,000	4,899	--
Chevron Oil Co. de Venezuela, S.A.	Standard Oil Co. of Calif.	do.	77,863	14,421	62
Cía. Shell de Venezuela, Ltd.	Royal Dutch/Shell Group.	British/Dutch	295,680	293,879	404
Continental Oil Co. of Venezuela.	Continental Oil Co.	United States	797	4,425	--
Coro Petroleum Co.	Texaco, Inc.	do.	70,865	2,648	--
Creole Petroleum Corp.	Exxon Corp.	do.	580,262	507,740	740
International Petroleum (Venezuela), Ltd.	do.	do.	6,133	--	--
Mene Grande Oil Co., C.A.	Gulf Oil Corp.	do.	593,748	144,120	--
Mito Juan Concesionaria de Hidrocarburos, C.A.	Venezuelan investors	Venezuelan	33,775	1,111	--
Mobil Oil de Venezuela	Mobil Oil Corp.	United States	144,054	34,960	106
Phillips Petroleum Co.	Phillips Petroleum Co.	do.	39,447	14,402	4
Sinclair Venezuelan Oil Co.	Atlantic Richfield Co.	do.	39,082	12,182	45
Sociedad Anónima Petrolera Las Mercedes.	Texaco, Inc., and Ultramar Co., Ltd.	United States/ British.	63,026	602	--
Taloń Petroleum Co., C.A.	Kirby Petroleum Co.	United States	60,167	1,149	--
Texaco Maracaibo, Inc.	Texaco, Inc.	do.	3,147	19,128	--
Texas Petroleum Co.	do.	do.	118,919	16,931	10
Venezuelan Atlantic Refining Co.	Atlantic Richfield Co.	do.	19,337	5	--
Venezuelan Gulf Refining Co.	Gulf Oil Corp.	do.	--	--	159
Venezuelan Sun Oil Co.	Sun Oil Co.	do.	20,000	68,832	--
Total private companies			2,208,685	1,155,640	1,530
VENEZUELAN GOVERNMENT					
Corporación Venezolana de Petróleo (C.V.P.)			1,179,338	22,847	25
Grand total			3,388,023	1,178,487	1,555

[1] To private companies.
[2] To the Government.

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1972, Caracas, Venezuela, March 1973.

The Mineral Industry of Yugoslavia

By Roman V. Sondermayer [1]

As in the past, Yugoslavia produced a large variety of minerals and mineral products and remained one of the leading European producers of nonferrous metals. However, because of declining production of antimony, chromite, lead, and zinc, the relative position of the country shifted slightly downward among European mineral producers. Among the nonferrous metals, only bauxite, copper and its byproducts, lead and zinc with their byproducts, and mercury were of world significance. Iron and steel output continued below demand. Consequently, imports of large quantities of iron and steel semimanufactures were required. The country's crude oil output was minor by world standards but ranked fourth after the U.S.S.R., Romania, and the Federal Republic of Germany in Europe. Output of crude oil was inadequate, and about 62% of refinery throughput was imported. Coal production, mostly lignite and brown coal, remained at the 1971 level; imports of high-rank coals and coke were a necessity. A power shortage adversely influenced mineral production during 1972.

There was a number of new mineral developments during 1972. Agreements were concluded with the U.S.S.R. and Hungary for alumina plants to be located near Zvornik in Bosnia and at Obrovac in Dalmacia, respectively. Alumina and aluminum production started at Titograd in Crna Gora (Montenegro). Construction continued on an aluminum plant at Šibenik and on alumina facilities near Mostar, Bosnia-Hercegovina. Production of agglomerate and sulfuric acid began at the lead and zinc plant at Titov Veles, Macedonia. A new electric steel facility went into production at the Skopje Steel Works, Macedonia. Crude oil production commenced at the Beničanci oilfield in eastern Croatia.

After long delays, the Federal Assembly approved the new Yugoslav 5-year plan (1971–75) on June 29, 1972. Basic goals of the plan were reported as follows:

1. Production and consumption of energy during the 5-year period will increase at an annual growth rate ranging from 10.8% to 11.6%, and the planned goal for power production in 1975 will range between 43.5 billion and 45 billion kilowatt hours.

2. Coal production should reach an annual output of 38 million to 40 million metric tons by 1975. The annual rate of growth for coal output was planned at 5.9% to 7.0%. Increased coal production will be based on more rapid development of modern highly productive open pit lignite mines. Thermal powerplants will be located at the mines.

3. Projected crude oil production of 4.5 million tons per year by 1975 indicates a growth rate of 9.6% per year. However, the target oil production is considerably lower than the projected consumption of petroleum refinery products, which is expected to reach 13 million tons in 1975. Imports of 8.5 million tons of crude oil were planned. Completion of a large gas distributing network was also part of the projection for 1975.

4. Ferrous metal production facilities will be expanded to reach an annual output of 4.5 million to 5 million tons. This goal should provide a better basis for domestic metal products manufacturing. The projected production for 1975 should be sufficient to meet at least 70% of estimated domestic demand.

5. Plans call for production of 150,000 to 200,000 tons of aluminum, 115,000 to 135,000 tons of copper, 150,000 to 160,000 tons of lead, and 95,000 to 100,000 tons of smelter zinc by 1975. New projects for re-

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

covery of byproduct metals were planned. In addition, new facilities for production of nickel should become operational at the end of the period.

6. Cement output should reach an annual production of 8 million to 9 million tons. Output of other nonmetallics should increase. Emphasis will be on modernization and expansion of existing nonmetallic facilities.

PRODUCTION

Mineral producers continued to direct their efforts toward better utilization of existing facilities rather than construction of new plants. Although investments in expanding and renovating processing facilities were predominant, a shift in channeling available capital toward mine expansion was apparent. The shortage of ores and concentrates forced the change. Mechanization and automation in both mining and processing continued during 1972. Most of the modern equipment was installed at new mines.

Productivity per man-shift of Yugoslav miners remained lower than the average productivity of miners in Western Europe. Labor shortages continued at mines. Working conditions and low pay were cited as main reasons for labor desertion from mines.

Modern and efficient methods prevailed in petroleum exploration, production, and refining. All three primary methods of oil production, flowing, pumping, and gas lift, were used; dual completion was used at some wells in the country; and secondary recovery was employed at some older fields. Chemical and hydraulic methods for stimulating gas and oil production were everyday practices in the oilfields of Yugoslavia during 1972.

Table 1.—Yugloslavia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
METALS			
Aluminum:			
Bauxite, gross weight—thousand tons	[r] 2,098	1,958	2,197
Alumina, gross weight	125,129	123,370	126,027
Ingot, including secondary	47,738	46,584	72,716
Antimony:			
Mine output, metal content	[r] 1,999	2,002	1,975
Metal (regulus)	1,967	1,381	1,744
Bismuth, smelter output	75	92	89
Cadmium, smelter output [e]	150	140	140
Chromium, chromite, gross weight	40,565	34,319	28,137
Copper:			
Mine output, metal content	90,808	94,392	103,132
Blister:			
Primary	105,901	111,304	149,047
Secondary	1,902	1,937	1,464
Refined (electrolytic):			
Primary	86,837	90,501	128,611
Secondary	2,450	2,075	1,363
Gold—troy ounces	97,384	123,780	136,898
Iron and steel:			
Iron ore and concentrate—thousand tons	3,694	3,724	3,960
Pig iron—do	[r] 1,274	1,514	1,819
Ferroalloys, all types—do	102	116	131
Crude steel—do	2,228	2,453	2,588
Semimanufactures—do	1,774	1,865	1,929
Lead:			
Mine output, metal content	126,693	124,347	120,173
Metal:			
Smelter, crude, including secondary	112,232	118,748	102,164
Refined, including secondary	97,399	99,139	87,496
Manganese ore and concentrate, gross weight	14,785	16,113	15,340
Mercury—76-pound flasks	15,461	16,593	16,419
Selenium, elemental—kilograms	16,000	24,320	40,880
Silver, refined, including secondary—thousand troy ounces	3,417	3,354	3,582
Zinc:			
Mine output, metal content	101,145	98,694	96,731
Smelter, including secondary	65,023	53,109	48,641

See footnotes at end of table.

Table 1.—Yugloslavia: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1970	1971	1972 [p]
NONMETALS			
Asbestos	12,104	15,432	11,040
Barite	79,729	64,690	70,528
Cement, hydraulic—thousand tons	4,399	4,954	5,751
Clays:			
Crude fire clay	292,070	282,503	335,604
Calcined fire clay	88,370	69,726	95,750
Feldspar, crude	49,504	53,617	48,335
Fertilizer materials, manufactured:			
Nitrogenous:			
Gross weight—thousand tons	r 1,188	1,316	1,371
Nitrogen content—do	r 238	263	274
Phosphatic:			
Gross weight—do	r 761	834	798
Phosphorous pentoxide content—do	r 126	138	132
Gypsum:			
Crude	250,619	250,241	270,532
Calcined	66,010	76,564	82,064
Lime:			
Quicklime—thousand tons	1,078	1,070	1,128
Hydrated—do	r 429	521	585
Magnesite:			
Crude	r 511,853	492,716	421,674
Sintered	r 210,310	202,231	149,335
Mica, all grades	227	554	126
Pyrite concentrate:			
Gross weight	354,900	276,084	230,806
Sulfur content [e]	149,058	115,955	96,939
Quartz, quartzite, glass sand	r 982	1,065	1,114
Salt:			
Marine	23,510	53,715	8,654
From brines	r 2 146,683	2 212,013	2 180,206
Rock	84,625	85,531	79,346
Total	r 254,818	351,259	268,206
Sand and gravel—thousand cubic meters	7,713	8,457	9,493
Stone:			
Dimension:			
Crude:			
Ornamental—do	39	42	42
Other—do	r 7	7	12
Partly worked facing stone—thousand square meters	485	529	629
Cobblestones, curbstones, others—thousand cubic meters	51	55	38
Crushed and broken—do	6,067	6,782	6,636
Milled marble and other—do	1,862	2,608	2,596
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	13,469	15,685	13,035
Coal:			
Bituminous—thousand tons	643	707	599
Brown—do	8,989	9,333	9,184
Lignite—do	18,790	20,862	21,157
Total—do	28,422	30,902	30,940
Coke:			
Metallurgical—do	1,226	1,229	1,226
Breeze—do	83	68	73
Total—do	1,309	1,297	1,299
Fuel briquets, all grades	21,312	26,526	7,063
Gas:			
Manufactured (city gas only)—million cubic feet	r 3,457	5,961	6,697
Natural, gross production—do	34,502	40,647	43,861
Natural gas liquids and liquefied petroleum gas: [3]			
Propane and butane—thousand 42-gallon barrels	1,103	1,217	2,280
Natural gasoline and pentane—do	209	238	237
Petroleum:			
Crude oil:			
As reported—thousand tons	2,854	2,961	3,200
Converted [e]—thousand 42-gallon barrels	21,140	21,932	23,702

See footnotes at end of table.

Table 1.—Yugoslavia: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]		1970	1971	1972 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued				
Petroleum—Continued				
Refinery products: [4]				
Gasoline	thousand 42-gallon barrels	[r] 10,472	12,512	11,849
Jet fuel	do	[r] 1,211	1,634	1,617
Kerosine	do	[r] 92	81	73
Distillate fuel oil	do	[r] 15,599	19,881	18,613
Residual fuel oil	do	16,710	19,514	19,907
Lubricants	do	[r] 729	808	863
Asphalt and bitumen	do	[r] 2,169	2,279	2,230
Other	do	[r] 408	471	491
Refinery fuel and losses	do	[r] 1,900	1,946	2,147
Total	do	49,290	59,126	57,790

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

[1] In addition to the commodities listed, germanium, clays (bentonite, kaolin, common) and diatomite are also produced, but information is inadequate to make reliable estimates of output levels.

[2] Includes vacuum salt.

[3] Apparently includes both natural gas liquids derived from gasfields and liquefied petroleum gas from petroleum refineries.

[4] Liquefied petroleum gas produced from refineries is reported under natural gas liquids (together with those materials actually derived from natural gas) and also is included here among refinery fuels and losses. The manner in which data is presented in available sources precludes avoiding this double counting. Reported refinery output has been converted from metric tons to barrels by multiplying the reported metric ton figures by the following factors: gasoline—8.5; jet fuel—8.0; kerosine—7.75; distillate fuel oil—7.46; residual fuel oil—6.66; lubricating oils—7.0; greases—6.3; asphalt—6.06; white spirit (included in other)—8.5; paraffin (included in other)—7.87; and petroleum coke (included in other)—5.5.

TRADE

During 1971, the latest year for which data are available, Yugoslavia's mineral trade was diversified and many commodities were exported to and imported from a large number of countries. Exports consisted mostly of nonferrous metals and related products. West Germany was again the principal purchaser of Yugoslav products. Imports included bituminous coal, crude oil, and iron and steel semimanufactured products. The largest source of mineral imports remained the U.S.S.R.

Table 2.—Yugoslavia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrates thousand tons	2,032	1,883	West Germany 696; U.S.S.R. 585; Italy 242.
Oxide and hydroxide	28,198	23,761	Austria 13,033; West Germany 7,823.
Metal, including alloys:			
Scrap	3,785	4,742	Italy 2,095; West Germany 1,995.
Unwrought	15,780	13,203	Italy 3,211; People's Republic of China 2,000.
Semimanufactures	25,086	30,564	United States 4,966; Poland 4,227; West Germany 4,172.
Antimony regulus	1,259	1,500	U.S.S.R. 920; United Kingdom 410; United States 100.
Arsenic, trioxide	222	81	Pakistan 51; Netherlands 30.
Bismuth, including alloys, all forms	47	11	United Kingdom 8; Netherlands 3.
Chromium, chromite concentrates	11,327	11,582	East Germany 6,076; Czechoslovakia 5,244.
Copper, including alloys:			
Scrap	422	249	All to Italy.
Unwrought	27,812	46,296	United Kingdom 26,836; France 9,700; United States 4,434.
Semimanufactures	48,052	57,451	United States 13,906; United Kingdom 13,458; U.S.S.R. 6,258.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Iron and steel:			
Ores and concentrates, except roasted pyrites	r 178,864	121,041	Romania 120,390.
Roasted pyrites	84	63	All to Austria.
Scrap	23,016	22,723	Italy 17,084; West Germany 4,032; Switzerland 1,079.
Pig iron, ferroalloys, similar materials	48,064	42,666	United States 12,755; Italy 8,224; Poland 4,952.
Steel, primary forms	15,194	1,754	Italy 912; Hungary 699.
Steel semimanufactures:			
Bars, rods, angles, shapes, sections	115,341	86,075	U.S.S.R. 57,039; Romania 7,572; Bulgaria 5,995.
Universals, plates, sheets	59,819	36,888	U.S.S.R. 12,784; Bulgaria 8,851; Czechoslovakia 6,993.
Hoop and strip	12,401	2,167	Romania 1,208; Italy 864.
Rails and accessories	32,913	45,312	Romania 35,478; Bulgaria 9,732.
Wire (excluding wire rods)	4,444	327	United States 225; Romania 55; Czechoslovakia 20.
Tubes, pipes, fittings	82,851	76,916	Czechoslovakia 10,352; East Germany 8,278; West Germany 5,906.
Castings and forgings, rough	12,342	8,391	Poland 2,161; West Germany 2,029; Hungary 675.
Total	320,111	256,076	
Lead:			
Ores and concentrates	11,833	12,580	Romania 7,626; Greece 4,383.
Oxides	640	50	Czechoslovakia 50.
Metal, including alloys:			
Unwrought	56,086	50,553	U.S.S.R. 20,833; Austria 9,956; United States 7,810.
Semimanufactures	718	222	Libya 76; Kuwait 72; Austria 35.
Mercury—76-pound flasks	13,930	493	United States 194; Greece 106; West Germany 55.
Nickel, including alloys, all forms	112	143	Austria 86; Poland 57.
Platinum-group metals, including alloys, all forms, palladium—troy ounces	23,149	514	West Germany 386; Austria 128.
Selenium, elemental—kilograms	14,544	30,212	West Germany 21,850; Greece 8,000.
Silicon	5,707	6,786	Romania 1,541; United Kingdom 1,521; West Germany 1,294.
Silver, including alloys—thousand troy ounces	3,242	2,904	West Germany 1,929; United Kingdom 588.
Tin, including alloys, all forms—long tons	45	(1)	NA.
Zinc:			
Ores and concentrates	27,023	57,782	Bulgaria 51,483; West Germany 4,815; Italy 800.
Oxide	1,049	625	Hungary 330; East Germany 200.
Metal, including alloys:			
Unwrought	23,296	20,179	Italy 9,718; Czechoslovakia 8,714; Greece 1,343.
Semimanufactures	13,358	9,445	West Germany 3,019; Denmark 2,241; France 1,756.
Other:			
Ores and concentrates	3,091	--	
Ash and residue containing nonferrous metals	7,719	6,635	Italy 2,605; West Germany 2,274; Austria 963.
Metals, n.e.s	1	--	
NONMETALS			
Abrasives, natural, grinding and polishing wheels and stones	1,936	1,491	Austria 985; Italy 245; West Germany 167.
Asbestos	4,741	1,403	United States 765; West Germany 638.
Barite and witherite	42,755	46,176	U.S.S.R. 22,965; Hungary 15,488; Albania 1,987.
Cement, hydraulic	29,438	9,374	United States 2,801; Austria 1,897; Italy 1,047.
Chalk	16	6	Czechoslovakia 3; East Germany 3.
Clays and products:			
Crude:			
Bentonite	21,590	23,413	Czechoslovakia 9,414; Poland 6,014; East Germany 5,172.
Fire	29,525	25,323	Italy 17,358; Hungary 5,978; Greece 1,289.
Kaolin	31	169	Romania 167; Czechoslovakia 2.
Other	349	1,963	Italy 1,599; Greece 305; West Germany 49.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Clays and products—Continued			
Products (including all refractory brick):			
Refractory	69,944	71,440	West Germany 36,274; Romania 11,736; Poland 5,759.
Nonrefractory	6,931	1,246	Hungary 1,018.
Diatomaceous earth	619	244	Greece 145; East Germany 59; Czechoslovakia 30.
Feldspar	16,840	17,348	East Germany 4,989; Hungary 4,849; Czechoslovakia 2,461.
Fertilizer materials, manufactured:			
Nitrogenous	8,350	42,136	Belgium-Luxembourg 21,184; West Germany 18,880.
Phosphatic	33,128	97,491	U.S.S.R. 46,752; Bulgaria 38,113; Hungary 12,425.
Other including mixed	23,645	231,469	Hungary 127,523; Italy 45,192; West Germany 31,440.
Ammonia	1	1	All to Pakistan.
Gypsum and plaster	10,954	186	Bulgaria 99; Libya 76; Czechoslovakia 11.
Iodine	2	2	All to Austria.
Lime	19,780	155	Hungary 129; Bulgaria 19.
Magnesite:			
Raw	1,595	928	All to Italy.
Calcined	7,917	359	East Germany 140; Italy 99; Poland 80.
Sintered	97,512	42,328	Poland 19,289; Italy 13,056; West Germany 2,377.
Pigments, mineral, natural, crude	--	3	All to Czechoslovakia.
Pyrites, gross weight	51,533	78,384	West Germany 51,944; Greece 15,115.
Salt	102	50	All to Hungary.
Sodium and potassium compounds, n.e.s.	26,563	7,879	Italy 3,685; Turkey 2,095; Czechoslovakia 1,249.
Stone, sand and gravel:			
Dimension, crude, partly worked	52,944	81,491	Italy 69,154; West Germany 5,588; Japan 2,746.
Gravel and crushed stone	19,687	3,210	West Germany 810; Italy 756; United Kingdom 707.
Limestone	15	252	Hungary 232.
Quartz and quartzite	12,322	13,871	West Germany 10,251; Austria 3,241.
Sand excluding metal bearing	585	215	Libya 133; Austria 43; Italy 20.
Sulfur:			
Elemental, all forms	624	2,265	Romania 2,210.
Sulfur dioxide	87	62	All to Hungary.
Sulfuric acid	41,084	27,316	Greece 13,306; Italy 6,148; Switzerland 4,379.
Talc, steatite, soapstone, pyrophyllite	--	344	All to Albania.
Other:			
Slag, dross, and similar waste not metal bearing:			
From iron and steel manufacture	453	29	All to Austria.
Slag and ash n.e.s.	204	191	All to Italy.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	288	--	
Carbon black and gas carbon:			
Carbon black	596	325	All to Poland.
Gas carbon	208	18	Do.
Coal:			
Bituminous coal	2,296	3,840	Italy 2,000; Malta 800.
Coal dust	62,140	13,740	Italy 13,700; Austria 40.
Brown coal	35,623	108,832	Austria 58,332; West Germany 50,001.
Lignite	129,743	105,872	Italy 59,388; Austria 27,490.
Coke and semicoke	132,177	279,897	Italy 80,747; West Germany 77,090; Poland 44,074.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	568	1,385	Italy 621; Austria 518; Greece 245.
Refinery products:			
Gasoline, including natural do.	1,131	9,272	Netherlands 552; Austria 385.
Kerosine and jet fuels do.	241	138	United Kingdom 73; West Germany 12; Austria 11.
Distillate fuel oil do.	938	730	Italy 466; West Germany 164.
Residual fuel oil do.	1,005	814	Italy 384; Austria 158; Israel 84.
Lubricants do.	10	43	Czechoslovakia 29; Austria 13.
Other do.	507	191	West Germany 139; Italy 17.
Total do.	3,832	11,188	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemical	--	840	West Germany 783; Italy 57.

r Revised. NA Not available.
1 Less than ½ unit.

Table 3.—Yugoslavia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrates thousand tons	258	246	Australia 219.
Oxide and hydroxide	6,472	1,019	France 996.
Metal, including alloys:			
Scrap	12	586	All from Bulgaria.
Unwrought	68,615	38,805	U.S.S.R. 20,563; United States 8,485.
Semimanufactures	18,458	15,105	West Germany 4,175; France 2,731; Austria 2,163.
Antimony:			
Ore and concentrate	1,939	87	All from Austria.
Metal, including alloys, all forms	16	71	United Kingdom 35; Austria 20.
Arsenic:			
Oxide	58	85	Austria 80; West Germany 5.
Metal and alloys, all forms	7	18	West Germany 9; Sweden 9.
Beryllium, including alloys, all forms kilograms	507	161	All from West Germany.
Bismuth, including alloys, all forms	21	13	Japan 6; United Kingdom 4.
Cadmium kilograms	2,797	61,428	West Germany 45,430; United Kingdom 10,000.
Chromium:			
Chromite, gross weight	68,472	86,163	Albania 68,730; Iran 6,597; Turkey 5,577.
Oxide, hydroxide and chromic acid anhydrous	699	1,203	U.S.S.R. 818; West Germany 341.
Metal, including alloys, all forms	5	10	United Kingdom 5; Italy 4.
Cobalt:			
Oxide and hydroxide	34	72	Austria 50; United Kingdom 6; Netherlands 6.
Metal, including alloys, all forms	57	46	Belgium-Luxembourg 28; Zambia 10.
Columbium and tantalum, tantalum including alloys, all forms kilograms	472	--	
Copper:			
Ore and concentrates	2,744	--	
Copper sulfate	1,812	1,102	U.S.S.R. 1,100.
Metal, including alloys:			
Scrap	2,123	1,060	United States 755; Belgium-Luxembourg 160.
Unwrought:			
Blister and other unrefined unalloyed	12,397	19,045	Zambia 9,837; United Kingdom 8,954.
Refined and alloys	39,635	45,695	United Kingdom 27,296; Zambia 8,258; Chile 5,246.
Semimanufactures	11,348	18,101	United Kingdom 6,244; West Germany 5,419.
Germanium, including alloys, all forms kilograms	6	--	
Iron and steel:			
Ore and concentrate	211,556	194,978	India 190,555.
Scrap	146,727	250,625	United States 79,445; U.S.S.R. 64,920.
Pig iron, including cast iron	171,535	203,690	India 79,298; U.S.S.R. 69,480.
Sponge iron, powder and shot	1,342	1,671	Sweden 1,247; Italy 219.
Ferroalloys:			
Ferromanganese	568	1,190	Italy 1,030; West Germany 151.
Other	3,162	4,638	West Germany 3,023; Switzerland 433.
Steel, primary forms:			
Blooms, billets, slabs	100,136	264,935	U.S.S.R. 162,018; Czechoslovakia 55,830; Romania 19,854.
Coils for rerolling	9,474	184,810	U.S.S.R. 94,364; Czechoslovakia 46,545.
Steel semimanufactures:			
Bars, rods, angles, shapes, sections	219,616	418,680	Poland 48,415; Romania 47,804; Italy 46,202.
Universals, plates, sheets	607,320	505,978	Japan 106,270; West Germany 91,188; Greece 83,586.
Hoop and strip	160,150	75,399	Czechoslovakia 14,654; Romania 13,351; West Germany 11,251.
Rails and accessories	3,883	3,824	West Germany 1,509; Austria 1,140.
Wire	19,962	31,474	West Germany 9,958; Poland 9,739; Italy 3,486.
Tubes, pipes, fittings	67,302	83,790	Bulgaria 32,699; West Germany 13,082.
Castings and forgings, rough	858	648	West Germany 173; Italy 59.
Total	1,079,091	1,119,793	

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Lead:			
Ores and concentrates	--	454	All from Italy.
Oxides	451	661	Switzerland 330; West Germany 211.
Metal, including alloys:			
Scrap	22	--	
Unwrought	5,595	11,457	Switzerland 4,258; Zambia 3,700; Italy 1,226.
Semimanufactures	740	125	United Kingdom 68; West Germany 33.
Lithium, elemental—kilograms	145	--	
Magnesium, including alloys, all forms	896	515	Italy 202; U.S.S.R. 200; United States 50.
Manganese:			
Ores and concentrates	48,240	43,054	U.S.S.R. 22,740; Brazil 20,030.
Oxides	491	405	United States 239; Netherlands 105.
Metal, including alloys, unwrought	190	175	Sweden 100; West Germany 41.
Mercury—76-pound flasks	380	--	
Molybdenum, including alloys, all forms—kilograms	23,672	21,224	Austria 17,233; Netherlands 1,889; Sweden 1,016.
Nickel, metal, including alloys:			
Scrap	212	--	
Unwrought and semimanufactures	1,554	1,853	West Germany 690; Austria 431; U.S.S.R. 325.
Platinum group:			
Platinum, all forms—troy ounces	1,207	1,865	Italy 1,093; West Germany 386.
Palladium, all forms—do	26,146	16,075	U.S.S.R. 15,239; Austria 739.
Selenium, elemental—kilograms	3,114	1,163	All from West Germany.
Silver, all forms—thousand troy ounces	1,333	973	West Germany 385; United Kingdom 195; Switzerland 163.
Tellurium, elemental—kilograms	197	250	All from West Germany.
Tin:			
Oxides—long tons	26	23	West Germany 22.
Metal, including alloys:			
Scrap—do	305	1,055	Switzerland 917; West Germany 131.
Unwrought—do	1,609	874	Malaysia 680; France 77; West Germany 24.
Semimanufactures—do	83	35	West Germany 31.
Titanium:			
Ore and concentrate	1,427	1,874	United Kingdom 1,334; Australia 381.
Oxides	5,636	5,267	West Germany 1,820; United Kingdom 1,713.
Metal, including alloys, all forms—kilograms	27,784	6,298	Switzerland 6,001; West Germany 177.
Tungsten, including alloys, all forms—do	20,281	20,094	United Kingdom 12,507; Netherlands 2,733.
Uranium and thorium:			
Ore and concentrate—do	200,000	--	
Metal, including alloys, all forms—do	--	331	All from United Kingdom.
Zinc:			
Ores and concentrates	13,666	--	
Oxides	76	1	All from United Kingdom.
Metal, including alloys:			
Scrap and blue powder	26	70	All from West Germany.
Unwrought	13,232	19,581	Zambia 13,795; Switzerland 2,927.
Semimanufactures	760	1,252	West Germany 876; Italy 195.
Zirconium, including alloys, all forms—kilograms	1,109	8,731	West Germany 6,023; Austria 2,640.
Other:			
Ores and concentrates	477	6	All from Austria.
Ash and residue containing nonferrous metals	520	454	Austria 264; Italy 190.
Oxides, hydroxides and peroxide of metals, n.e.s	477	463	West Germany 207; Czechoslovakia 100; Norway 50.
Metal, including alloys	14	14	All from West Germany.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	987	608	Italy 200; Denmark 165; Greece 108.
Grinding and polishing wheels and stones	1,632	1,491	Austria 985; Italy 245; West Germany 167.
Asbestos	28,552	38,678	U.S.S.R. 24,335; Canada 6,332; Botswana 6,291.
Barite and witherite	513	449	West Germany 264; Czechoslovakia 100.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Boron materials:			
Crude, natural borates	1,731	5,907	All from United States.
Oxide and acid	405	1,158	U.S.S.R. 887; Czechoslovakia 131.
Bromine—kilograms	6,247	149	West Germany 75; Italy 74.
Cement:			
Portland—thousand tons	1,478	1,094	U.S.S.R. 385; Czechoslovakia 198; Romania 189.
Other—do	165	301	Austria 114; Italy 99; Turkey 58.
Chalk	929	1,064	Switzerland 731.
Clays and products:			
Crude, n.e.s.:			
Bentonite	42	50	Austria 25; Hungary 18; Sweden 5.
Fire (including calcined)	33,019	20,703	West Germany 16,806; Poland 1,715.
Fuller's earth, dinas, chamotte	4,060	3,406	West Germany 1,590; Austria 1,255; France 440.
Kaolin	37,463	36,066	Czechoslovakia 17,259; East Germany 7,955; Greece 5,600.
Other	1,247	2,634	Czechoslovakia 1,669; West Germany 567.
Products:			
Refractory (including nonclay bricks)	16,196	18,766	West Germany 4,483; Austria 3,523; United Kingdom 2,378.
Nonrefractory	289,949	822,908	Italy 559,206; Romania 139,520; Bulgaria 34,023.
Diamond, all grades—carats	138,085	42,920	Switzerland 20,750; United Kingdom 11,050; West Germany 4,500.
Diatomite and other infusorial earths	1,417	1,194	Austria 966.
Fertilizer materials:			
Crude:			
Phosphatic	789,673	769,537	Morocco 495,726; Jordan 125,212; Israel 90,437.
Potassic	2,796	3,052	All from East Germany.
Manufactured:			
Nitrogenous	80,158	107,214	Bulgaria 54,486; U.S.S.R. 36,443; Romania 6,058.
Phosphatic:			
Thomas slag	7,850	4,148	All from Arab Republic of Egypt.
Other	--	12,967	Morocco 8,267; Tunisia 4,700.
Potassic	304,197	343,711	U.S.S.R. 154,530; East Germany 144,304; West Germany 35,904.
Other, including mixed	--	18	All from Netherlands.
Ammonia	68,354	35,905	Hungary 18,247; Austria 11,841.
Fluorspar and cryolite	6,835	1,194	All from Austria.
Graphite, natural	1,788	1,943	Austria 1,544; West Germany 255.
Gypsum and plaster	19,987	36,403	Italy 28,223; Poland 7,617.
Iodine—kilograms	11,644	24,437	West Germany 7,800; Poland 6,300; United States 4,000.
Lime	3,225	35,930	Italy 19,701; Austria 10,626; Bulgaria 1,895.
Magnesite	720	7,976	Czechoslovakia 6,913; Austria 744.
Mica:			
Crude, including splittings and waste	165	158	Norway 49; Austria 37; Malagasy Republic 21.
Worked, including agglomerated splittings	466	103	Czechoslovakia 26; India 25; Switzerland 20.
Pigments, mineral:			
Natural, crude	51	6	Austria 5; West Germany 1.
Iron oxides, processed	2,921	1,389	West Germany 994.
Precious and semiprecious stones except diamond—kilograms	167	663	Switzerland 542; West Germany 49.
Pyrite (gross weight)	94,723	186,980	All from U.S.S.R.
Quartz, piezoelectric—kilograms	1,573	963	United Kingdom 500; West Germany 452.
Salt	145,445	119,179	Romania 70,305; Tunisia 17,860; U.S.S.R. 14,339.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	17,770	38,456	West Germany 26,210; Italy 10,616.
Caustic potash, sodic and potassic peroxides	2,424	1,705	East Germany 1,168; Czechoslovakia 399.
Stone, sand and gravel:			
Dolomite, chiefly refractory grade	5,831	5,679	Italy 5,018.
Gravel and crushed rock	160,800	149,149	Hungary 139,076.
Limestone, except dimension	16,242	10,080	All from Hungary.
Quartz and quartzite	9,825	14,709	Hungary 8,390; West Germany 4,307.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Sand, excluding metal bearing	81,063	88,564	Italy 48,396; Hungary 27,145; West Germany 6,905.
Dimension:			
Crude and partly worked	17,866	3,625	All from Italy.
Worked	3,626	6,162	Do.
Sulfur:			
Elemental, all forms	20,596	20,879	Poland 11,445; West Germany 6,122.
Sulfuric acid	356	1,014	Albania 554; West Germany 435.
Talc and related materials	1,396	1,517	India 603; Italy 395; Czechoslovakia 224.
Other nonmetals n.e.s.:			
Crude	427	79	Italy 49; Bulgaria 23.
Slag, dross, similar waste, nonmetal bearing	107,731	150,238	Italy 149,997.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	18,705	7,851	Czechoslovakia 4,084; Albania 1,716; West Germany 1,305.
Carbon black and gas carbon	2,471	5,499	West Germany 2,894; Italy 2,200; U.S.S.R. 150.
Coal, anthracite and bituminous thousand tons	1,820	1,972	U.S.S.R. 1,181; Czechoslovakia 494; United States 256.
Coke and semicoke do.	201	280	Italy 80; West Germany 77; Poland 44.
Hydrogen, helium, rare gases kilograms	35,845	108,735	Italy 70,848; West Germany 26,109; Austria 10,375.
Peat, including briquets and litter	2,346	3,624	Poland 2,323.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	33,053	36,504	Iraq 16,620; U.S.S.R. 10,290; Iran 9,117.
Refinery products:			
Gasoline, including natural do.	258	207	United Kingdom 92; U.S.S.R. 68; Italy 38.
Kerosine and jet fuels do.	174	81	U.S.S.R. 36; Romania 29; Italy 15.
Distillate fuel oil do.	2,876	3,872	U.S.S.R. 2,076; Romania 1,116; Italy 543.
Residual fuel oil do.	2,809	2,067	U.S.S.R. 1,278; Romania 396; Italy 224.
Lubricants do.	411	392	Hungary 100; Romania 57; Italy 52.
Mineral jelly and wax do.	1,040	51	Romania 12; East Germany 11; West Germany 7.
Other do.		742	Albania 233; United States 216; Romania 89.
Total do.	7,568	7,412	
Mineral tar and coal-, petroleum-, or gas-derived crude chemicals	48,552	2,376	Bulgaria 2,331.

COMMODITY REVIEW

METALS

Aluminum.—Aluminum was the most active segment of the nonferrous industry of Yugoslavia during 1972. Programs were continued on the conversion of the country's aluminum industry from being a producer and exporter of bauxite to being a processor of bauxite and an exporter of aluminum. Developments at the Titograd, Šibenik, and Mostar alumina and aluminum complexes were the focal points of the industry. Furthermore, two agreements, one with the U.S.S.R. and the second one with Hungary, will increase the country's alumina capacity by 1 million tons of alumina per year.

The first agreement between Energoinvest of Sarajevo, and the U.S.S.R. calls for construction of a 700,000-ton-per-year alumina plant near Zvornik in eastern Bosnia. The U.S.S.R. will finance $130 million of a total expenditure of $200 million. In repayment of the credit, Energoinvest will deliver 600,000 tons of alumina, 500,000 tons of bauxite, and all of the special "ab-

rasive bauxite" produced at the Bosanska Krupa mine to Soviet foreign trade organizations annually for 10 years. Repayment of the credit will begin January 1, 1977, and continue through 19 semiannual installments at an interest rate of 4.5%. The new facility will create jobs for an estimated labor force of 10,000. Of this, 1,200 will be employed in the alumina plant at Zvornik, 1,600 at the Vlasenica mine, 600 in ore transport, and the rest will take part in increased activities of the Government and local economy.

The second agreement was concluded between representatives of Jadral, a bauxite production enterprise at Obrovac, Dalmacia, and the Hungarian enterprise Hemokompleks of Budapest. This will lead to construction at a 300,000-ton-per-year alumina plant located in Obrovac. Hemokompleks will furnish expertise and equipment for the new installation. Reportedly, total investments will be about $85 million. The plant was scheduled for production in 1974, and about 1,500 persons will be employed there.

During 1972, Yugoslavia remained a significant producer and exporter of bauxite. Bauxite output increased 12% and totaled 2.2 million tons. Preliminary figures on Yugoslavia's bauxite trade for 1972 indicated a decrease in bauxite exports and imports by 2% and 23%, respectively. Domestic bauxite consumption accounted for only about 20% of the country's production.

Exploration for bauxite was centered in the major producing areas in Dalmacia on the Adriatic Sea, Crna Gora, central and eastern Bosnia, and Kosmet in Serbia. Discovery of a new bauxite deposit near Jajce in central Bosnia was announced. Reportedly, reserves totaled over 1 million tons of bauxite. Although results of bauxite analysis were not published the quality of bauxite reserves was reported as excellent. Furthermore, the Institute for Mining Research at Tuzla made public a discovery of two bauxite deposits, one at Podravne and the second at Bracan-Podbracan, with reserves of over 1.5 million tons each.

During 1972, alumina output reached 126,000 tons, or 2% higher than that of 1971. At the same time alumina imports increased from 8,000 tons in 1971 to 40,000 tons in 1972. Aluminum production increased from 47,000 to 73,000 tons during the same time period. Increased aluminum production was attributed to the output of the new plant at Titograd. The electrolytic plant at Titograd was in trial production all year. In addition, the alumina plant in Titograd went onstream in November 1972. The trial production of the electrolytic plant was hampered by lack of foreign currency for spare parts. Out of 264 cells, about 100 were out of production at yearend. When in full operation, the plant should produce 100,000 tons of alumina and 50,000 tons of aluminum per year.

The construction of an alumina plant near Mostar continued according to plans. When completed in 1973, the plant will produce 260,000 tons of alumina. While this construction was underway, preparation for construction of an electrolytic plant with a capacity of 80,000 tons of aluminum per year continued at Mostar. The electrolytic plant was to go onstream in 1974.

Construction of the Šibenik aluminum facility proceeded according to plans. However, at yearend reports indicated a possible delay in construction of a powerplant in the area, which may adversely affect the future production of aluminum at Šibenik.

Copper.—During 1972, production of copper ore, copper concentrates, blister copper, and electrolytic copper increased by 16%, 13%, 33%, and 40%, respectively. Increases in production reflected full operation of new facilities recently completed at Bor, Serbia. In spite of increased domestic production of copper, imports remained essential for operations of the copper metal consumers.

The Bor copper complex remained the only producer of copper ores, blister, and electrolytic copper in the country. During 1972, the complex went through debugging operations of new facilities completed in late 1971. In addition, exploration for new copper deposits was underway in Bosnia and Serbia. Results of explorations were scarce, but Krivelj in Serbia remained the principal objective of geological exploration.

Iron and Steel.—The slowly developing major expansion of the steel industry in Yugoslavia continued through 1972. Again, as in the past, imports of iron and steel semimanufactures remained one of the largest import items. Exports were insignificant by world standards. Although most

of the iron and steel plants had expansion of facilities underway or completed, the major expansions were at plants at Zenica, Smederevo, and Skopje.

The Zenica iron and steel complex in Bosnia, largest steel-producing facility in the country, embarked on an active period of expansion. Production should increase from 1 million tons in 1972 to 2.5 million tons. As part of expansion, construction continued on a steel converter plant with two 100-ton vessels and three continuous casting lines. In addition, a new wire rolling mill was under construction at yearend. The Export-Import Bank agreed to finance the project with a $41 million loan. Reportedly, the plant will have a capacity of 350,000 tons of wire when completed. U.S. Steel Corp., Pittsburgh, Pa., will supply the technology and equipment for the plant.

Construction of the Smederevo iron and steel plant in Serbia proceeded. Production of pig iron at Smederevo started in 1971. A loan of $36 million was granted for this project by a group of international banks. The money was raised by a syndicate headed by the First National Ltd., a subsidiary of the First National Bank of Chicago. The loan was made to the Beogradska Banka, Belgrad, Yugoslavia's largest commercial and investment bank. When all planned phases of the project are completed, the Smederevo plant will include, in addition to the pig iron plant, a 840,000-ton-per-year converter steel unit, a 200,000-ton-per-year cold-rolling plant, and a 840,000-ton-per-year hot-rolling plant.

At the Skopje iron and steel works in Macedonia, a new electric steel plant, with an annual capacity of 300,000 tons, started trial production in the early spring. During the year the plant produced at only one-third of its rated capacity. Problems with equipment and supply of electric power were quoted as reasons for the poor performance.

The expansion program continued for the Nikšić steel plant in Crna Gora. At the Jesenice, Ravne, and Štore plants, located in Slovenia, operations were transferred to production of high-quality electric steel. In addition, a new plant at Uroševac for production of welded pipe started production at yearend. This new plant will have an annual capacity of 25,000 tons when in full operation. Plans call for further expansion to 60,000 tons in 1974. Tisen will be the principal buyer of pipe from Uroševac.

Discussions continued on merits of different sites for a steel plant on the Adriatic coast. Labin, Bakar, Zadar, and Split were mentioned as possible locations. However, at yearend no decision had been announced.

The Prijedor plant, a new facility for production of steel, based on large iron ore reserves of Ljubija and its vicinity, entered into a phase of intensive planning. Reports indicated that the new plant may have a capacity of about 2 million tons of steel per year. However, planning was in an early stage, and changes in capacity, location, and technology may be expected.

Lead and Zinc.—According to preliminary results for 1972, mine and smelter production of lead and zinc declined in Yugoslavia. Delays in starting new mines, difficulties in supply of concentrates, and mechanical problems at the Trepča smelter caused lower output.

The Trepča lead-zinc mine, Stari Trg, was modernized, and its capacities expanded during 1972. Ore output is expected to increase to 1 million tons per year. Total costs were estimated at about $25 million. This reconstruction was necessary because the mine reached a depth of 2,500 feet, and a new ventilation system became necessary.

Modernization of the lead-zinc mine at Lece, near Medvedja, was near completion at yearend 1972. This reconstruction held the record as the longest in time required for completion in the history of modern mining in Yugoslavia. Modernization started in 1961, and because of financial problems, lasted more than 10 years. When completed, the reconstruction should make possible an annual production of 260,000 tons of lead-zinc ore.

The new Trepča smelter at Zvečan had technological and labor problems which adversely affected the overall performance of the Trepča combine. The Titov Veles lead and zinc plant under construction for several years continued to lag behind schedule. However, the ore agglomeration plant went onstream and the production of sulfuric acid started.

Nickel.—A French company, Compagnie pour l'Etude et le Development des Ex-

changes Comerciaux (Compadec), has arranged a 10 year, $120 million loan for construction of a ferronickel facility at Ržanovo, Macedonia. Feni of Skopje, the operator, planned a yearly output of 64,000 tons of ferronickel, which includes 16,000 tons of nickel. The basic agreement between Compadec and Feni calls for exportation of about 90% to 95% of the production. Reserves of nickel-bearing ores at Ržanovo were estimated at 24 million tons with an average nickel content of 0.9%.[2]

Other Metals.—Yugoslavia produced antimony, bismuth, cadmium, chromite, germanium, gold, manganese, mercury, selenium, and silver in 1972. Except for mercury, produced in Idria, Slovenia, output of the other metals was modest. Antimony was produced at Zajača, Serbia; bismuth was a byproduct of the lead and zinc operation at Trepča, Serbia; and cadmium was a byproduct at Trepča and at the Zorka plant at Šabac, Serbia. The Bor complex in Serbia yielded gold, germanium, and selenium as byproducts of copper. Manganese was produced in Bosnia. Trepča was the main source of silver, a byproduct of lead and zinc processing.

NONMETALS

Cement.—Although production of cement increased by 16% compared with that of 1971, shortages of cement persisted during 1972. Imports, 40% lower when compared with those of 1971, were necessary to supply the rapidly expanding market. Exports of cement were insignificant. The larger domestic output of cement resulted from a new and recently modernized plant, which reached capacity levels of production. In addition, new facilities went onstream in Popovac and Usje, and a new plant started production in Goražde, Bosnia, with an installed capacity of 200,000 tons per year.

Authorities continued to make all possible financial efforts to eliminate cement imports by supporting construction of new plants and expansion of existing plants because the country has ample reserves of cement raw materials. At yearend, the Kosjerič cement plant in Serbia (550,000 tons per year), the Lukavac cement plant in Bosnia (350,000 tons per year), and the Kakanj plant also in Bosnia (650,000 tons per year) were under construction. At the same time, two plants in Croatia, Podsused near Zagreb, and Koromočan near Labin, were expanding their cement-producing facilities to 600,000 and 400,000 tons per year, respectively. During 1972 planning continued for two 600,000-ton-per-year plants, one in Ostružnica, near Belgrade, and the second in Našice, Slavonia. When these projects are completed, Yugoslavia will have an additional cement-producing capacity of 2.9 million tons per year.

Clays.—A variety of clays was produced during 1972. The industry remained primitive with little mechanization. Few new significant developments were announced.

The Keramika enterprise for production of industrial ceramics at Mladenovac, Serbia, was receiving clays from distant quarries. The long haulage increased the price of raw clay delivered to Keramika. To avoid excessively priced clay, Keramika started its own exploration program for clay in the vicinity of Mladenovac, and a new deposit was discovered near the village of Stojnik, near Arandjelovac. Reportedly, the clay is excellent for production of ceramic pipe, one of the Keramika products. Reserves were estimated at 800,000 tons of clay.

Graphite.—A deposit of graphite was discovered near Ražanj in southeastern Serbia. Preliminary evaluations of field reports indicated a large high-grade deposit.

Lime.—During 1972 lime plants at Doboj, Bosnia, Varaždin, Croatia, and Golubac, Serbia, were in different stages of planning.

The Doboj-Ševarlije plant, with an annual capacity of 220,000 tons of lime, will be constructed and operated by the Zenica iron and steel complex. The plant will be fully automated. Manufacturers from West Germany will supply the equipment. The start of production was scheduled for 1974. Zenica will be the principal user of the lime from the Doboj-Ševarlije plant.

The Hungarian enterprise Nikex of Budapest won a contract for building a new lime plant near Varaždin for Zagorje, the construction enterprise of Varaždin. When in full operation the new plant will produce 100,000 tons of lime per year. Total

[2] Bakic, M. Megucnosti razvoja Industrije nikla u Jugoslaviji (Possibilities for Developing a Nickel Industry in Yugloslavia). Vesnik Jugoslovenske Investicione Banke, Belgrade, Yugloslavia, No. 181, January 1972, pp. 25–28.

construction cost for the plant was reported at $5.6 million. The small 8,000-ton-per-year lime plant now in production will be closed.

The Veljko Dugošević stone and lime combine, located at Kucevo, eastern Serbia, and the nearby Hydropower System Derdap have agreed to construct a 120,000-ton-per-year lime plant. The new plant will be located near Golubac on the shore of Derdap Lake.

Magnesite.—A new mine, Trnava, near Kraljevo, Serbia, was under development during 1972. When in full operation the mine will produce about 150,000 tons of raw magnesite per year. Reserves of 3 million tons will provide for 20 years of mining operation.

MINERAL FUELS

During 1972 coal continued to be the principal source of energy in Yugoslavia. However, crude oil and natural gas again increased their combined share of the energy input, accounting for 39%, a record high for these two mineral fuels. Domestic output of high-rank coals and liquid hydrocarbons was below demand and imports of bituminous coal, coke, and crude oil were essential. Exports of both solid and liquid fuels were nominal.

Most of Yugoslavia's coal production, which remained at the same level as that of 1971 (about 30 million tons), consisted of low-rank coals. Approximately 2 million tons of bituminous coal and coke were imported to assure adequate supply.

Petroleum output from domestic fields was higher by 8% compared with that of 1972 and shared 38% of the country's refinery throughput of 8.4 million tons (168,000 barrels per day). The petroleum refineries operated at 70% of installed capacity during 1972.

Although production and consumption of natural gas increased, lack of large gas pipeline systems hampered greater use of natural gas. To increase use of natural gas, the Serbian authorities prepared a plan for a gas distribution network for Vojvodina and Serbia proper. At yearend, negotiations were underway with the World Bank to assure financing for the project.

As a result of the continuing shortage of electric power Yugoslavia has entered the nuclear field for production of electric power. Yugoslav authorities decided to construct a nuclear powerplant near Krske, in the Croatian-Slovenian State border area.

During 1972 the supply of electric power and fuels was irregular during the year, indicating weaknesses in the distribution network.

Coal.—For the second consecutive year, the coal industry faced labor shortages and lack of funds. However, increased energy consumption and irregular crude oil supply made demands for domestic coal stable throughout the year. Brown coal and lignite comprised the bulk (98%) of the country's coal output. During 1972 most activities in the coal industry were concentrated in the following large coal basins: Kolubara, Kosovo, Kostolac, and Aleksinac in Serbia and the Banovići-Kreka and central Bosnian mines in Bosnia-Hercegovina.

A large mining enterprise was created, comprising 17 of the operating coal mines in Bosnia-Hercegovina. The new organization will produce approximately 12 million tons of coal per year, about 37% of the present coal output, and will employ 24,000 people. At yearend the new entity was in the process of organization. Separate departments, such as financial and commercial, were centralized. Sarajevo, the capital of Bosnia-Hercegovina, was mentioned as the possible location for the headquarters of the new enterprise.

A new open pit lignite mine at Cirkovac, Serbia, was being planned. The new facility will replace the underground works at Cirkovac, which ceased production during 1972. The new mine will be supplied with equipment from Poland. Production was scheduled for the end of 1977 and the mine was designed for a production of 2.5 million tons of coal per year. Reportedly, investments should total an equivalent of $17.6 million.[3]

Development of the Raspotočje brown coal underground mine in the Zenica coal basin continued according to plans. The work was underway at a depth of 353 meters. Completion date, reserves, or mine capacity were not reported. However, the management expected production in 1974 for a period of 30 years.

The bituminous coal mine Dobra Sreča in Serbia was closed. The railroad system was the principal consumer of coal from

[3] Privredni Pregled (Belgrade). Aug. 22, 1972, p. 8.

this mine. Because of a switch to diesel and electric power by the railroad, orders for coal declined in recent years.

Coke demand was higher than domestic production during 1972, and imports of coke were essential to assure continuous operations of the country's iron and steel industry. According to the Yugoslav 5-year plan, the output of steel should increase 4 to 5 million tons in 1975. Consequently, coke demand will increase substantially. Yugoslav authorities planned to increase domestic output and eliminate imports of coke. As in the past, imported coking coal comprised the bulk of the coal processed in coking plants during 1972. Imports will continue in the future until an economic method for coking lignite is developed. As the first step toward self-sufficiency, construction of a fourth coke battery at the Lukavac coke plant, near Tuzla, Bosnia, started in July. Reports indicated the capacity of the new coke battery at 700,000 tons of coke per year.

Petroleum.—Because production from two new fields, Beničanci in Croatia and Kelebija in Vojvodina, Serbia increased Yugoslavia's domestic output of crude oil and attained a record high of 3.2 million metric tons (about 64,000 barrels per day) in 1972. Other highlights of the petroleum industry included completion of the Sisak refinery expansion, and planning for a gas pipeline network in Serbia. Industrija Nafte (INA), headquartered in Zagreb, Croatia, and Naftagas at Novi Sad, Vojvodina, remained the only producers and the most important processors of crude oil in the country.

Exploration and Development.—INA, through its exploration and production division, Naftaplin, was by far the largest producer of crude oil, accounting for 73% of the total. Evaluation of results obtained from offshore drilling in the vicinity of Dugi Otok Island continued during 1972. However, financing of the offshore drilling appeared excessive. Consequently, at year-end 1972 the management of INA-Naftaplin was in the process of making all possible efforts to obtain approval from authorities for a joint venture with foreign interests in development of the offshore Adriatic coast.

Inland, in the Pannonian Basin where most of the country's production originates, the Beničanci oilfield, located between the towns of Donji Miholjac and Našice in northeastern Croatia, started production in the fall of 1972. Productive zones of Miocene Age are at depths ranging from 1,800 to 2,050 meters. According to Naftaplin sources, in 1973 the field will produce about 500,000 tons of crude oil from 25 to 30 wells operated through a fully automated production system. With an output of 500,000 tons per year, Beničanci will join Žutica, Stružec, and Jagnjedovac on the list of most productive oilfields in the country. A pipeline connects the Beničanci oilfield with the village of Rešica on the Sava River. At Rešica, where facilities for crude oil storage and river barge loading were under construction, the Beničanci crude will be shipped to the Sisak refinery by river barge.

In 1972 Naftaplin celebrated its 20th anniversary of operation. During this period, a total of 2,055,585 meters were drilled. Production of crude oil increased from 75,000 tons in 1952 to over 2 million tons in 1972.

Naftagas, the country's only other crude oil producer, accounted for about 27% of total output in 1972. Output at the Kelebija oilfield, located close to the Hungarian border, should reach 70,000 tons per year. The field extends into Hungary and is operated in close cooperation with the Hungarian operators. Crude oil from Kelebija was shipped to Hungary for partial processing and then was sold to Shell Oil Co. of Austria. Development of the nearby Palic oilfield, near the village of Hajdučica, continued during 1972 and production is expected to start in 1973. Exploration of Timočka Krajina was renewed, and a well up to 3,500 meters deep was planned near Negotin in eastern Serbia. In general, exploration in Vojvodina was directed toward deeper formations. A well 3,570 meters deep was tested for oil and gas potentials at the end of 1972.[4]

Refining.—During 1972 expansion of capacity at the Sisak refinery by 2 million tons per year and completion of a 12,000-ton-per-year lube plant at Žitnjak, near Zagreb, were the most important events in the refining sector. The six petroleum refineries were operated under the management of INA (three refineries), Naftagas (two refineries), and Hena of Bosnia-Hercegovina (one refinery).

[4] Borba (Belgrade). Aug. 19, 1972, p. 11.

Refineries processed 8.4 million tons of crude oil of which 62% was imported. Yugoslav refineries operated at 70% of installed capacity during 1972.

An additional 2 million tons per year of crude oil capacity completed at the Sisak refinery made it the largest inland refinery in Yugoslavia. The new lube plant, with an annual capacity of 12,000 tons of lubricants, was completed at Žitnjak, near Zagreb, and was operating under the management of INA. The expansion at the Rijeka refinery and construction of a petrochemical plant there proceeded according to plan. When completed in 1974, this refinery reportedly will have additional capacity for processing 2 million tons of crude oil per year and the petrochemical section should have an annual capacity of 300,000 tons of ethylene, 200,000 tons of vinyl chloride, 25,000 tons of plasticizer, and 150,000 tons of polyethylene.

The construction of additions to the Pančevo refinery related to Hemiska Industrija Pančevo continued. When completed in 1974, the Hemiska Industrija Pančevo will have the following capacities: 200,000 tons of ethylene, 88,000 tons of propylene, 110,000 tons of gasoline, and 100,000 tons of vinyl chloride.

Expansion at the Novi Sad refinery continued through 1972. A new vacuum distillation unit, a lube plant, and an asphalt plant were under construction. Capacities for these units were not made public and existing information is conflicting.

Pipelines.—The controversy concerning merits of a pipeline, planned by INA and connecting Rijeka with inland areas, and the pipeline planned by Energoinvest of Sarajevo continued during 1972. At yearend it appeared that both parties had concluded that only one pipeline was necessary. Negotiations with central European countries resulted in conclusion of preliminary agreements for use of the new pipeline.

To better develop use of natural gas resources in Serbia, the Yugloslav Government submitted to the World Bank a project for a new network of natural gas distribution pipelines in Serbia. The project would cost about $95 million, of which the World Bank is expected to provide 40%. The plan calls for construction of a trunk pipeline that would connect the Mokrin gasfield at Banat with the city of Niš in eastern Serbia, through Senta, Gospodjinci Beška, Umka, Mladenovac, Svetozarevo, and Aleksinac. At Batajnica a spur through Srem would bring natural gas to Šabac and Loznica in Serbia. Total length of the pipeline would be 527 kilometers. The trunk pipeline would be connected by 133 kilometers of supply pipelines that would bring gas from the fields located in Begejci, Medja, Srpska Crnja, Ada, Srbobran, and Banatsko Miloševo. The largest part of the distributing natural gas network would be constructed in Serbia proper (330 kilometers), Vojvodina (227 kilometers), and the city of Belgrad (71 kilometers). The whole project should be completed within 3 years after financing is secured. The city of Belgrad, where power is generated by burning coal and most house heating is accomplished by burning of coal and wood, will ease its air pollution problems when the project becomes operational.

The only large manufactured-gas plant based on lignite in the Kososvo Basin added the Trepča lead combine to the list of its customers. The lead and zinc smelter at Zvečan and other installations in the complex started using gas from Obilić via a 40-kilometer pipeline connecting Obilić with Zvečan.

The Mineral Industry of Zaire

By Harold J. Schroeder [1]

Production of minerals remained an important part of the Zaire economy, providing approximately 85%, by value, of the nation's exports and 45% of government revenues. Copper, cobalt, zinc, and associated metals produced in Shaba Province dominated the mineral output, accounting for about 85% of the value of mineral product exports. Most of the remaining mineral exports were diamond, tin, and manganese. Zaire continued to be the largest producer of cobalt and industrial diamond in the world and was the sixth ranked country in the mine production of copper.

Developments were in progress to substantially expand productive capability for copper and associated metals in Shaba Province. A major problem confronting this expansion over at least the next 4 years is the possible shortage of electric power. However, by the end of 1976, a high-voltage, direct-current transmission line from new generating capacity at the Inga I project on the lower Zaire River to Shaba Province is to be completed. When the 1,000-mile transmission line, the longest direct-current line in the world, is operational ample power will be available. In the interim, a critical energy shortage could curtail projected mineral production in Shaba.

PRODUCTION AND TRADE

Mine production of copper continued an upward trend, increasing 8% to a record 437,250 tons in 1972. Other important mineral commodities with mine production increases were cadmium 14%; coal 12%; and silver 15%. Production decreases were recorded for cobalt 10%; diamond 7%; manganese 5%; tin 10%; and zinc 14%. Details of mineral production are shown in table 1, and available trade data are shown in tables 2 and 3.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Zaire: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Beryllium, beryl concentrate, gross weight	130	76	e 70
Cadmium, smelter production	317	260	296
Cobalt:			
Mine output, metal content	13,958	14,518	13,112
Refinery production	13,374	14,518	13,043
Columbium-tantalum concentrate	146	114	85
Copper:			
Mine output, metal content	r 387,116	407,064	437,250
Blister and leach cathodes	r 386,900	404,600	427,000
Refined	189,600	207,842	216,200
Germanium, content of concentrates—kilograms	21,205	53,133	e 53,000
Gold—troy ounces	177,128	179,079	81,566
Manganese ore and concentrate, gross weight	346,950	387,000	369,481
Rare-earth metals, monazite concentrate, gross weight	143	217	232
Silver—thousand troy ounces	1,709	1,800	2,078
Tin:			
Mine output, metal content—long tons	r 6,356	6,356	5,689
Smelter, primary—do	1,374	e 1,330	e 1,400
Tungsten mine output, metal content	r 189	321	e 300
Zinc:			
Mine output, metal content	105,082	130,680	111,900
Metal, primary	63,750	62,760	63,000
NONMETALS			
Cement, hydraulic—thousand tons	r 419	455	e 360
Diamond:			
Gem—thousand carats	1,649	2,314	e 980
Industrial—do	12,438	12,002	e 12,380
Total—do	14,087	14,316	e 13,360
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous—thousand tons	102	114	128
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	1,022	925	945
Kerosine and jet fuel—do	572	553	594
Distillate fuel oil—do	1,332	1,235	1,343
Residual fuel oil—do	1,754	1,970	2,248
Other—do	13	17	--
Refinery fuel and losses—do	266	264	301
Total—do	4,959	4,964	5,431

e Estimate. p Preliminary. r Revised.

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

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal destinations, 1970
METALS			
Aluminum metal, including alloys, all forms	122	177	West Germany 59; Ivory Coast 46; Belgium-Luxembourg 29.
Copper metal, including alloys:			
Scrap	903	684	West Germany 389; Belgium-Luxembourg 262.
Unwrought	364,243	351,860	Belgium-Luxembourg 199,313; Angola 50,968;[2] Italy 41,344.
Semimanufactures	54	101	Zambia 91; West Germany 10.
Iron and steel metal:			
Scrap	3,912	2,962	Spain 1,798; Italy 1,164.
Semimanufactures	8	--	
Lead metal, including alloys, scrap	59	105	Belgium-Luxembourg 53; Netherlands 26; Italy 16.
Manganese ore and concentrate	243,459	271,754	Angola 270,648.[2]
Tin:			
Ore and concentrate—long tons	7,265	6,487	Belgium-Luxembourg 5,130; Netherlands 991.
Metal, including alloys, all forms—do	1,844	1,203	All to Belgium-Luxembourg.
Tungsten:			
Ore and concentrate	163	300	Belgium-Luxembourg 220; Switzerland 80.
Metal, including alloys, all forms	142	--	
Zinc:			
Ore and concentrate	65,988	25,304	Mozambique 9,075;[2] Angola 9,055;[2] Belgium-Luxembourg 7,173.
Metal, including alloys:			
Scrap	23	--	
Unwrought and semimanufactures	57,859	62,679	Angola 43,730;[2] Mozambique 12,859.[2]
Other:			
Ore and concentrate:			
Of molybdenum, tantalum, titanium, vanadium, and zirconium	105	168	Belgium-Luxembourg 126; Switzerland 42.
Of base metals, n.e.s	373	1,992	Angola 1,735;[2] Switzerland 100.
Ash and residue containing nonferrous metals	777	1,411	Africa, not further specified 609; Angola 402;[2] Netherlands 325.
Metals, including alloys, all forms:			
Metalloids	--	5	All to United States.
Base metals, including alloys, all forms, n.e.s	9,481	10,727	Angola 10,701.[2]
NONMETALS			
Cement	18,164	12,513	Burundi 10,510; Rwanda 1,900.
Diamond, gem, not set or strung—thousand carats	15,000	15,000	All to United Kingdom.
Salt	--	10	All to Belgium-Luxembourg.
Other:			
Slag, dross and similar waste, not metal bearing, n.e.s	21	--	
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	4	118	All to Central African Republic.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude—thousand 42-gallon barrels	248	107	All to Netherlands.
Refinery products:			
Gasoline—do	172	--	
Kerosine—do	[3]	[3]	All to Burundi.
Residual—do	1,388	597	Senegal 125; Greece 122; Netherlands Antilles 111.
Total—do	1,560	597	

[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Zaire, rather than from trade returns of trading partner countries as was done in the previous edition when actual Zairian statistics were not available.

[2] For shipment elsewhere.

[3] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal sources, 1970
METALS			
Aluminum:			
Oxide and hydroxide	1	301	West Germany 230; Belgium-Luxembourg 71.
Metal, including alloys, all forms	611	971	Belgium-Luxembourg 508; Hong Kong 204; United Kingdom 65.
Arsenic, natural sulfides	5	--	
Chromium, oxide and hydroxide	1	2	Belgium-Luxembourg 1; West Germany 1.
Copper metal, including alloys:			
Unwrought	40	17	Belgium-Luxembourg 15.
Semimanufactures	140	245	Belgium-Luxembourg 172; United Kingdom 19; Japan 16.
Iron and steel:			
Roasted pyrite	51	104	Norway 84; Belgium-Luxembourg 20.
Metal:			
Scrap	--	11	All from Kenya.
Pig iron and similar materials	989	1,515	Africa, not further specified 1,197; West Germany 277.
Steel, primary forms	488	504	Belgium-Luxembourg 154; Sweden 95; Italy 79.
Semimanufactures:			
Bars, rods, angles, shapes, sections	30,669	57,857	Belgium-Luxembourg 43,547; Italy 3,021; Southern Rhodesia 2,048.
Universals, plates, sheets	33,233	53,279	Belgium-Luxembourg 30,474; Japan 11,227; West Germany 3,570.
Hoop and strip	1,431	3,314	West Germany 2,164; Belgium-Luxembourg 1,036.
Rails and accessories	9,452	10,886	Belgium-Luxembourg 2,441; France 2,419; United Kingdom 811.
Wire	969	1,997	Belgium-Luxembourg 1,616.
Tubes, pipes, fittings	5,893	12,019	Belgium-Luxembourg 4,833; Japan 3,137; France 955.
Castings and forgings, rough	2,262	1,358	Belgium-Luxembourg 228; United States 146; West Germany 126.
Lead:			
Oxides	71	124	Zambia 66; France 24; West Germany 20.
Metal, including alloys:			
Unwrought	21	64	Belgium-Luxembourg 36; United Kingdom 21.
Semimanufactures	94	133	Belgium-Luxembourg 108.
Manganese oxides	14	--	
Mercury—76-pound flasks	58	29	NA.
Nickel:			
Matte, speiss, and similar materials	19	20	United Kingdom 10; U.S.S.R. 10.
Metal, including alloys, all forms	1	1	All from United Kingdom.
Platinum-group metals and silver:			
Waste and sweepings—kilograms	3,000	--	
Silver metal, including alloys—troy ounces	32,151	64,301	All from Belgium-Luxembourg.
Tin metal, including alloys:			
Unwrought—long tons	11	21	Belgium-Luxembourg 14; France 7.
Semimanufactures—do	8	14	Belgium-Luxembourg 11; West Germany 2.
Titanium oxides	219	685	Belgium-Luxembourg 541; France 66; Italy 57.
Tungsten metal, including alloys, all forms	4	--	
Uranium and thorium oxides, including rare-earth oxides	1	--	
Zinc:			
Oxide and peroxide	45	67	Belgium-Luxembourg 22; Netherlands 15; West Germany 15; France 15.
Metal, including alloys, semimanufactures	81	89	Belgium-Luxembourg 80; West Germany 2.
Other:			
Oxides, hydroxides and peroxides of metals, n.e.s	51	1	NA.
Metals, including alloys:			
Alkali, alkaline earth and rare-earth metals	--	1	NA.
Base metals, including alloys, all forms, n.e.s	17	25	United States 13; Belgium-Luxembourg 10.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal sources, 1970
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	5	8	Italy 3; France 2.
Grinding and polishing wheels and stones	88	116	Belgium-Luxembourg 41; France 18; West Germany 13.
Asbestos	809	1,896	Canada 1,503; Belgium-Luxembourg 241.
Barite and witherite	240	686	France 573; Belgium-Luxembourg 88.
Boron oxide and acid	3	5	All from France.
Cement	1,006	10,467	Denmark 7,323; Belgium-Luxembourg 2,050; Kenya 782.
Chalk	1,420	1,479	France 964; Belgium-Luxembourg 208.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	477	783	West Germany 130; Italy 110; France 99.
Products:			
Refractory (including nonclay bricks)	5,066	4,537	Belgium-Luxembourg 1,081; Southern Rhodesia 597; Zambia 579.
Nonrefractory	2,550	4,845	Italy 1,665; Belgium-Luxembourg 1,119; West Germany 738.
Diatomite and other infusorial earth	371	722	United States 436; Belgium-Luxembourg 143; West Germany 75.
Feldspar and fluorspar	299	102	Italy 64; Africa, not further specified 34.
Fertilizer materials:			
Crude:			
Nitrogenous	5	336	Kenya 329; Netherlands 7.
Phosphatic	96	58	United States 21; Belgium-Luxembourg 10.
Potassic	3,316	1,562	West Germany 806; Belgium-Luxembourg 354; France 322.
Manufactured:			
Nitrogenous	9,063	9,263	Belgium-Luxembourg 3,913; Kenya 1,677; West Germany 1,381.
Phosphatic	488	1,544	Belgium-Luxembourg 672; Kenya 402; France 120.
Potassic	68	957	Netherlands 354; Belgium-Luxembourg 203; Kenya 200.
Other, including mixed	2,478	4,542	Italy 2,563; Belgium-Luxembourg 1,184.
Ammonia	128	193	Netherlands 81; Belgium-Luxembourg 68; West Germany 17.
Gypsum and plasters	7,752	16,449	France 15,701; Morocco 638.
Magnesite	234	191	Africa, not further specified 163; West Germany 23.
Mica, worked, including agglomerated splittings	6	6	France 3.
Pigments, mineral:			
Natural, crude	13	108	Belgium-Luxembourg 51; United Kingdom 29; West Germany 20.
Iron oxides, processed	104	174	West Germany 148; Belgium-Luxembourg 26.
Precious and semiprecious stones, except diamond, manufactured	--	114	All from Kenya.
Salt	38,047	41,385	Angola 19,231; Portuguese Guinea 5,204; Tunisia 4,738.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	5,686	6,716	Belgium-Luxembourg 3,282; United States 1,307; Italy 1,189.
Caustic potash, sodic and potassic peroxides	96	33	Belgium-Luxembourg 11; France 11.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	9	112	Italy 105.
Worked	150	104	Italy 54; Belgium-Luxembourg 23, Tunisia 22.
Dolomite, chiefly refractory grade	47	61	Belgium-Luxembourg 30; West Germany 20.
Gravel and crushed rock	227	8,931	Zambia 8,564; Italy 121.
Limestone (except dimension)	--	1	All from West Germany.
Quartz and quartzite	145	--	
Sand, excluding metal bearing	58	24	Belgium-Luxembourg 21.
Sulfur:			
Elemental:			
Other than colloidal	246	78	Belgium-Luxembourg 53; West Germany 24.
Colloidal	109	116	Belgium-Luxembourg 101; West Germany 15.
Sulfur dioxide	2	--	
Sulfuric acid, oleum	315	298	Netherlands 227; West Germany 37.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1969	1970	Principal sources, 1970
NONMETALS—Continued			
Talc, steatite, soapstone, pyrophyllite	110	243	Norway 66; France 59; United Kingdom 40.
Other nonmetals, n.e.s.:			
Crude, n.e.s	3,699	2,604	Kenya 1,920; France 510.
Slag and ash, n.e.s	50	254	All from United States.
Oxides and hydroxides of magnesium, strontium, and barium	1	240	West Germany 200; Austria 38.
Bromine, iodine and fluorine	1	3	Belgium-Luxembourg 2; France 1.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	191	440	Belgium-Luxembourg 324; Burundi 46.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	418	282	Zambia 222; Belgium-Luxembourg 60.
Carbon black	14	4	Belgium-Luxembourg 2; West Germany 1.
Coal and briquets:			
Coal	210,324	135,367	Southern Rhodesia 68,775; Africa, not further specified 48,936; Zambia 13,098.
Briquets of coal	1,114	1,107	All from Belgium-Luxembourg.
Lignite and lignite briquets	1	2,244	Southern Rhodesia 2,242.
Coke and semicoke	64,004	65,616	Southern Rhodesia 34,511; Zambia 15,343; United Kingdom 4,562.
Hydrogen, helium and rare gases	61	70	France 27; Norway 12.
Peat, including peat briquets and litter	37	--	
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	7,031	4,588	Iran 1,708; Saudi Arabia 1,422; Nigeria 1,335.
Refinery products:			
Kerosine do	2,011	973	Iran 620; Netherlands Antilles 154; Aden 56.
Distillate fuel oil do	1,442	645	Iran 283; Netherlands Antilles 252; Aden 55.
Residual fuel oil do	319	207	Angola 153; Iran 34; Israel 10.
Lubricants do	85	265	West Germany 136; Netherlands Antilles 39; United States 26.
Liquefied petroleum gas do	32	4	Iran 2; Netherlands 1.
Bitumen and other residues, and bituminous mixtures, n.e.s. do	45	59	Africa, not further specified 33; Netherlands 13; Belgium-Luxembourg 5.
Other do	1	3	United States 1; West Germany 1.
Total do	3,935	2,156	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	1,440	891	Belgium-Luxembourg 366; United States 236; Iran 106.

NA Not available.

[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Zaire, rather than from trade returns of trading partner countries as was done in the previous edition when actual Zairian statistics were not available.

COMMODITY REVIEW

METALS

Cobalt, Copper, Zinc, and Associated Metals.—Until October 1972 all of the copper, cobalt, and zinc production was from mines in Shaba Province operated by the nationalized company, La Générale des Carrières et des Mines du Zaire (Gécamines). In October a new company, Société de Dévelopement Industriel et Minière du Zaire (Sodimiza), began production of copper from its operation in Shaba.

The Gécamines complex includes the open pit mines of Musoshi, Kamoto, and Ruwe, and the underground mine at Kamoto in the western group; the M'Sesa and Karanda open pit mines and the Kambove-West underground mine in the central group; and the Kipushi underground mine in the southern group. There are associated concentrators at the various mine groups and metallurgical plants at Lubumbashi, Shituru, and Karanda. Cobalt production is primarily from the western group of mines, and zinc output, with associated cadmium and germanium, comes from the Kipushi mine. Byproduct gold and silver are recovered during metallurgi-

cal processing of the concentrates. Gécamines is, by far, the largest mining company in Zaire and is the economic mainstay of the Government. During 1972, sales from metal production were $504 million, and the company provided more than 30% ($170 million) of national treasury revenues. Employees total 24,586 of which 2,200 are considered management level. Zairians employed at the management level have increased from 11% in 1967 to 37% in 1972.

Gécamines produced 428,000 tons of copper in 1972 and anticipates production of 460,000 tons in 1974, which, if achieved, will be the realization of a 5-year expansion program goal a year ahead of the original schedule. Completion of the plan includes a major expansion of underground operations at Kamoto and an associated new concentrator with an annual capacity of 1.8 million tons of ore. Gécamines has a second 5-year development plan under consideration that aims at increasing copper production to 600,000 tons per year by 1980. About 14% of the 1972 zinc production was exported as a concentrate. The remaining 86% was roasted, and 145,000 tons of sulfuric acid for use in production of copper was recovered from the roaster gases.

Sodimiza, owned 15% by the Zairian Government and 85% by a consortium of six Japanese mining companies, with the Nippon Mining Co. having the largest interest, completed construction of the Musoshi mine and concentrator southeast of Lubumbashi near the Zambian border. Test production began in September, and after October 2, production began on a regular basis. However, startup problems restricted output to about 60% of the rated capacity of 50,000 tons of copper per year. Concentrates containing 36% to 40% copper are to be sent to Japan for smelting. Ore reserves in the present mining area at Musoshi are estimated to be 30 million tons grading 3% copper and if lower grade zones are included a total of 100 million tons grading 2.1% copper is indicated. Sodimiza continued exploration of a copper deposit at nearby Kinsenda and has proven reserves of 35 million tons of 4% copper. A decision on exploitation of the deposit will be made within 2 years. Extensive aerial and ground surveys have been conducted in the 36,000-square-kilometer concession in southeastern Shaba granted to the company. The agreement requires Sodimiza to surrender half of its concession area in 1974 and half of the remainder in 1979.

Société Minière de Tenke-Fungurume (SMTF), an international consortium formed in 1970, has an agreement with the Government of Zaire to develop known copper-cobalt deposits in the Tenke-Fungurume area of Shaba. Ownership of the consortium is as follows: the Zaire Government, 20%; Amoco Minerals Co., 28%; Charter Consolidated Ltd. of London 28%; Mitsui & Co. Ltd., 14%; Omnimines, 3.5%; Bureau de Recherches Géologiques et Minières (BRGM) of Paris, 3.5%; and Leon Tempelsman & Son, Inc., of New York, 3%.

SMTF conducted a drilling program to better define known mineralization and by yearend had completed 350 holes with a combined length of 47,000 meters. Reserves of sulfide, oxide, and mixed oxide-sulfide ore amenable to open pit mining were estimated at 46 million tons containing 5.5% copper and 0.44% cobalt. A feasibility study is in progress to determine the best technology, scale of operations, and timing for exploitation of the deposits. A tentative view is to initiate production in 1977 to coincide with availability of electrical power from the Inga-Shaba high-voltage transmission line. Estimated capital expenditures including the required infrastructure for a capacity of about 100,000 tons of copper per year would be $300 million.

Société Internationale des Mines du Zaire (SIMZ) with identical ownership and management as SMTF was formed in 1970 to undertake a program of systematic exploration in a 30,000-square-kilometer concession in Shaba. In accordance with the agreement, in March SIMZ surrendered half of the original concession area. The remaining 15,000 square kilometers will be further reduced to 5,000 square kilometers in October 1973.

Columbium-Tantalum, Gold, Tin, and Tungsten.—Syndicat Minière de l'Etain (SYMETAIN) is Zaire's largest producer of tin and a major producer of tungsten. There are two major production areas, Kalima and Punia, both in the Maniema District of Kivu Province. Tin production

Table 4.—Zaire: Estimated exports of copper
(Metric tons)

Commodity and destination	1969	1970	1971
Unrefined:			
Belgium-Luxembourg	176,167	184,900	195,800
France	5,300	4,800	11,200
	181,467	189,700	207,000
Refined:			
Belgium-Luxembourg	83,551	75,000	71,300
France	27,285	26,300	23,100
Greece	5,700	2,300	6,000
India	4,670	7,700	--
Italy	43,045	48,600	43,300
Japan	14,771	13,800	13,100
Netherlands	--	--	8,000
United Kingdom	3,614	3,900	4,800
Other	655	2,400	29,100
Total	183,291	180,000	198,700

Source: Metal Statistics 1962–1972. Metallgesellschaft Aktiengesellschaft. Frankfurt-am-Main, 60th Edition, 1973, p. 205.

data were not available for 1972, but the 1971 production consisted of 3,200 tons of cassiterite concentrate containing about 75% tin. The concentrate is obtained by crushing, screening, and washing the ore, which yields about 2 kilograms of product per ton of material treated. Shipment of the concentrate for export is via a river-rail system to the port of Matadi.

Cobelmin-Zaire, a subsidiary of Compagnie Belge d'Enterprises Minières, operates concessions owned by Compagnie Minière des Grands Lacs (MGL), Kinoretain, Kindamines, Minerga, and Miluba. Cobelmin's production from mines in Kivu Province included 990 kilograms of gold, 2,558 tons of tin concentrate, and quantities of columbium-tantalum and tungsten concentrates.

Philips Brothers Sobaki (Phibraki) operated properties at Kabili, Kivu Province, and produced 88 tons of concentrate from a mixed cassiterite-columbium-tantalum ore. Kivumines, owned by the Belgian company Sobaki and the U.S. company Engelhard Minerals & Chemicals Corp., produced 627 tons of tin concentrate, compared with 695 tons the previous year. It also produced 139 tons of tungsten concentrate and 224 tons of monazite concentrate. Somikubi, owned by Kivumines and MGL, produced 10 tons of tin concentrate.

In Shaba Province, Zaire-Etain, owned equally by the Government and Compagnie Géologique et Minière des Ingénieurs et Industriels Belges (GÉOMINES), produced 1,804 tons of 70% tin concentrate and 65 tons of byproduct columbium-tantalum. The ore is mined from four open pits near Manono, concentrated, and then converted to metal in Zaire's only tin smelter. Shipment of the tin ingots for export is by road, barge, and rail to the Angolan port of Lobito.

Manganese.—Société Minière de Kisenge (SMK), a Zaire company owned wholly by Société Générale de Belgique, was the only producer of manganese. The company operated two open pit mines at Kisenge near the Angola border. Most of the ore, which averages 40% to 42% manganese, is upgraded to 50% manganese by simple crushing and washing. However, about one-fourth of the crushed ore in the form of fines is shipped without washing and averages 46% to 48% manganese. Operation of the existing concentrator, which would permit mining lower grade ore with subsequent concentration to a 90% manganese product, is considered to be uneconomic. Production in 1972 was approximately 289,000 tons of the 50% grade and 80,000 tons of the 46% to 48% grade.

NONMETALS

Cement.—Ciments et Materiaux de Construction du Shaba (Cimshaba) and Société des Ciments du Congo (CICO) operated at capacity and produced a total of 360,000 tons of cement. Both companies had expansion programs in progress.

A German firm, Klöchner-Industrie-Anlagen, and the Zaire Government are engaged in a joint venture to construct a modern cement plant at Kinsangani in Haut-Zaire Province. The plant, designed for a final capacity of 1.5 million tons per

year, is scheduled for initial production in 1976.

Diamond.—Production of diamond was 13.4 million carats compared with 14.3 million carats in 1971. Most of the output was as industrial diamond in Lubilash by Société Minière de Bakwanga (MIBA). Diamond of gem stone quality was obtained from alluvial deposits in the Kasai field.

Glass Sand.—A Japanese company, Marubeni, is proceeding with plans for a glass factory at Lukala, along the lower Zaire River, utilizing nearby glass sands and power from the Inga Dam. The projected operation would require an investment of $26 million and 170 employees.

MINERAL FUELS

Coal.—La Société des Charbonnages de la Luena operated a colliery about 45 miles northwest of Lubudi in southwest Shaba. Production in 1972 increased 12.13% to 128,000 tons, well below peak production of 456,000 tons in 1955. Coal from Luena is sold to the KDL Railroad, Gécamines, and Cimshaba. Since Luena coal is soft and not satisfactory for coking, the colliery operates at only a fraction of its capacity. Zaire imports much of its coal requirements from the Wankie mine in Southern Rhodesia.

Petroleum.—Société Zaire-Italienne de Raffinage operates an oil refinery at Kinlao near the mouth of the Zaire River. The plant processed 750,000 tons of imported crude oil to produce motor gasoline, jet fuel, distillate fuel oil, and residual fuel oil.

Oil exploration continued in the offshore and adjacent areas; but results have not been reported.

The Mineral Industry of Zambia[1]

By Gertrude N. Greenspoon [2]

Copper production continued to dominate the Zambian mineral industry; smelter output was slightly below the record of 1969, but refinery production exceeded that of 1969 by 2%. Production at the Mufulira mine was still at reduced rates as work proceeded toward reestablishing output at the rate in effect prior to the September 1970 mine disaster.

Loans for expansion of the Zambian copper industry were approved by the Export Import Bank (EXIM). Terms of the Roan Consolidated Mines, Ltd. (RCM) loan called for cash payment of 10% or $2 million,[3] EXIM direct credit of 45% or $9 million, and private financing guaranteed by EXIM of 45% or $9 million. Repayment will be made in 20 semiannual installments beginning no later than January 15, 1974, with the private financing to be repaid from the first 10 installments. Financial arrangements for the Nchanga Consolidated Copper Mines, Ltd. (NCCM) loan of $30.3 million were on the same basis—10% cash payment, 45% EXIM direct credit, and 45% financial guarantee by EXIM. The loans will be repaid in 20 semiannual installments beginning March 15, 1974. EXIM's loan will be repaid out of the last 10 installments at an annual interest rate of 6% on outstanding balances.

The Metal Fabricators of Zambia (ZAMEFA) completed its first full year of operation at the Luanshya fabricating plant. Production began in February 1971, and in the first 9 months, copper cable production was valued at $3.4 million, of which $350,000 was exported. Consumption of refined copper totaled 1,438 tons in 1971 and rose to 1,982 tons in 1972.

The second national development plan, covering 1972 to 1976, was presented in January. Although the plan is directed toward rural development, two factors are vital in attaining this objective—expectations concerning the copper industry and the growth of population. A copper price of $1,036 per ton has been assumed, and an annual rate of 2.9% was projected for population growth.

Traditionally, Zambia relies on the copper industry as the major contributor to its economy. However, efforts are now directed toward diversification, and prospecting and exploration licenses have been issued to companies from the United States, the United Kingdom, Japan, Yugoslavia, Italy, and Romania. Under the Mindeco, Ltd., policy of assisting small-scale mining, the Lochinvar gypsum deposit was reactivated, and studies are proceeding on the possibility of opening the phosphate deposits at Kaluwe in the Central Province. Small-scale cooperative tin production is being carried out in the Southern Province. Other mineral commodities known to occur in Zambia include graphite, tantalum, manganese, and various clays.

Construction of the Tan-Zam Railway from the port city of Dar es Salaam, Tanzania, was proceeding rapidly and was expected to reach the Zambian border before the end of 1973. The line was still ahead of schedule, but the rapid rate of progress was slowed by difficulties in the Makumbako region in the Southern Highlands of Tanzania. Construction of bridges, culverts,

[1] Monthly and annual publications of The Standard Bank, Ltd., London, were the principal source of information for this chapter.

[2] Mineral specialist, Division of Nonferrous Metals—Mineral Supply.

[3] Where necessary, values have been converted from the Zambian currency kwacha to U.S. dollars at the rate of K1.00 = US$1.40.

and embankments on the Zambian side was being pushed vigorously.

On December 6, Zambia's currency was linked to the U.S. dollar instead of the pound sterling. The parity fixed was K1.00=U.S.$1.40.

PRODUCTION

The value of mineral production rose 10% to $722 million in 1972 but was substantially below the $1.1 billion record of 1969. Output of blister and electrolytic copper in 1972 rose 8% and 15%, respectively, as activities toward rehabilitation continued at the Mufulira mine. Electrolytic zinc production decreased slightly from 1971. Coal production continued the upward trend started in 1970 and rose 15% in 1972.

Table 1.—Zambia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
METALS			
Beryl, gross weight, kilograms	60	NA	[1] 186,764
Cadmium, metal	12	10	12
Cobalt:			
Mine output, metal content	2,400	2,080	2,053
Metal production	2,052	2,079	2,055
Copper:			
Mine output, metal content of concentrate	684,064	651,396	717,700
Blister and anodes, copper content	682,820	643,674	697,289
Refined	580,722	534,339	615,222
Gold [2], troy ounces	11,690	9,866	e 11,400
Lead:			
Mine output, lead content	r 32,600	33,900	31,400
Smelter (refined)	27,300	27,700	25,900
Manganese ore, gross weight	6,179	NA	NA
Selenium [3], kilograms	39,141	r e 35,800	e 41,200
Silver [4], thousand troy ounces	1,530	r e 1,400	e 1,600
Tin, concentrate, gross weight, long tons	5	e 6	7
Zinc:			
Mine output, zinc content	65,800	68,900	70,500
Smelter (electrolytic)	53,500	57,000	55,900
NONMETALS			
Amethyst, kilograms	35,172	93,417	46,125
Cement, hydraulic, thousand tons	377	471	485
Lime, hydraulic and quick, do	104	e 104	e 104
Stone:			
Limestone	r 753,089	873,562	1,000,896
Phyllite	r 57,073	73,291	84,735
Talc	r 2,323	713	4,521
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous, thousand tons	623	812	937

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Includes emerald.

[2] Chiefly contained in blister copper, refinery muds, and electrolytic copper.

[3] Contained in blister copper, refinery muds, and electrolytic copper.

[4] Refined silver and silver contained in blister copper, refinery muds, and electrolytic copper.

TRADE

Mineral exports from Zambia in 1971 were valued at $658 million, substantially below the $985 million exported in 1970. Copper exports valued at $630 million, 93% of total commodity exports, continued as the leading exchange earner, followed by zinc, lead, and cobalt. For the second successive year, Japan was Zambia's major market.

The value of imports in 1971 was $553 million, 16% more than in 1970. Mineral commodities accounted for $61 million, of which $50 million was for mineral fuels.

The value of total trade and mineral trade, in million dollars, follows:

	Mineral commodity trade	Total commodity trade
Exports:		
1969	1,046.5	1,073.1
1970	984.6	1,000.7
1971	658.1	678.8
Imports:		
1969	56.1	436.5
1970	64.8	r 477.0
1971	61.3	553.3

r Revised.

Table 2.—Zambia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, waste and scrap	--	4	All to Mozambique.
Cadmium, metal	31	--	
Cobalt, metal	1,814	1,189	Mainly to United Kingdom.
Copper metal, including alloys:			
Sludge	651	82	All to Japan.
Slimes	815	56	West Germany 40; Sweden 16.
Residues	--	1,997	Japan 888; Belgium-Luxembourg 726; West Germany 281.
Unwrought, crude:			
Anodes	736	1,199	All to Austria.
Blister	103,226	98,678	Japan 43,732; West Germany 16,983; Yugoslavia 12,965; People's Republic of China 9,321.
Refined:			
Wire bars	543,998	494,654	United Kingdom 92,494; Japan 80,666; Italy 67,556; France 51,626.
Cathode form	33,628	37,804	Japan 16,233; France 7,590; United Kingdom 3,974.
Ingots and bars	990	--	
Iron and steel semimanufactures, including ferroalloys	(1)	19	Mainly to Uganda.
Lead:			
Oxide	--	438	All to Republic of South Africa.
Unwrought	22,065	23,895	Republic of South Africa 10,503; Yugoslavia 3,450; Iran 3,010.
Semimanufactures	16	--	
Silver, unworked troy ounces	97,491	93,816	All to Republic of South Africa.
Zinc:			
Unwrought	50,343	49,453	Yugoslavia 14,004; Republic of South Africa 12,151; India 7,229.
Semimanufactures	(1)	--	
NONMETALS			
Cement	5,475	6,227	Mainly to Zaire.
Fertilizers, nitrogenous	--	20	All to Tanzania.
Lime	65	344	All to Zaire.
Magnesite	--	2	Do.
Precious and semiprecious stones, except diamond value	$697,728	$1,106,367	West Germany $446,571; Hong Kong $400, 943; Republic of South Africa $151,473.
Talc	358	471	All to Republic of South Africa.

[1] Less than ½ unit.

Table 3.—Zambia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum, semimanufactures	601	822	Republic of South Africa 303; Tanzania 215; United Kingdom 86.
Antimony, powder, including tellurium powder	--	6	All from Republic of South Africa.
Chromium, ore and concentrate	595	1,482	Do.
Cobalt metal, including alloys, all forms	--	12	All from Zaire.
Copper:			
Ore and concentrate	--	1,187	All from United States.
Copper sulfate	5	134	Mainly from Republic of South Africa.
Metal, including alloys, all forms	862	2,224	Republic of South Africa 464; United Kingdom 129; Italy 61.
Iron and steel:			
Ore and concentrate	29,379	10,000	All from Republic of South Africa.
Pig iron, sponge iron and ferroalloys	3,314	1,097	Republic of South Africa 962; United Kingdom 73.
Ingots and other primary forms	113	987	Mainly from Japan.
Scrap	--	14,135	United Kingdom 9,786; Zaire 2,897; United States 1,452.
Semimanufactures	86,236	203,164	Japan 92,554; United Kingdom 39,896; Republic of South Africa 28,870.
Lead:			
Oxides	85	39	Republic of South Africa 27; United Kingdom 12.
Metal, including alloys, unwrought and semimanufactures	44	33	Republic of South Africa 17; United Kingdom 15.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Mercury——76-pound flasks	8	8	United Kingdom 6; Kenya 2.
Nickel metal, including alloys	14	27	Mainly from United Kingdom.
Platinum-group metals, including alloys, all forms——troy ounces	889	1,303	United Kingdom 1,211.
Silver metal, including alloys——do	15,373	1,025	Mainly from United Kingdom.
Tellurium, elemental	145	2	All from France.
Tin metal, including alloys——long tons	65	62	Brazil 33; Republic of South Africa 20.
Titanium oxide	594	613	Republic of South Africa 366; West Germany 201; France 25.
Zinc:			
Oxides	NA	--	
Metal, including alloys	6	9	United Kingdom 6; Netherlands 1.
Other:			
Ore and concentrate of base metals, n.e.s.	78	114	Australia 106.
Ash and residue containing nonferrous metals	20	--	
Metals, including alloys, all forms	120	159	United Kingdom 67; Zaire 36.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum, etc.	16	22	United States 19; Republic of South Africa 2.
Grinding and polishing wheels and stones	[1] $280,519	80	Republic of South Africa 54; West Germany 13; United Kingdom 11.
Other, crude	1	--	
Asbestos	15,607	1,985	Mainly from Republic of South Africa.
Barite	112	222	West Germany 169; Republic of South Africa 52.
Boron materials:			
Crude, natural borates	105	4	United States 2; France 1; United Kingdom 1.
Oxide and acid	9	55	Mainly from Republic of South Africa.
Bromine——kilograms	--	322,490	United Kingdom 281,090; Republic of South Africa 41,400.
Cement	917	7,150	Southern Rhodesia 5,921; United Kingdom 452.
Chalk	391	318	United Kingdom 222; West Germany 42; France 40.
Clays and clay products (including all refractory bricks):			
Crude clay, n.e.s.:			
Fire clay	283	76	United Kingdom 42; Republic of South Africa 33.
Fuller's earth, dinas, chamotte	100	136	Mainly from United Kingdom.
Kaolin (china clay)	708	888	Republic of South Africa 742; United Kingdom 145.
Other	1,189	1,448	Mainly from Republic of South Africa.
Products:			
Refractory (including nonclay bricks)——value, thousands	$1,624	$3,149	Austria $1,012; United Kingdom $914; Republic of South Africa $823.
Nonrefractory——do	$168	$212	United Kingdom $114; Republic of South Africa $29.
Diamond, industrial——thousand carats	--	21,405	All from United Kingdom.
Diatomite and other infusorial earth	804	995	Republic of South Africa 782; United States 193.
Feldspar and fluorspar	45	76	All from Republic of South Africa.
Fertilizer materials:			
Crude, phosphatic	175	192	United Kingdom 71; Israel 56; West Germany 40; Australia 25.
Manufactured:			
Nitrogenous	31,743	76,310	Republic of South Africa 37,855; Italy 22,474; Netherlands 8,650.
Phosphatic	4,188	22,670	Italy 20,195; Republic of South Africa 1,976.
Potassic	3	817	Republic of South Africa 505; United Kingdom 202; Italy 109.
Other, including mixed	1	[2]	All from United Kingdom.
Ammonia, anhydrous	1,245	1,698	France 600; Southern Rhodesia 534; Republic of South Africa 522.
Graphite, natural	6	48	Mainly from Republic of South Africa.
Gypsum and plasters	11,822	52,785	Do.
Lime	NA	10	All from Kenya.
Magnesite	286	799	Mainly from Republic of South Africa.
Mica, all forms	30	8	Mainly from West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Pigments, mineral:			
Natural, crude	26	212	West Germany 169; Czechoslovakia 34.
Iron oxides, processed	311	162	United Kingdom 86; West Germany 55; Republic of South Africa 21.
Precious and semiprecious stones, except diamond—value, thousands	$26	$5	West Germany $2; Zaire $2; Republic of South Africa $1.
Salt	13,186	24,036	United Kingdom 6,097; Mozambique 5,813; Republic of South Africa 5,605.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	2,163	3,356	West Germany 1,322; Italy 752; United States 435; India 340.
Caustic potash, sodic and potassic peroxide	22	72	Belgium-Luxembourg 30; United Kingdom 24; United States 14.
Stone, sand and gravel:			
Dimension stone	101	31	Republic of South Africa 18.
Dolomite, chiefly refractory grade	2,500	29	Norway 20; Republic of South Africa 9.
Gravel and crushed rock	75	10	Republic of South Africa 9; United Kingdom 1.
Limestone (except dimension)	26	18	All from Republic of South Africa.
Sand, excluding metal bearing	196	206	Republic of South Africa 193; United Kingdom 12.
Sulfur:			
Elemental, all forms	53	11,771	Mainly from France.
Sulfur dioxide	--	10	All from United Kingdom.
Sulfuric acid	268	1,411	Republic of South Africa 951; Southern Rhodesia 331; Israel 80.
Talc, steatite, soapstone, pyrophyllite	7	99	Republic of South Africa 66; United Kingdom 14; France 11.
Vermiculite	10	3	All from Republic of South Africa.
Other nonmetals, n.e.s.:			
Crude	203	14	Mainly from Republic of South Africa.
Slag, dross and similar waste, not metal bearing	105	101	United States 95; United Kingdom 6.
Oxides and hydroxides, n.e.s	2,179	458	United Kingdom 247; Republic of South Africa 141; Kenya 28.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	3,091	5,385	Republic of South Africa 4,954.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	--	13,674	Iran 4,796; Kenya 3,443; People's Republic of China 2,000.
Carbon black and gas carbon	NA	--	
Coal and coke, including briquets	364,921	145,317	Southern Rhodesia 124,869; Republic of South Africa 19,433.
Gas, hydrocarbon	527	1,352	Republic of South Africa 330; Italy 30; Iran 16.
Petroleum:			
Refinery products:			
Gasoline thousand 42-gallon barrels	1,145	1,328	Iran 1,268.
Kerosine—do	83	32	Iran 28; Saudi Arabia 3.
Jet fuel—do	276	22	Mainly from Iran.
Distillate fuel oil—do	1,620	1,957	Iran 1,926; Saudi Arabia 18.
Residual fuel oil—do	18	4	All from Kenya.
Lubricants—do	162	248	Kenya 121; United Kingdom 58; Netherlands 33.
Mineral jelly and wax—do	20	37	United States 16; Singapore 4.
Other:			
Pitch and pitch coke 42-gallon barrels	132	398	United States 200; Zaire 134; Republic of South Africa 34.
Petroleum coke—do	10,236	8,254	United States 4,946; United Kingdom 3,000.
Bituminous mixtures, n.e.s. do	27,845	16,895	Bahrain 6,156; Kenya 5,419; Republic of South Africa 2,020.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals—value	$112,801	$39,263	United States $13,951; United Kingdom $12,412; Republic of South Africa $11,074.

NA Not available.
[1] Tonnage not reported.
[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Copper.—Mine, smelter, and refinery production of copper increased significantly in 1972 from the low levels of 1971. Except for refinery output, however, copper production fell short of the record outputs of 1969.

Plans proceeded for expansion of copper production from the 1969 level of 720,000 tons to nearly 900,000 tons in 1975. Most of the additional output will come from the Chingola, Chambishi, Baluba, Rokana, and Mufulira operations, but the accident at Mufulira in 1970 resulted in a short-term modification in the planned expansions. In addition, improvements included installation of a tailing leach, solvent extraction, and electrowinning plant at Nchanga in 1974, and the installation of periodic current reversal facilities in some sections of the Mufulira and Rokana refineries. Research at Mufulira indicated that copper refinery tankhouse production could be increased by 30%, through use of a higher intensity current and by briefly reversing the direction of the current during electrolysis.

RCM produced 242,800 tons of refined copper in the year ended June 30, 1972, slightly below the 250,400 tons produced in the same period of 1971. Production at Mufulira rose 3% over 1971 but was still less than half that expected before the cave-in in 1970. All divisions at RCM reported increased output except Luanshya where production fell 16% as a result of lower grade ore being mined. Copper production consisted of 212,100 tons of wirebars, 24,700 tons of cathodes, 5,600 tons of leach cathodes, and 400 tons of anodes.

Production of cathodes at the Ndola Copper Refinery totaled 121,000 tons (119,400 tons in 1971), and the casting plant produced 133,600 tons of wirebars (132,100 tons in 1971).

The Mufulira division produced 5.12 million tons of ore averaging 2.12% copper (3.75 million tons and 2.20% in 1971). Smelter production, including concentrates and smelting ore from other RCM mines, was 143,900 tons of anodes (128,900 tons in 1971). A fire in February damaged the new electric furnace and curtailed smelter output. Refined copper production was 86,800 tons compared with 84,400 tons in 1971. The installation of the fourth tankhouse in August will increase Mufulira refining capacity by 75,000 tons to 255,000 tons annually.

Ore production at Luanshya totaled 6.26 million tons, 4% below the record 6.55 million tons in 1971. The decrease was due in part to mining of lower grade ore. Smelter production of anodes was 110,200 tons (110,500 tons in 1971), and refined copper output was 85,000 tons (101,700 tons in 1971). Work continued on preparing the Baluba mine for production which was expected to begin in January 1973. Expansion of the concentrator to treat Baluba ore was proceeding on schedule. Initial output of 22,000 tons per year at Baluba will be increased to about 50,000 tons annually as other sections of Luanshya are depleted.

At Chibuluma, 715,000 tons of ore averaging 3.96% copper and 0.20% cobalt was produced, compared with 659,700 tons averaging 4.01% copper and 0.20% cobalt in 1971. Refined copper production totaled 25,400 tons (23,900 tons in 1971). Cobalt hydroxide containing 588 tons of cobalt (922 tons in 1971) was sold to NCCM. A total of 1.46 million tons of ore from the Chambishi mine was treated in the Chambishi and Mufulira concentrators and the leach plant. Output of refined copper was 34,600 tons (30,000 tons in 1971). Development of underground mining at Chambishi and expansion of the concentrator continued throughout the year. Increased capacity at the concentrator was expected to become available in the second half of 1973, but treatment of some ore will continue at Mufulira.

The Kalengwa open pit mine produced 241,000 tons of ore, of which 147,000 tons was concentrated and 94,000 tons of low-grade ore was stockpiled. Refined copper production totaled 11,000 tons compared with 10,400 tons in 1971.

Ore reserve data for the RCM group at the end of June 1972 follow:

Mine	Ore (thousand metric tons)	Copper (%)
Mufulira	133,829	3.15
Luanshya	128,455	2.65
Chambishi	41,313	2.92
Chibuluma	5,353	4.84
Kalengwa	1,326	8.85

Copper production at the NCCM operations (Rokana, Chingola, and Konkola) for the year ended March 31, 1972, totaled 401,300 tons. The Mindola ore body accounted for 56% of the 5.6 million tons of ore produced at Rokana. Concentrator production was 261,800 tons of copper concentrate averaging 35.26% copper, and 55,400 tons of cobalt concentrate averaging 6.81% cobalt. Smelter output totaled 303,900 tons of blister and anode copper, and refinery production was 294,200 tons.

At Chingola, 10 million tons of ore was produced—3 million tons from the Lower and Upper underground mines, and 7 million tons from open pit mines (Nchanga, River Lode, Chingola, Mimbula, and Fitula). The Chingola concentrator treated 8.5 million tons of ore and produced 251,200 tons of copper contained in concentrate.

The Konkola concentrator treated 1.4 million tons of Chingola ore and 1.7 million tons of ore from the Konkola mining operation. Production from Chingola ore was 37,000 tons of copper in concentrate, and the Konkola ore yielded 48,200 tons of copper in concentrate.

Ore reserve data for the NCCM group follows:

Mine	Ore (thousand metric tons)	Copper %
Chingola	229,021	3.95
Nkana (Rokana)	123,027	2.53
Bancroft (Konkola)	122,399	3.55
Kansanshi (Konkola)	6,842	3.44
Bwana Mkubwa (Rokana)	5,102	3.32

Lead and Zinc.—The Broken Hill Division of NCCM produced 297,100 tons of lead-zinc ore in the year ended March 31, 1972. The flotation plant treated 296,800 tons of ore containing 11.7% lead and 23.2% zinc, and produced 27,200 tons of lead concentrate averaging 43% lead, and 32,900 tons of zinc concentrate averaging 58.7% zinc. Production of zinc totaled 56,000 tons, of which 31,800 tons was from the Imperial Smelting Furnace, and 24,200 tons was from the electrolytic plant. Output of lead totaled about 26,000 tons. Proven reserves at the Broken Hill division at the end of 1971 were 1.9 million tons averaging 23.3% zinc and 11.1% lead, and indicated reserves were 1.6 million tons containing 25.2% zinc and 10.5% lead.

An agreement was signed between NCCM and Kloeckner-Deutz A.G., Cologne, Germany, for construction and installation of two Waelz kilns at the Broken Hill division in Kabwe. The entire project will cost about $30.8 million, and will involve treatment of low-grade lead and zinc ores by volatilization. Operations at the existing plant would not produce more than 87,000 tons of lead and zinc annually and would cease in 1983 when ore reserves were exhausted. The Waelz kilns are expected to be in operation in mid-1975 and production will be at the rate of 115,000 tons until 1978, after which it will average 106,000 tons per year until 1983. Increased output of silver and cadmium will also result from operation of the kilns.

Silver.—Silver was produced as a byproduct of copper and lead refining. In 1955 the first attempt was made at the NCCM Broken Hill division to recover the silver from the lead operations, thus enabling the mine to produce a 99.997% purity lead. All crude silver material was stockpiled until 1958 when the silver cupellation furnace was installed. In the first year of operation 54,800 troy ounces of silver was produced, and until 1964 the silver output was used in the purification section of the leach plant. After the leach plant was modified, silver production was exported, mostly to the Republic of South Africa. Silver is produced twice a year because sufficient stocks of the crude material must be accumulated. By the end of March, about 104,200 troy ounces of 96.17% pure silver was produced in a single operation, the highest achieved in 13 years.

NONMETALS

Mindeco, Ltd., Zambia's mining development corporation, completed development of the Lochinvar gypsum deposit, near Monze. The 25,000-ton-per-year project is expected to provide gypsum requirements for the cement industry when production begins in mid-1973. Magnetite mining was begun in the Kaluwe area, and an apatite deposit is under evaluation.

Chilanga Cement, Ltd. was doubling the capacity of its plant at Ndola with the addition of a second dry process kiln equipped with a suspension preheater and planetary cooler, having a daily capacity of 600 tons. When completed in 1973 the total annual capacity of the plant will be 440,000 tons.

MINERAL FUELS

Coal.—Supplies of coal from Maamba Collieries, Ltd., were adequate throughout the year. A record output was attained in 1972, the seventh year of coal production. The copper smelting and refining industries were the major coal consumers. However, it was planned to install equipment at the Mufulira smelter and Ndola refinery to utilize heavy fuel oil from the Ndola oil refinery. The conversion is scheduled for completion in 1973. Imports of coal from the Wankie Colliery Co. Ltd., Southern Rhodesia, have been discontinued.

Petroleum.—A rapid increase in demand for petroleum products, together with construction of an oil refinery at Ndola, made it necessary to expand the Tazama Pipelines, Ltd., oil pipeline. A $32 million loan was signed with Italy, of which Zambia will furnish $21 million. Completion of the expanded pipeline by the end of 1973 will increase capacity from 760,000 tons to 1.1 million tons annually. The pipeline capacity will be in line with the capacity of the Indeni oil refinery under construction at Ndola. The refinery, also a joint Italian-Zambian project, is expected to begin operations in 1973. Heavy fuel oil produced as a byproduct of the refining process will be used at the copper smelters instead of coal. It was expected that the smelters would account for about 170,000 tons of the heavy fuel oil produced.

The Mineral Industry of the Islands of the Caribbean

By Staff, Bureau of Mines

CONTENTS

BAHAMAS [1]

Ocean Industries. Inc., a subsidiary of Dillingham Corp. of Hawaii, continued to expand its aragonite (calcium carbonate) production facilities during 1972. Ocean Industries began large-scale aragonite mining operations in January 1972, from Ocean Cay, which is an artifical island located south of Bimini. The aragonite is stored and shipped from Ocean Cay to Eastern U.S. ports in the bulk ocean carrier "Aragonite Islander." Ocean Industries has leased Ocean Cay and three other Bahama seabed areas until 2015.

In addition, Ocean Cay is used as an export terminal and will become a petroleum transshipment terminal upon completion of the necessary tanker handling and associated storage facilities under construction. Oil is expected to be transported from the Persian Gulf to Ocean Cay via two 350,000-deadweight-ton tankers that Ocean Industries is having built. The oil will then be loaded aboard smaller tankers for delivery to a U.S. east coast refinery.

Another transshipment terminal is being constructed at Riding Point, Grand Bahama Island by a joint venture of Burmah Oil (49%) and the Bahamas Development Corp. (51%). This facility will include a 100-million-barrel oil storage plant and accommodations for large crude carriers. The agreement covering this facility provide's for an option on a refinery of 300,000- to 500,000-barrel-per-day capacity.

The Freeport refinery on Grand Bahama Island, owned by Bahamas Oil Refinery Co. (BORCO), a subsidary of New England Petroleum Corp. (65%) and Standard Oil of California (35%), completed its second year of operation at approximately 250,000 barrels per day. This plant operated primarily to supply low-sulfur residual fuel oil to the east coast of the United States; lighter products output was shipped to Western Europe. Feedstock consisted primarily of almost sulfur-free Lybian and Nigerian crudes blended with higher sulfur crudes from the Persian Gulf area.

In 1971, BORCO awarded a contract to an Italian firm for the expansion of the Freeport plant's crude oil distillation capacity to 500,000 barrels per day. This expansion is to be accomplished primarily by the addition of a third atmospheric distillation unit. During 1972, BORCO received bids on the construction of desulfurization facilities at Freeport. Initial plans involve installation of a hydroisomax desulfurization unit capable of processing 60,000 barrels of oil per day.

[1] By Larry S. Dewey, mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Islands of the Caribbean: Production of mineral commodities

Area, commodity, and unit of measure [1]	1970	1971	1972 [p]
ANTIGUA [2]			
Petroleum refinery products: [3]			
Gasoline—thousand 42-gallon barrels	468	680	NA
Jet fuel and kerosine—do.	504	543	NA
Distillate fuel oil—do.	746	746	NA
Residual fuel oil—do.	2,664	2,664	NA
Other, including refinery fuel and losses [e]—do.	[r] 178	267	NA
Total [e]—do.	[r] 4,560	4,900	NA
Stone, crushed and broken—thousand cubic meters	NA	29	55
Sand and gravel—thousand metric tons	NA	NA	25
BAHAMAS [2]			
Cement, hydraulic—thousand metric tons	833	831	986
Petroleum refinery products:			
Jet fuel—thousand 42-gallon barrels	4,100	10,228	12,115
Distillate fuel oil—do.	3,200	10,242	11,200
Residual fuel oil—do.	13,000	42,267	45,713
Other—do.	3,700	10,913	11,419
Refinery fuel and losses—do.	1,500	3,000	1,354
Total—do.	25,500	76,650	81,801
Salt—thousand metric tons	621	1,213	809
Stone:			
Aragonite [4]—do.	2,142	762	NA
Limestone (for cement only)—do.	990	NA	1,207
BARBADOS [2]			
Gas, natural:			
Gross production—million cubic feet	[r] 117	129	[e] 130
Marketed production—do.	97	106	[e] 110
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	268	301	321
Kerosine—do.	89	92	95
Distillate fuel oil—do.	305	219	225
Residual fuel oil—do.	198	228	243
Other—do.	27	34	41
Refinery fuel and losses—do.	45	46	49
Total—do.	932	920	974
CUBA [2 5]			
Cement, hydraulic—thousand metric tons	742	1,088	1,474
Chromium, chromite, gross weight [e]—metric tons	NA	15,000	20,000
Cobalt, mine output, metal content [e]—do.	1,500	1,500	1,500
Copper, mine output, metal content [e]—do.	3,000	3,000	3,000
Iron and steel, crude steel—thousand metric tons	140	[r e] 140	[e] 140
Nickel:			
Content of oxide product [e]—metric tons	18,500	[r] 34,000	36,000
Content of sulfide product [e]—do.	16,700		
Petroleum: [3]			
Crude—thousand 42-gallon barrels	1,330	1,330	NA
Refinery products:			
Gasoline—do.	7,395	8,075	NA
Jet fuel and kerosine—do.	3,108	3,488	NA
Distillate fuel oil—do.	6,714	7,012	NA
Residual fuel oil—do.	13,453	14,386	NA
Liquefied petroleum gas—do.	661	696	NA
Other [e]—do.	[r] 1,317	[r] 1,483	NA
Refinery fuel and losses [e]—do.			
Total [e]—do.	[r] 32,648	[r] 35,140	NA
DOMINICA [2]			
Pumice used for aggregate—metric tons	61,690	[e] 62,000	77,111
DOMINICAN REPUBLIC [2]			
Aluminum, bauxite, dry equivalent, gross weight [6]—thousand metric tons	1,067	1,311	1,227
Cement, hydraulic—do.	492	603	681
Copper mine output, metal content—do.	425	[e] 450	[e] 450
Gypsum—do.	176	248	[e] 300
Marble—cubic feet	1,084	6,413	NA
Nickel, content of ferronickel product—metric tons	--	200	17,400
Salt—thousand metric tons	[r] 37	39	[e] 39
Stone, limestone (excluding that for cement)—do.	48	NA	52
GRENADA [2]			
Sand and gravel—thousand cubic meters	27,524	NA	NA
Stone, crushed and broken—do.	72,351	NA	NA

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities—Continued

Area, commodity, and unit of measure [1]	1970	1971	1972 [p]
HAITI [2 7]			
Aluminum, bauxite, dried, gross weight ____thousand metric tons__	632	643	687
Cement, hydraulic _____do____	65	72	89
Copper mine output, metal content _____metric tons__	[r] 4,848	6,622	--
Gold mine output, metal content _____troy ounces__	[e] 3,000	[e] 3,000	--
Silver mine output, metal content _____thousand troy ounces__	[e] 17	[e] 17	--
JAMAICA			
Aluminum:			
Bauxite, dry equivalent of crude ore, gross weight thousand metric tons__	12,009	12,767	12,114
Alumina (exports) _____do____	1,689	1,812	2,136
Cement, hydraulic _____do____	457	431	431
Clays for cement _____do____	161	[e] 150	[e] 150
Gypsum _____metric tons____	282,843	309,249	[8] 441,159
Lime _____do____	NA	137,000	165,929
Petroleum refinery products:			
Gasoline _____thousand 42-gallon barrels__	2,248	1,247	2,345
Jet fuel _____do____	549	1,319	792
Kerosine _____do____	672		528
Distillate fuel oil _____do____	2,253	2,042	2,062
Residual fuel oil _____do____	5,104	5,467	5,851
Other _____do____	985	345	337
Refinery fuel and losses _____do____	303	335	596
Total _____do____	12,114	10,755	12,511
Sand and gravel:			
Sand:			
Glass _____thousand metric tons__	15	14	25
Common _____thousand cubic meters__	NA	NA	900
Gravel _____do____	NA	NA	[e] 70
Stone:			
Limestone for cement and lime _____thousand metric tons__	744	494	NA
Marble _____metric tons__	NA	2,604	NA
MARTINIQUE			
Clays _____do____	NA	NA	[e] 60
Pumice [e] _____do____	18	18	18
Salt [e] _____do____	300	300	300
Sand _____do____	NA	NA	[e] 50
Stone, including gravel:			
Crushed and broken _____do____	NA	NA	[e] 650
Other [9] _____do____	NA	NA	[2] 160
NETHERLANDS ANTILLES [2]			
Fertilizer materials:			
Phosphatic, crude phosphate rock _____do____	[e] 110	92	[10] 60
Nitrogenous, manufactured (sales) _____do____	NA	NA	112
Petroleum refinery products:			
Gasoline aviation _____thousand 42-gallon barrels__	1,823	2,114	4,438
Gasoline, other _____do____	30,130	27,964	24,175
Jet fuel _____do____	14,662	12,877	24,865
Kerosine _____do____	16,046	14,045	15,403
Distillate fuel oil _____do____	27,857	25,208	21,480
Residual fuel oil _____do____	200,160	159,545	165,983
Lubricants _____do____	7,453	2,519	6,234
Other _____do____	21,697	25,060	7,863
Refinery fuel and losses _____do____	16,189	15,842	10,363
Total _____do____	336,017	285,174	280,804
Stone, limestone _____metric tons__	NA	975	NA
ST. LUCIA			
Sand and gravel _____thousand metric tons__	70	NA	NA
Stone, crushed _____do____	520	NA	NA

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities—Continued

Area, commodity, and unit of measure[1]	1970	1971	1972 p
ST. VINCENT			
Sand ——metric tons——	NA	NA	e 31,000
Stone, crushed ——do——	NA	NA	e 25,000
TRINIDAD AND TOBAGO			
Asphalt, natural ——thousand metric tons——	132	124	115
Cement, hydraulic ——do——	271	256	287
Clays:			
Argillite ——thousand cubic meters——	181	169	NA
Other, unspecified ——do——	[11]29	78	96
Fertilizer material, manufactured nitrogenous thousand metric tons——	605	578	640
Gas, natural:			
Gross production ——million cubic feet——	121,060	109,814	104,338
Marketed production ——do——	66,687	65,074	e 70,000
Gypsum ——metric tons——	e 4,000	271	--
Natural gas liquids ——thousand 42-gallon barrels——	168	141	137
Petroleum:			
Crude ——do——	51,047	47,147	51,212
Refinery products:			
Gasoline, aviation ——do——	1,677	210	227
Gasoline, other ——do——	19,392	22,928	20,145
Jet fuel ——do——	12,141	11,526	9,451
Kerosine ——do——	6,100	5,782	6,766
Distillate fuel oil ——do——	15,269	18,728	13,769
Residual fuel oil ——do——	91,501	79,272	85,197
Lubricants ——do——	1,261	1,270	1,241
Other ——do——	1,832	1,787	1,942
Refinery fuel and losses ——do——	5,687	4,045	5,536
Total ——do——	154,860	145,548	144,274
Sand and gravel:			
Pitch sand ——thousand cubic meters——	12	20	24
Other sand and gravel ——do——	92	173	664
Stone:			
Diorite ——do——	3	28	2
Limestone (for cement) ——do——	[11] 199	379	441
Porcellanite ——do——	35	32	9
Sulfur, elemental, byproduct ——metric tons——	4,194	e 4,000	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to the countries listed individually in this table, Bermuda, also covered by this chapter, presumably produces crude construction materials (clays, sand and gravel, and stone) but output is not reported and available information is inadequate to make reliable estimates of ouptut levels.

[2] In addition to the commodities listed, mineral commodity output may also include crude construction materials (clays, sand and gravel, stone, and lime) other than those listed (if any) but data on such production are not collected and available information is inadequate to make reliable estimates of output levels.

[3] Official figures are not available; data on products listed individually are converted to barrels from metric tons given in: United Nations, World Energy Supplies 1968–71, Statistical Papers, Series J, No. 16, New York, 1972, pp. 61–125; total is estimated from crude oil production and imports reported on pp. 53–60 of same source; other products derived by subtraction.

[4] Of total output, a large part in each year was used locally for fill, with only a small part of the total exported, for agricultural use. Exports totaled 109,775 tons in 1970 (1971 and 1972 data are not available).

[5] In addition, gypsum, iron ore, manganese ore, pyrite, and salt, all produced in significant quantities prior to the termination of public official statistics, presumably were produced during the period covered by the table, but information is inadequate to formulate reliable estimates of output.

[6] Shipments.

[7] Salt presumably also is produced, but output is not reported, and information is inadequate to make reliable estimates of output levels.

[8] Figure represents local sales and exports.

[9] Includes volcanic tuff and materials used for fill, ballast, and other purposes.

[10] Exports.

[11] Excludes output for cement production; a total of 408,140 metric tons of limestone and clays (undifferentiated) was reportedly produced for this purpose in 1970.

Table 2.—Bahamas: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms:			
Unwrought	3	--	
Worked	(1)	1	Mainly to United States.
Copper metal, including alloys, all forms	11	16	All to United States.
Iron and steel:			
Ore and concentrate	--	97	Do.
Scrap	20	142	Mainly to United States.
Unwrought and semimanufactures	160	15	All to United States.
Lead, including alloys, all forms	2	2	Do.
Other:			
Ores and concentrates	--	1	Do.
Nonferrous scrap and base metals, n.e.s	(1)	533	United States 397; Netherlands 102.
NONMETALS			
Cement, other than building materials	706,290	800,142	United States 769,579.
Clays, refractory and construction materials value	--	$305	All to United States.
Fertilizer materials	16	(1)	NA.
Salt	767,981	1,058,986	United States 1,009,436.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	--	1	All to United States.
Worked value	--	$1,675	Do.
Gravel	--	46	Do.
Sand	14,243	12,193	Do.
Other, building materials of cement value	$1,531,707	$20,845	United States $20,745.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	--	(1)	NA.
Refinery products:			
Gasoline:			
Motor do	1,625	10,457	Puerto Rico 7,836; United States 2,443.
Aviation do	213	1	Mainly to Turks Island.
Kerosine do	15	458	Mainly to Netherlands.
Jet fuel do	152	4,940	United States 4,754.
Distillate fuel oil do	2,531	7,560	Canada 3,079; United States 2,366.
Residual fuel oil do	2,680	10,487	United States 7,675.
Lubricants do	(1)	(1)	NA.
Mineral jelly and wax value, thousands	$6	--	
Other thousand 42-gallon barrels	1	--	

NA Not available.

[1] Less than ½ unit.

Table 3.—Bahamas: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum metal, including alloys, all forms:			
Unwrought	17	11	United States 9.
Semimanufactures	216	314	United States 112; United Kingdom 78.
Copper, including alloys, all forms	75	50	United Kingdom 22; United States 19; Canada 9.
Iron and steel:			
Ore and concentrates	11,882	7,530	Canada 7,519.
Metal:			
Scrap	81	48	United States 33.
Primary forms [1]	2,539	6	Mainly from United States.
Semimanufactures	101,862	62,860	United States 44,023; United Kingdom 16,777.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Lead, including alloys, all forms	57	40	United Kingdom 22; United States 18.
Platinum-group metals and silver, troy ounces	127,021	7,627	United Kingdom 4,360; United States 3,267.
Tin, including alloys, all forms, long tons	127	788	United States 781.
Uranium and thorium, including alloys, all forms	--	1	All from United Kingdom.
Zinc, including alloys, all forms	5	5	Mainly from United States.
Other:			
Ores and concentrates	1,067	--	
Nonferrous metal scrap	--	1	All from United States.
Base metals, including alloys, all forms	57	6	United States 3; United Kingdom 3.
NONMETALS			
Abrasives, natural (including industrial diamonds)	3	(2)	NA.
Cement	18,900	39,385	United Kingdom 31,911.
Clays and clay products	1,505	249	United States 248.
Diamond, gem, not set or strung, value	$290	$6	All from United Kingdom.
Fertilizer materials:			
Crude	1,587	2,479	United States 2,314.
Manufactured	2,632	2,099	United States 1,983.
Precious and semiprecious stones, except diamond, value	$800	$25,080	United States $12,834; Canada $8,300.
Salt	40,701	72,162	United States 67,424; United Kingdom 4,696.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	483,922	265,150	United States 202,869; Canada 55,303.
Worked, value	$317,778	$63,277	United States $44,603; United Kingdom $15,021.
Gravel	10,828	22,385	United States 21,539.
Limestone	3	10	All from United States.
Sand	77,916	92,421	United States 89,193.
Other nonmetals, n.e.s	57	11	United States 10.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	15,635	15,179	Venezuela 13,937; Curaçao 1,159.
Coal and coke, including briquets	1,068	1,196	West Germany 518; United Kingdom 429.
Petroleum:			
Crude and partly refined, thousand 42-gallon barrels	18,857	50,032	Nigeria 15,135; Libya 13,894; United States 6,737.
Refinery products:			
Gasoline:			
Motor, do	540	598	Jamaica 360; Venezuela 154.
Aviation, do	352	136	Curaçao 105; Aruba 22.
Kerosine, do	r213	280	Aruba 262.
Jet fuel, do	66	(2)	NA.
Distillate fuel oil, do	1,012	1,106	Venezuela 423; Jamaica 320.
Residual fuel oil, do	2,345	8,506	Venezuela 4,580; Aruba 1,566; Curaçao 1,411.
Lubricants, do	49	18	United States 14.
Mineral jelly and wax, do	(2)	(2)	NA.
Liquefied petroleum gas, do	r121	126	Venezuela 40; United States 53; United Kingdom 22.
Other, value	$97,948	$67,507	United States $53,379; St. Kitts $19,394.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals, do	$36,148	$33,223	United States $23,624; United Kingdom $9,599.

r Revised. NA Not available.
[1] Includes small quantity of pig iron.
[2] Less than ½ unit.

BARBADOS [2]

General Crude Oil Co. of Houston, Tex., operated four producing wells in 1972. All four wells are onshore and production from these wells amounted to 30,878 barrels for the year. Natural gas production in Barbados during 1972 came from one producing well and totaled 130 million cubic feet.

Mobil Oil Barbados, Ltd., increased its refinery capacity from 2,500 to 2,750 barrels per day in 1972. The imports for this refinery come from Venezuela and are almost entirely reexported.

The production of mineral commodities in Barbados is shown in table 1.

[2] By Larry S. Dewey, mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 4.—Barbados: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, all forms	23	60
Copper metal, including alloys, all forms	4	4
Iron and steel:		
Scrap	2,136	[1] 96
Pig iron, ferroalloys, and similar materials	5	([2])
Steel, primary forms	18	4
Semimanufactures	884	1,219
Lead metal, including alloys, all forms	64	94
Tin metal, including alloys, all forms ---long tons--	1	([2])
Zinc metal, including alloys, all forms	1	([2])
Other ash and residue containing nonferrous metals	92	[1] 69
NONMETALS		
Cement	12	46
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	([2])	[1] 1
Products:		
Refractory (including nonclay bricks)	2	1
Nonrefractory	272	33
Diatomite and other infusorial earth	--	[1] ([2])
Fertilizer materials	([2])	1
Lime	6,122	10,924
Salt	16	[1] 36
Sodium and potassium compounds, n.e.s	6	4
Stone, sand and gravel:		
Dimension stone:		
Crude	12	[1] ([2])
Worked	52	5
Gravel and crushed stone	1,329	NA
Sand, excluding metal bearing	2	[1] 2
Sulfuric acid	([2])	, 1
Other crude nonmetals, n.e.s	6	[1] 5
MINERAL FUELS AND RELATED MATERIALS		
Coal and briquets	4	10
Peat and briquets	2	--
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels--	45	13
Kerosine and jet fuel ---do---	346	456
Distillate fuel oil ---do---	343	368
Residual fuel oil ---do---	551	575
Lubricants ---do---	2	1
Other:		
Nonlubricating oils ---do---	([2])	--
Other ---do---	1	1

NA Not available
[1] Partial figure.
[2] Less than ½ unit.

Table 5.—Barbados: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, unwrought and semimanufactures	110	139
Cobalt oxides and hydroxides	(1)	(1)
Copper metal, including alloys, unwrought and semimanufactures	89	43
Iron and steel metal:		
Ore and concentrate	--	130
Scrap	65	86
Pig iron, ferroalloys, and similar materials	6	44
Steel, primary forms	62	128
Semimanufactures	12,141	8,099
Lead:		
Oxides	67	19
Metal, including alloys, unwrought and semimanufactures	115	85
Mercury 76-pound flasks	--	(1)
Nickel metal, including alloys, all forms	--	(1)
Silver metal, including alloys troy ounces	3,484	9,483
Tin metal including alloys, all forms long tons	621	158
Titanium oxides	197	169
Zinc:		
Oxides	40	32
Metal, including alloys, all forms	87	52
Other:		
Ores and concentrates of nonferrous metals, not further identified	--	33
Scrap of all nonferrous metals	30	79
Ash and residue containing nonferrous metals	30	--
Oxides, hydroxides and peroxides of metals n.e.s	4	--
Metals and alloys n.e.s., all forms	--	1
NONMETALS		
Abrasives:		
Natural, n.e.s	24	(1)
Grinding and polishing wheels and stones	23	6
Asbestos	4	4
Cement	54,336	56,240
Chalk	1	1
Clays and products (including all refractory brick):		
Crude n.e.s	45	15
Products:		
Refractory (including nonclay bricks)	151	20
Nonrefractory	666	430
Diatomite and other infusorial earth	65	21
Fertilizer materials:		
Manufactured:		
Nitrogenous	1,606	971
Phosphatic	33	411
Potassic	812	1
Other, including mixed	9,515	10,225
Ammonia	12	12
Graphite, natural	(1)	(1)
Lime	102	165
Mica, crude and worked	(1)	1
Pigments, mineral, iron oxides, processed	1	5
Salt	2,332	2,098
Sodium and potassium compounds, n.e.s.:		
Caustic soda	183	153
Caustic potash, sodic and potassic peroxides	10	10
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	64	3
Worked	65	20
Gravel and crushed rock	262	186
Sand excluding metal bearing	19	24
Sulfuric acid	117	71
Other nonmetals n.e.s.:		
Quartz, mica, feldspar, etc	57	41
Other	97	55
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	711	1,264
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	(1)	4
Carbon black	1	(1)
Coal, including briquets, all grades	205	167
Coke and semicoke	44	33
Hydrogen and rare gases	2	6
Peat and briquets	21	12

See footnote at end of table.

Table 5.—Barbados: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude	thousand 42-gallon barrels	604	454
Refinery products:			
Gasoline	do	124	79
Kerosine and jet fuel	do	422	361
Distillate fuel oil	do	316	454
Residual fuel oil	do	562	712
Lubricants	do	12	12
Mineral jelly and wax	do	[1]	[1]
Other:			
Liquefied petroleum gas	do	38	56
Other	do	3	1
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		11	2

[1] Less than ½ unit.

BERMUDA [3]

Continued expansion of the construction industry in 1972 led to increased output of sand, crushed limestone, and dimension stone. As in past years, mineral production in Bermuda in 1972 consisted of small quantities of sand, dimension limestone, and crushed limestone. Limestone quarried for use in private residences is a soft, porous but very durable type of dimension stone. Production of crushed limestone totals about 50,000 tons per year. The great bulk of the output is used as aggregate in asphalt mixes; the remainder is used in paving and concrete construction units such as blocks and curbing. Imports consisted principally of petroleum refinery products, cement, and fertilizers. Table 6 shows foreign trade in selected mineral commodities for 1970 and 1971.

[3] By Harold J. Drake, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 6.—Bermuda: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970 [1]	1971 [1]
EXPORTS AND REEXPORTS			
Petroleum refinery products:			
Gasoline, aviation	thousand 42-gallon barrels	38	41
Gasoline, other	do	17	13
Kerosine	do	[2]	137
Jet fuel	do	798	1,550
Distillate fuel oil	do	--	202
Residual fuel oil	do	177	9
Lubricating oil	do	[2]	--
Scrap metal unspecified	value, US dollars	$302,673	$105,054
IMPORTS			
METALS			
Aluminum metal, including alloys, all forms		1,123	2,058
Copper metal, including alloys, all forms		1,040	1,118
Iron and steel:			
Pig iron, sponge iron and ferroalloys		4,486	2,190
Steel, primary forms		13,392	5,462
Semimanufactures		327,159	247,804
Lead metal, including alloys, all forms		144	50
Nickel metal, including alloys, all forms		13	11
Platinum-group metals and silver:			
Metals, including alloys:			
Platinum group	troy ounces	375	63
Silver	do	29,356	46,529
Tin metal, including alloys, all forms	long tons	6	7
Zinc metal, including alloys, all forms		2	4
Other metals, including alloys, all forms		18	133

See footnotes at end of table.

Table 6.—Bermuda: Foreign trade of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970 [1]	1971 [1]
NONMETALS			
Abrasives, natural, grinding and polishing wheels and stones		3	(2)
Cement		49	32
Clays and products:			
Clays and other refractory materials		9	(2)
Clay bricks		250	364
Diamond not set or strung	carats	579	243
Fertilizer materials:			
Crude		12	13
Manufactured:			
Nitrogenous		7	6
Phosphatic		2	1
Mixed		133	141
Gypsum and plaster		65	64
Lime		86	93
Precious and semiprecious stones, except diamond:			
Natural	carats	186	60
Manufactured	do	14	20
Salt		71	76
Stone, sand and gravel:			
Dimension stone		1	7
Gravel and crushed stone		31,644	53,583
Sand		39,613	27,092
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets		(2)	3
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	254	224
Kerosine	do	630	720
Jet fuel	do		
Distillate fuel oil	do	r831	193
Residual fuel oil	do		
Lubricants		6	7
Other:			
Asphalt [3]		14	16
Other	do	11	1

r Revised.

[1] For calendar year 1971; figures partly duplicate those in 1970 column, in that both columns include figures for January 1, 1971 to March 31, 1971.

[2] Less than ½ unit.

[3] Includes natural asphalt and bitumen.

CUBA [4]

Estimates of Cuban mineral production are shown in table 1. Detailed information on the Cuban mineral industry was not available to the Bureau of Mines and the following items were gathered from a few published accounts.

Cuba became a member of Comecon, the East European Economic Community, in mid-1972, and late in the year signed agreements with the U.S.S.R. which covered long-term economic aid and scientific-technological cooperation. These developments naturally affected the future of the Cuban mining industry. For example, East European and Soviet geologist and cartographers were at work compiling the first comprehensive geologic map of Cuba, and the U.S.S.R. agreed to subsidize the expansion of Cuban nickel production.

COMMODITY REVIEW

Cement.—Cuban cement production totaled 1,474,000 tons in 1972, reflecting major additions to productive capacity. In 1971, it was reported that a 400,000 ton-per-year plant of Soviet design was under construction and presumably was completed in 1972. A new 700,000 ton-per-year plant, being built in Siguaney under Czechoslovak direction, was scheduled to come onstream late in the year. Also, new capacity at the Nuevital plant in Camaguey Province probably became available during the year.

Chromite.—Production is reported to have increased to about 20,000 tons in 1972. The mines are located in the Moa-Baracoa area of Oriente Province.

[4] By William C. Butterman, physical scientist, Division of Nonferrous Metals—Mineral Supply.

Cobalt.—Production remained at about the same level as in 1971. The metal was produced in sulfide form as a byproduct of lateritic nickel ore processing at Moa Bay.

Copper.—The Capitan Alberto Fernandez mine (formerly the Matahambre mine) in Pinar del Rio Province was reopened after a 2-year modernization and development project. A major extension of the ore body was blocked out in the late 1960's, and reportedly contains enough ore to sustain production for more than 10 years at the pre-1959 rate of about 15,000 tons per year of copper (in concentrate). Annual production in the 1960's averaged just under 5,000 tons, and in the last few years had declined to about 3,000 tons.

Nickel.—Production remained at about 36,000 tons, the same as in 1971. Late in the year, the new long-term economic aid agreements with the U.S.S.R. provided for the construction of a 30,000-metric-ton-per-year ammonia-leach laterite processing plant at Punta Gorda in Oriente Province, the modernization of the Nicaro and Moa Bay plants, and the eventual expansion of Cuban nickel capacity to 126,000 tons per year. At the same time, the U.S.S.R. agreed to buy Cuban nickel for 7 years at a fixed price of $2.265 per pound, considerably above current world market prices.

Table 7.—Cuba: Selected mineral commodity trade with Poland
(Metric tons)

Commodity	1969	1970	1971
EXPORTS TO POLAND			
Chrome ore	9,614	17,727	--
Copper concentrate	587	--	--
Manganese ore	15,546	NA	--
Other nonferrous metal concentrates	478	228	--
IMPORTS FROM POLAND			
Steel semimanufactures	819	300	--
Petroleum products	3,890	494	--

NA Not available.

Sources: Rocznik Statystyczny Handlu Zagranicznego (Foreign Trade Statistical Yearbook), 1970 and 1973, Warsaw 1971, 458 pp., and 1974, 416 pp.

Table 8.—Cuba: Selected mineral commodity imports from U.S.S.R.[1]
(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, all forms	4,218	5,311
Copper metal, including alloys, all forms	5,693	4,857
Iron and steel:		
Pig iron	72,400	89,500
Ferroalloys	2,700	2,900
Steel semimanufactures	235,800	191,100
Lead metal, including alloys, all forms	1,200	1,200
Zinc metal, including alloys, all forms	500	500
NONMETALS		
Asbestos	9,500	10,800
Cement, hydraulic	103,000	144,000
Fertilizer materials:		
Nitrogenous:		
Urea	37,100	65,900
Other manufactured	247,700	258,800
Phosphatic	82,500	77,000
Potassic	76,800	61,200
Refractory materials	12,100	15,200
Sodium compounds, n.e.s.:		
Caustic soda	16,300	33,600
Soda ash	8,019	16,300
Sulfur	137,200	141,300
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	2,425	3,818
Coal:		
Anthracite ---thousand tons	41	45
Bituminous ---do	10	33
Coke ---do	38	54
Petroleum, crude oil and refinery products ---do	5,987	6,444

[1] Soviet exports to Cuba, reported in: Vneshnyaya Torgoviya S.S.S.R. za 1971 god (Foreign Trade of the U.S.S.R for 1971). Moscow, 1972, 318 pp.

DOMINICAN REPUBLIC [5]

Falconbridge Dominicana C. por A. (Falcondo), a $180 million ferronickel mining and metallurgical complex at Bonao, was officially dedicated on June 21, 1972. Falcondo is owned by Falconbridge Nickel Mines, Ltd., 65% Armco Steel Corp., 17.5%; the Dominican Government, 9.5%, and the remainder by minority shareholders in Canada, the Dominican Republic, and the United States.

The Bonao complex is located about 60 miles northwest of Santo Domingo and had a rated capacity of 63 million pounds of nickel in ferronickel per year. The Falcondo project represented 17 years of development since geologists first began exploration in 1955. Construction began in the fall of 1969, and on December 29, 1971, Falcondo made its first 500-ton shipment of ferronickel.

Falcondo mines lateritic ore which grades about 1.58% nickel. Iron makes up 45% of the ore body, with small traces of cobalt and other metals. The ore is mined by open pit methods, and is ground, stored, and then dried in large rotary driers from which it is then conveyed to the reduction plant, briqueted, and reduced in shaft furnaces.

In 1972, the Falcondo operation ran at about two-thirds of capacity; full operational capacity was expected by 1973. This installation, Dominican Republic's second largest industry after sugar, makes the island republic the fourth largest non-Communist nickel-producing nation after Canada, New Caledonia, and Australia.

On May 30, 1972, the Dominican Government granted the New York and Honduras Rosario Mining Co. a concession under the terms of the new Dominican mining code for the operation of the Pueblo Viejo gold-silver property. An agreement also was reached with the Central Bank of the Dominican Republic regulating both the fiscal arrangements and the exoneration from exchange control of the Pueblo Viejo mine. During 1972, a subsidiary company, Rosario Dominicana, S.A. (Rosario), was formed to develop and operate the Pueblo Viejo mine; this company is owned 50% by Simplot Industries, Inc.

As the result of a second phase of extensive exploration drilling confined to detailed sampling of the weathered zone, Rosario indicated that ore reserves containing 0.15 ounce of gold and 0.76 ounce of silver per ton were increased to over 20.0 million tons. Pending further development drilling, reserves in the underlying complex sulfide ore remained estimated at 17.7 million tons grading 2.19% zinc, 0.252% copper, and 0.131 ounce of gold and 1.12 ounces of silver per ton. Rosario will build a pilot plant to determine optimum metallurgical treatment for the sulfide ore. Additionally, an exploration concession of 67 square kilometers surrounding the Pueblo Viejo mine was awarded on July 14, 1972, to Rosario.

Increased reserves together with increased gold prices resulted in Rosario's decision to increase the mill design capacity to 6,000 tons per day. Production was projected to yield approximately 300,000 ounces of gold per year, which would make Rosario the second largest gold mine in the Western Hemisphere. Production was targeted to commence before the end of 1974. Total cost of the project was estimated to be around $24.0 million, and negotiations for the financing were in progress.

Refineria Dominicana de Petroleo S.A., jointly owned by Shell International and the Dominican Government, completed construction of a $40 million, 30,000-barrel-per-day petroleum refinery at Nigua, 25 miles from Santo Domingo. Inauguration of the facility was scheduled for February 24, 1973. Refinery capacity was reportedly sufficient to meet the anticipated Dominican demand only through 1974; however, the refinery could be expanded as needed. In addition to motor gasoline, it will produce aviation gasoline, kerosine, motor oil, fuel oil, and liquefied petroleum gas.

Construction of the Travera Dam, the first major hydroelectric facility in the Dominican Republic was substantially completed by yearend 1972. Inauguration of this facility was scheduled for February 27, 1973. While some minor work remains, it was anticipated that full completion will be in June 1973. The final cost of construction was expected to be in excess of

[5] By E. Chin, physical scientist, Division of Nonferrous Metals—Mineral Supply.

$44.0 million. Financing was provided by the International Development Bank ($22.9 million) and the Agency for International Development ($14.0 million), with the Dominican Government obligated for the remainder.

A summary of hydroelectric projects in the Dominican Republic follows:

Project name	Construction date		Generating capacity (megawatts)	Irrigated area (thousand acres)	Cost (million dollars)	Financing
	Initiated	Completion				
Travera Dam	April 1969	June 1973	80	125	$44	International Development Bank, Agency for International Development, and the Dominican Government.
Valdesia Dam	May 1969	1975	54	69	30	Dominican Government and Spanish interests.
Sabana Yegua Dam	[1]	--	13	59	56	[2]
Sabaneta Dam	[1]	--	75	40	25–30	[2]

[1] Feasibility study and design underway.
[2] Net yet determined.

Table 9.—Dominican Republic: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS [1]		
Copper including alloys, semimanufactures	765	NA
Iron and steel semimanufactures	59,812	
Other nonferrous metals, all forms	3,410	
NONMETALS [1]		
Cement	5,551	
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products: [2]		
Gasoline ---thousand 42-gallon barrels	1,947	1,951
Kerosine and jet fuel ---do---	477	361
Distillate fuel oil ---do---	799	1,099
Residual fuel oil ---do---	2,774	3,129
Lubricants ---do---	180	41
Other ---do---	342	387

NA Not available.
[1] Data for metals and nonmetals from 1970 edition of Supplement to the World Trade Annual, v. 2 (South and Central America) published by Walker and Co., New York, 1972.
[2] From International Petroleum Annual, 1970 and 1971.

HAITI [6]

The Sedren copper mine, owned by International Halliwell Mines, Ltd. of Canada (Halliwell), closed at the beginning of 1972. Halliwell announced that the shutdown was temporary but indefinite. Depressed copper prices and sustained high operating costs were described as responsible for the closure. It was reported that new interests and capital were being sought to participate in the mining operation.

The mill and plant have been placed on a care-and-maintenance basis with a skeleton crew, and repairs were scheduled in the crushing plant, which had been accidentally damaged prior to the closing. The mine was being kept dewatered. About 300 persons were normally employed at the mining operation. Copper mine production had been running at about 12,000 tons per month. The mill had three ball mills with a daily capacity of about 500 tons each.

Under the terms of Halliwell's original contract with the Government of Haiti, signed in 1955, the concession was for 35 years, renewable for an additional 35 years,

[6] By E. Chin, physical scientist, Division of Nonferrous Metals—Mineral Supply.

and covered about 100 square miles north of Gonaives. Provisions in the contract also stated that part or all of the concession could be renounced upon payment of fees due the Government of Haiti, and that the latter could then grant the concession to third parties. In addition to this, the company with the permission of the Government of Haiti could cede its rights under the contract to Haitian or foreign companies, but not to foreign governments.

An agreement to develop bauxite in Haiti, excluding the present workings of Reynolds Haitian Mines S.A., was signed by the Haitian Development Bank and Haiti Minerals Corp. of America (Haiti Minerals). The concession agreement was for 30 years with an option for renewal for an additional 20 years.

Total bauxite reserves in Haiti were estimated to be between 40 and 50 million tons. The cost of exploration and development of bauxite by Haiti Minerals was estimated to be around $50 million. Haiti Minerals was also considering an alumina plant and the installation of port facilities.

Early in 1972, the Government of Haiti granted a 21.3-million-acre oil concession to Wendell Phillips Oil Co. (Wendell Phillips), covering the Continental Shelf, the islands, and all territorial waters of Haiti including six inland concession areas in all major sedimentary basins. The concession is for 35 years, extendable for 5 years, and at the end of the 40-year period, the property reverts to the Government. Twenty-five percent of the concession will be surrendered 5 years after signing the agreement, and an additional 33% of the remaining area, 10 years later. The entire concession will be surrendered 10 years after the signing if no commercial production is established.

Production bonuses were as follows: $50,000 on the first commercial production: $500,000 on 75,000 barrels per day; $1 million on 100,000 barrels per day and $3 million on 300,000 barrels per day. Wendell Phillips must spend a minimum of $1.5 million in the first 30 months and three test drills must be drilled within 36 months. During the first 5 years of the concession, the company must spend a further minimum of $2.5 million and at least $6 million in each of the succeeding periods of 5 years.

Table 10.—Haiti: Exports of mineral commodities[1]

(Metric tons)

Commodity	1970	1971	Principal destinations, 1971
Aluminum:			
Bauxite	646	752	All to United States.
Metal semimanufactures	(2)	(2)	NA.
Copper metal, all forms	5	7	All to Japan.
Iron and steel, all forms	14	--	

NA Not available.
[1] Years ended September 30 of those stated.
[2] Less than ½ unit reported.

Table 11.—Haiti: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum metal, all forms	245	172	West Germany 56; Austria 48; France 33.
Copper metal, all forms	17	21	United States 9; United Kingdom 5; Canada 3.
Iron and steel semimanufactures[2]	10,544	7,463	Belgium 2,683; Japan 1,522; France 1,088.
Lead metal, all forms	(3)	6	United States 5.
Nickel metal, scrap	(3)	(3)	NA.
Silver metal ---kilograms---	--	(3)	NA.
Tin metal, all forms ---long tons---	356	411	United States 410.
NONMETALS			
Cement	229	474	Denmark 414.
Chalk	18	48	Puerto Rico 27; Dominican Republic 18.
Clays:			
Crude	48	63	West Germany 35; United States 24.
Manufactured products	r 224	209	Japan 101; United States 59; Austria 21.
Diamond, industrial ---thousand carats---	55	200	All from United States.
Fertilizers:			
Crude:			
Phosphatic	15	33	All from United States.
Potassic	37	54	West Germany 53.
Manufactured, nitrogenous	(3)	--	
Graphite, natural	1	(3)	NA.
Salt	125	40	United States 38.
Stone, sand and gravel:			
Dimension stone	20	13	West Germany 8; United States 4.
Sand and gravel	3	10	United States 9.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	166	299	United Kingdom 194; United States 50; West Germany 45.
Coke and semicoke	r 16	36	Belgium 20; United States 16.
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels---	74	78	Curaçao 76.
Kerosine ---do---	3	7	All from Curaçao.
Distillate fuel oil ---do---	542	472	Curaçao 456.
Lubricants ---do---	11	14	United States 5; Curaçao 5.
Other ---do---	3	2	United States 1; West Germany 1.

r Revised. NA Not available.
[1] Years ended September 30 of those stated.
[2] Includes small quantities of pig iron, ferroalloys and crude steel.
[3] Less than ½ unit reported.

JAMAICA [7]

The Ministry of Industry and Tourism (Ministry of Industry) announced that the Jamaican Government was reexamining its present incentive policies on tax holidays for certain industries. The Government planned to honor existing commitments on record. However, if the original commitment has changed substantially and maintaining it would be unfair to one or another, then the Government would insist upon renegotiating the agreement.

The Ministry of Industry will continue to welcome foreign investment in Jamaica to achieve certain goals. These include the development of labor-intensive industries, full exploration and development of means to link the manufacturing sector with indigenous resources, and a rational policy of rural industrialization. Plans were also reported to reduce the current 17% unemployment rate and to introduce more expertise and technical skills into the Jamaican work force.

Jamaica was the world's leading producer of bauxite but in 1972 its output was surpassed by that of Australia. Revenues from the export of bauxite and alumina are one of the nation's largest sources of income. The value of bauxite and alumina production account for approximately 13% of the Jamaican gross national product (GNP).

Accordingly, the Ministry of Mining and Resources created a Bauxite Commission to make a greater effort to insure that Jamaica benefits from its bauxite resources. One of the main objectives of the Bauxite Commission is to investigate the possibility of investing proceeds from the sale of

[7] By E. Chin, physical scientist, Division of Nonferrous Metals—Mineral Supply.

bauxite and alumina overseas in developments of a magnitude and type most beneficial to Jamaica.

The Jamaica Industrial Development Corporation (Development Corporation) reportedly developed an experimental process to use red mud from alumina plants as a source of metal and mineral compounds. More than 2.0 million tons of red mud tailings are produced and stored annually by bauxite refining plants on the island. The Development Corporation estimated for every 1.0 million tons of red mud, 323,000 tons of powdered iron, 60,000 tons titanium dioxide, and 900,000 tons of aluminum sulfate could be recovered. The Development Corporation is also conducting a market study to determine the demand and prices for these byproducts.

The bauxite mines and alumina plants in Jamaica were operated below rated capacities in 1972 because of a continued oversupply of aluminum in world markets. Bauxite decreased 5% and alumina production increased 18%, from that in 1971. The increase in alumina production reflects the trend to process at the site a larger percentage of the bauxite mined in Jamaica.

The Aluminum Company of America's new alumina plant in Clarendon Parish came onstream in 1972 at an annual rated capacity of 0.5 million tons. Alumina Partners of Jamaica, Ltd., completed the expansion of its alumina plant at Nain, St. Elizabeth Parish, to a capacity of 1.2 million tons.

Producers of alumina in Jamaica by company, plant location, capacity, and ownership are as follows:

Company and plant location	Yearend capacity (thousand metric tons)		Ownership
	1971	1972	
Alcan Jamaica, Ltd:			Alcan Aluminum, Ltd., 100%.
Ewarton	556	556	
Kirkvine	556	556	
Alumina Partners of Jamaica, Ltd:			Reynolds Metals Co., 36.8%; The Anaconda Aluminum Co., 36.8%; Kaiser Aluminum and Chemical Corp., 26.4%.
Nain	862	1,179	
Revere Jamaica Alumina, Ltd:			Revere Copper and Brass, Inc., 100%.
Magotty	200	200	
Aluminum Company of America:			Self, 100%.
Woodside	--	500	
Total	2,174	2,991	

The Government announced that the construction of a major oil refinery complex will commence in 1974 at Luana Point, St. Elizabeth Parish. The $350 million investment will be a joint venture between the Moratti Group of Italy (Moratti) and the Jamaican Government which in turn will form the Jamaican subsidiary to be known as SARJAM. Moratti will own 90% of SARJAM and the Jamaican Government will own the remainder. After 15 years, the equity ratio will change with Moratti's holdings being reduced to 80% and the Government's holding being raised to 20%.

The oil refining complex is expected to process 250,000 barrels of crude oil per day when completed in mid-1976. The complex expects to produce competitively priced refinery products for export and for local consumption. Cheap fuel for a planned powerplant is another expected benefit.

Beyond the completion of the refinery complex, the Government of Jamaica hopes ancillary industries will be attracted to the Luana Point area due to the availability of electric power. Possible industries mentioned by the Government included petrochemicals, aluminum smelting, cement, caustic soda, and steel manufacturing.

The island's only refinery, Esso West Indies, Ltd., (Esso) is located at Kingston. Esso has a crude oil capacity of 36,000 barrels per day; vacuum distillation, 1,500 barrels per day; power forming, 2,800 barrels per day; naphtha hydrofining, 5,200 barrels per stream day; kerosine hydrofining 5,200 barrels per stream day; gas-oil hydrofining, 5,700 barrels per stream day; and asphalt, 760 barrels per day.

Three Japanese firms entered into an agreement with the Development Corporation to erect a $2.6 million galvanized steel plant in Jamaica with a capacity of 18,000 tons per year of galvanized steel. The Government of Jamaica will hold 65% of the shares; Mitsubishi International Corp., 15%; and Kawasaki Steel Corp., and Nippon Kokan K.K., 10% each. The new company to be called GI Industries, expects eventually to increase the capacity to 36,000 tons per year.

Table 12.—Jamaica: Foreign trade in selected mineral commodities[1]

(Metric tons unless otherwise specified)

EXPORTS	1970	1971
METALS		
Aluminum:		
Bauxite and concentrate ——thousand tons	7,697	[2] 7,712
Oxide (alumina) and hydroxide ——do	1,796	[2] 1,812
Metal, including alloys, unwrought and semimanufactures	121	
Iron and steel:		
Scrap	37	
Semimanufactures	5	
Lead metal and alloys, unwrought and semimanufactures	101	
Zinc metal and alloys, unwrought and semimanufactures	(9)	
Nonferrous metal scrap, not further described	2,792	
NONMETALS		
Cement, hydraulic	70,170	
Clays, crude	(3)	NA
Fertilizers, manufactured, all types	6,433	
Mica, crude	39	
Salt	34	
Stone, sand and gravel:		
Dimension stone, crude and worked	17	
Gravel and crushed rock	2	
Sand	(3)	
Stone, industrial, n.e.s	109	
Sulfur, sulfuric acid	793	
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ——thousand 42-gallon barrels	689	[4] 934
Kerosine ——do	56	[4] 75
Distillate fuel oil ——do	590	[4] 27
Residual fuel oil ——do	--	[4] 1,381
Lubricants ——do	132	[4] 136
Liquefied petroleum gas ——do	(3)	--
Other ——do	53	--

IMPORTS		
METALS		
Aluminum:		
Oxide (alumina)	243	
Metal, including alloys, unwrought and semimanufactures	3,791	
Copper metal, including alloys, unwrought and semimanufactures	745	
Iron and steel:		
Scrap	172	
Pig iron and ferroalloys	296	
Crude steel	2,119	
Semimanufactures	213,954	
Lead metal, including alloys, unwrought and semimanufactures	320	
Nickel metal, including alloys, unwrought and semimanufactures	25	
Platinum-group metals, unwrought and semimanufactures ——troy ounces	8	
Silver metal, unwrought and semimanufactures ——value, thousands	$93	
Tin metal, including alloys, unwrought and semimanufactures ——long tons	2,720	
Zinc metal, including alloys, unwrought and semimanufactures	219	
Other:		
Ore and concentrates of nonferrous metals, n.e.s	9	
Scrap of nonferrous metals, not further described	(3)	
Nonferrous metals n.e.s., unwrought and semimanufactures	25	
NONMETALS		
Abrasives, natural:		
Crude, including industrial diamond	407	NA
Grinding and polishing wheels and stones	730	
Cement, hydraulic	2,669	
Clays and clay products:		
Crude clay	643	
Clay products:		
Nonrefractory	356	
Refractory	8,631	
Feldspar, fluorspar, cryolite and chiolite	78	
Fertilizer materials:		
Crude:		
Phosphatic	3	
Potassic	(3)	
Manufactured:		
Nitrogenous	36,755	
Phosphatic	9,145	
Potassic	12,547	
Other, including mixed	10,613	
Ammonia	82	
Graphite, natural	41	
Mica, crude and worked	100	

See footnotes at end of table.

Table 12.—Jamaica: Foreign trade in selected mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
IMPORTS—Continued			
NONMETALS—Continued			
Precious and semiprecious stones	value, thousands	$56	
Salt		6,075	
Stone, sand and gravel:			
Dimension stone		213	
Gravel and crushed stone		61	
Stone for industrial use, n.e.s		694	
Sand, including ground quartz		848	
Sulfur:			NA
Elemental		2,818	
Sulfur dioxide		(3)	
Sulfuric acid		626	
Other, crude nonmetals n.e.s		627	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		1,208	
Coal, coke and briquets		1,016	
Petroleum:			
Crude oil	thousand 42-gallon barrels	11,660	[4] 11,066
Refinery products:			
Gasoline	do	1,183	[4] 1,175
Jet fuel and kerosine	do	8	[4] 257
Distillate fuel oil	do	521	[4] 212
Residual fuel oil	do	1,388	[4] 540
Lubricants	do	134	[4] 234
Other	do	33	[4] 98

NA Not available.

[1] Source: Unless otherwise specified, Department of Statistics. External Trade Calendar Year 1970. 390 pp.

[2] Source: National Planning Agency. Economic Survey, Jamaica 1972, pp. 42–44.

[3] Less than ½ unit.

[4] Source: U.S. Bureau of Mines, World Petroleum Annual 1971, March 1973, 32 pp.

MARTINIQUE [8]

Mineral production in Martinique in 1972 consisted of construction aggregates, clays, marine salt, fertilizers, cement, and petroleum refinery products. Production of crushed stone in 1972 is estimated to have been about 650,000 tons, salt about 300,000 tons, and sand about 50,000 tons. Small tonnages of clays and pumice were also produced. No official statistics were reported on the output of refinery products, fertilizers, and cement.

The oil refinery and a cement plant on Martinique, completed in January 1971, operated at near capacity in 1972. A new refinery with an annual capacity of 5 million tons was proposed. Output from this facility was to be sold almost exclusively in the United States. Mineral production on Guadeloupe, consisting principally of construction aggregates and cement, was not reported in official statistics. The project to establish an oil refinery and deepwater port was suspended for the time being.

[8] Harold J. Drake, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

NETHERLANDS ANTILLES [9]

Petroleum refining was the most important industry in the Netherlands Antilles during 1972. Planned and completed improvements aim to increase refinery capacity, allow petroleum products to meet market environmental standards, and create the flexibility needed to economically handle crudes from Eastern as well as Western Hemisphere sources.

In 1972 Shell Curaçao N.V. refinery neared completion of a 175,000 barrel-per-day oil distillery which would increase over all refinery capacity to 425,000 barrels per day. The expanded refinery will be supplemented in 1974 by a $33 million transshipment facility. New oil storage tanks and a pier capable of handling large crude oil carriers is expected to be built in the near future.

The Lago Oil and Transport Co., a subsidiary of the Exxon Corp. of New Jersey, will build a second desulfurization plant at its 500,000-barrel-per-day refinery on Aruba. The new unit will double the current 100,000-barrel-per-day desulfuration capacity.

The Antilles International Salt Co., a subsidiary of the International Salt Co., opened its fully automated loading pier on Bonaire. Planned annual production will be on the order of 500,000 tons with 1-year production stockpiled. In 1972 the first shipment which consisted of 10,000 tons of solar dried salt was exported to Jamaica.

The output of mineral commodities in the Netherlands Antilles is shown in table 1.

[9] By Larry S. Dewey, mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 13.—Netherlands Antilles: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Iron and steel metal, scrap and other		360	NA
Lead metal, including alloys		50	
Silver and platinum-group metal	value	$107,117	
Other nonferrous metals		1,264	
NONMETALS			
Fertilizer materials:			
Crude		91,521	
Manufactured, nitrogenous		67,586	
Ammonia		65,715	
Stone, sand and gravel		975	
Other		119	
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude	thousand 42-gallon barrels	4,950	
Refinery products:[1]			
Aviation gasoline	do	1,819	1,818
Motor gasoline	do	15,059	16,372
Kerosine and white spirit	do	14,542	12,299
Jet fuel	do	16,003	13,813
Distillate fuel oil	do	26,280	23,259
Residual fuel oil	do	175,034	150,456
Lubricants including grease	do	6,239	2,360
Liquefied petroleum gas	do	345	28,977
Mineral jelly and wax	do	220	
Bitumen and other residues	do	6,533	
Other	do	5,526	

NA Not available.
[1] Data obtained from refinery companies.

Source: Unless otherwise specified, Jaarstatistiek Van de In-en Uitvoer Per Goederensoort Van de Nederlandse Antillen, Bureau Voor de Statistiek (Annual Statistical Report of Import and Export Commodities of the Netherlands Antilles by the Bureau of Statistics 1970 and 1971).

Table 14.—Netherlands Antilles: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, all forms	195	
Copper metal, including alloys, all forms	376	
Iron and steel semimanufactures	51,974	
Lead metal, including alloys, all forms	78	
Nickel metal, including alloys, all forms	132	
Tin metal, including alloys, all forms ——long tons	13	
Zinc metal, including alloys, all forms	88	
Other:		
Nonferrous metal scrap	214	
Base metals, including alloys n.e.s	44	
NONMETALS		
Cement	72,738	
Clays and products (including all refractory brick):		NA
Crude	3,039	
Manufactured	2,645	
Fertilizer materials, manufactured	488	
Gypsum and plasters	94	
Lime	540	
Precious and semiprecious stones, except diamond ——troy ounces	184	
Salt	1,032	
Sodium compounds	21,549	
Stone, sand and gravel	32,001	
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	40	
Gas, liquefied petroleum, petroleum gas ——thousand 42-gallon barrels	259	
Petroleum:[1]		
Crude ——do	318,253	274,266
Refinery products:		
Gasoline ——do	456	1,818
Kerosine and jet fuel ——do	260	104
Distillate fuel oil ——do	2,865	1,280
Residual fuel oil ——do	12,273	3,286
Lubricants ——do	649	352
Other ——do	20	5,643
Mineral tar and other coal–, petroleum–, or gas-derived crude chemicals	14	NA

NA Not available.

[1] Data obtained from refinery companies.

Source: Unless otherwise specified, Jaarstatistiek Van de In-en Uitvoer Per Goederensoort Van de Nederlandse Antillen, Bureau Voor de Statistiek (Annual Statistical Report of Import and Export Commodities of the Netherlands Antilles by the Bureau of Statistics 1970 and 1971).

TRINIDAD AND TOBAGO [10]

Crude oil output increased by 8.6% and daily crude production averaged 139,920 barrels per day in 1972. Petroleum production and refining which continued to account for about 25% of Trinidad and Tobago's gross national product (GNP), were the source of approximately 30% of government revenue, and accounted for about 80% of the country's total export receipts.

The increased production of crude oil in 1972 reversed a rapid decline which began after a peak of 191,315 barrels per day had been recorded in 1968. The long-awaited boost during 1972, came when Amoco Trinidad Oil Co., Ltd., began commercial production. Industry-wide field development activities, which began in 1971, were brought onstream and helped to reverse a 3-year downward trend in crude oil output. The Amoco Trinidad Oil Co., Ltd., in its first year of production, contributed an average of 25,400 barrels per day. The majority of field development activity centered around recent oilfield discoveries off Trinidad's east coast. There, a 17-well platform located in the Galeota field of the Trinidad-Tesor Petroleum Co., Ltd., was brought into production. However, the 17-well Galeota platform was not as successful as preliminary information indicated; production was hindered by both sand and water entry. Together with a concentrated effort on their steam projects in Northeast Palo Seco and in Guapo, production rose from 20,880 to 22,180 barrels per day. This increase in production amounted to 7.5% for the year.

Throughout 1972, development of Amoco's two east coast offshore oilfields were well advanced. Work on initial offshore production facilities in the Teak and Samaan

[10] By Larry S. Dewey, mineral specialist, Division of Fossil Fuels—Mineral Supply.

Fields, a crude oil pipeline, and the necessary shore installations were completed. A 37-kilometer, 16-inch pipeline was constructed between the first of two production platforms in the Teak Field to a tank farm and marine export terminal at Galeota Point.

An additional 18 kilometers of a 16-inch line extended from the Teak Field to the production platform in the Samaan Field. During 1972, Amoco completed 14 producing wells on the Teak A platform and three each on Teak B and Samaan A. The Teak structure is still under development and great efforts are being made to solve production problems which have been experienced in this field because of very fine-grained sand. Towards the end of the year results utilizing triple-wrapped screens were very encouraging. Early in 1972, there was a steady decline in Trinidad Northern Area Ltd.'s production but development of the East Soldado Field provided some measure of stability to the crude oil production rates so that the decline registered over the 12-month period was comparatively low. Teak and Samaan crudes have an average gravity of 32.5° API and a low sulfur content.

The reduction of drilling activity by Shell Trinidad, Ltd., together with a falloff in offshore activity in North Trinidad resulted in a 10% drop in the total footage drilled during 1972 compared with 939,134 feet during 1971. In all, 187 wells were drilled, of which 64 were marine, changing the historic ratio of land to marine wells, the majority being exploratory wells drilled from Amoco's Mariner 1. Most of the inland exploration was carried out by Texaco Trinidad, Inc.

The country's largest producer at yearend was still Trinidad Northern Areas, operating the Soldado Fields; and although the fields suffered a substantial drop in production as rates fell from 60,200 barrels per day in 1971 to 51,400 barrels per day in 1972, they did manage to hold the decline to 3.3% for the year 1972.

An exploration and production permit covering a 187,000-acre tract off the southeast coast of Trinidad, south of Amoco's Teak Field, was awarded to a three-company consortium late in 1971. Both Texaco Trinidad, Inc., and Shell Trinidad, Ltd., hold a 37.5% interest in the Trinidad-Tesoro Petroleum Co., Ltd.

Should commercial quantities of oil and/or gas be discovered in this tract, the Government is entitled to a 20% interest in the consortium without contributing to exploration costs or to an overriding 10% royalty. Terms of the agreement also included a signature bonus, sliding bonus, sliding-scale production bonuses, and a 15% royalty (in addition to the optional overriding royalty) on all production.

Early in 1972, the Government contracted with Delta Exploration Co., Inc., of Houston, Tex. to perform a joint venture marine seismic survey covering 400,000 acres in the northern half of the Gulf of Paria and 1,340,000 unlicensed acres of Trinidad's east coast. Approximately 840,000 acres of the east coast area to be surveyed involve water depths of between 600 and 2,000 feet. Delta Exploration, along with the Ministry of Petroleum and Mines, conducted a 1,300-line-mile marine geophysical survey off the coast of Trinidad and Tobago during April and May 1972.

The program covered approximately 1,800-000 acres in the unlicensed parts of the northern half of the Gulf of Paria and of eastern offshore Trinidad. The coverage included part of the Continental slope where water depths ranged from 600 to 2,000 feet. The open-acreage blocks will be available for licensing within 1 year following completion of the survey. Geophysical activity by private companies during 1972 was restricted to the marine areas surrounding Trinidad and Tobago. A total of 743 line-miles was recorded in 3.46 party-months. No surface geologic work was conducted during the year.

Refinery expansion programs in progress during 1972, saw construction work continue on the Texaco's, 250-ton-per-day sulfur recovery unit at Texaco's refinery at Pinte-à-Pierre. The utilities section of the complex was commissioned in December 1972, and the vacuum tower, designed to handle reduced crude at the rate of 108,000 barrels per day, produced good-quality gas oil-hydrotreater feedstock.

Shell, almost completed the debottlenecking and moderization work on their Point Forin refinery, and the throughput is expected to be increased by 22,000 to 100,000 barrels per day by the end of February 1972.

The production of mineral commodities in Trinidad and Tobago is shown in table 1.

Table 15.—Trinidad and Tobago: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, all forms	104	56
Copper:		
Ore	2	--
Metal, including alloys, all forms	311	239
Iron and steel:		
Scrap	16,597	4,263
Steel, primary forms	9	11
Semimanufactures	806	680
Lead:		
Ore	--	98
Metal, including alloys, all forms	56	77
Silver metal, including alloys, troy ounces	1,915	--
Zinc metal, including alloys, all forms	--	2
Other:		
Scrap, nonferrous metals	251	171
Base metals, including alloys, all forms	31	50
NONMETALS		
Barite	--	1,539
Cement	71	41
Clays and products (including all refractory brick)	4,739	1,111
Fertilizer materials manufactured:		
Nitrogenous	94,306	85,670
Other	3,600	2,886
Lime	8,893	5,702
Precious stones cut, troy ounces	8	3
Salt	16	51
Sodium and potassium compounds	13	25
Stone, sand and gravel:		
Dimension stone:		
Crude	(1)	5
Worked	2	37
Gravel and crushed stone	552	235
Sand	202	312
Other nonmetals, n.e.s.:		
Crude	129	74
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals, n.e.s	1,007	879
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	60,450	50,775
Coal, coke, and peat	9	4
Petroleum:[2]		
Crude and partly refined, thousand 42-gallon barrels	8,669	6,998
Refinery products:		
Gasoline, do.	19,552	21,176
Kerosine, do.	6,911	5,613
Jet fuel, do.	11,594	11,386
Distillate fuel oil, do.	13,382	13,402
Residual fuel oil, do.	81,619	73,441
Lubricants, do.	1,271	2,492
Other, do.	1,627	1,438
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	153,840	171,682

[1] Less than ½ unit.
[2] Government of Trinidad and Tobago, Ministry of Petroleum and Mines.

Source: Unless otherwise specified, Government of Trinidad and Tobago, Central Statistical Office, Overseas Trade. Part A, Port-of-Spain, 1970 and 1971, 413 pp.

Table 16.—Trinidad and Tobago: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Bauxite and concentrate	208	94
Metal, including alloys, all forms	455	510
Arsenic and compounds	16	5
Chromium ore and concentrate	r(1)	--
Copper:		
Copper sulfate	18	12
Metal, including alloys, all forms	272	535
Iron and steel:		
Scrap	767	469
Pig iron, ferroalloys, and similar materials	138	5
Steel, primary forms	1,287	381
Semimanufactures:		
Bars, rods, angles, shapes, sections	19,226	14,994
Universals, plates and sheets	31,045	17,113
Hoop and strip	1,261	256
Rails and accessories	5	19
Wire	2,192	2,440
Tubes, pipes and fittings	19,159	63,909
Castings and forgings	143	25
Lead:		
Ore and concentrate	20	20
Metal, including alloys, all forms	358	442
Magnesium metal, including alloys, all forms	(1)	2
Nickel metal, including alloys all forms	3	12
Platinum-group metals and silver:		
Metals, including alloys:		
Platinum group—troy ounces	3	9
Silver—do	112,119	108,229
Tin metal, including alloys, all forms—long tons	66	30
Zinc metal, including alloys, all forms	67	100
Other:		
Ore and concentrate	--	1
Scrap, nonferrous metals	14	(1)
Metals, including alloys, all forms	4	7
NONMETALS		
Abrasives, natural, n.e.s	23	37
Barite and witherite	7,090	13,731
Cement	5,251	8,033
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	257	782
Products	3,303	4,023
Feldspar	677	1,013
Fertilizer materials:		
Crude	84	118
Manufactured:		
Nitrogenous	284	644
Phosphatic	896	1,226
Potassic	4,328	3,692
Other, including mixed	1,428	2,138
Lime	21	496
Magnesite	151	--
Mica, all forms	27	44
Pigments, mineral	12	22
Precious and semiprecious stones, cut and uncut—troy ounces	810	709
Salt	10,706	11,586
Sodium and potassium compounds, n.e.s		
Caustic soda	2,856	11,139
Caustic potash, sodic and potassic peroxides	2,850	1,313
Stone, sand and gravel:		
Dimension stone:		
Crude	11,918	23,955
Worked	84	35
Gravel and crushed stone	415	406
Sand	88	75
Sulfur:		
Elemental	15,744	15,276
Sulfuric acid	36	48
Other nonmetals, n.e.s.:		
Crude	812	536
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,078	872

See footnotes at end of table.

Table 16.—Trinidad and Tobago: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1970	1971
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		2	--
Coal, coke and briquets		116	200
Petroleum: [2]			
Crude and partly refined	thousand 42-gallon barrels	113,265	106,869
Refinery products:			
Gasoline	do.	269	161
Kerosine and jet fuel	do.	984	203
Distillate fuel oil	do.	238	55
Residual fuel oil	do.	332	180
Lubricants	do.	69	76
Liquefied petroleum gas	do.	3	3
Other	do.	278	25
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		81	133

r Revised.
[1] Less than ½ unit.
[2] Government of Trinidad and Tobago, Ministry of Petroleum and Mines.

Source: Unless otherwise specified, Government of Trinidad and Tobago, Central Statistical Office, Overseas Trade. Part A, Port-of-Spain, 1970 and 1971, 413 pp.

The Mineral Industry of Central America Areas

By Burton E. Ashley [1]

CONTENTS

BRITISH HONDURAS [2]

Mineral production in British Honduras was limited to the output of limestone, marl, and sand and gravel.

Anschutz Overseas Corp. and People's Gas Co. entered a joint agreement for marine petroleum exploration off the northern coast. Anschutz was to be the operator and held exploration rights over about 3 million acres.

Prosser Fertilizer and Agrotec Co. Ltd. began operation of a fertilizer mixing plant on December 4, 1971. Total investment amounted to approximately $500,000. Annual capacity for mixed products was 25,000 tons, and during the first full year of operation 2,480 tons was produced. Raw materials were imported from the United States. The industry is protected by fertilizer import restrictions. The company will blend fertilizer to order, but products regularly offered were urea, triple superphosphate, diammonium phosphate, potash, and ammonium nitrate.

Two papers were published on the geology of the Maya Mountains.[3]

The new planned capital of British Honduras, Belmopan, is situated in hilly country about 40 miles southwest of the old sea-level capital of Belize City and had a population of 3,000 in 1972. Work on the new administrative center started in the early 1960's, and the first permanent settlers arrived in 1970. Resistance to moving to Belmopan was evident and some civil servants commuted daily. Belmopan was founded in order to avoid the hurricanes which have periodically wrecked Belize City.

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Name to be changed to Belize on June 1, 1973.

[3] Bateson, J. H. New Interpretation of Geology of Maya Mountains, British Honduras. Am. Assoc. Petrol. Geol. Bull., v. 56, No. 5, May 1972, pp. 956–963.

Hall, I. H. S., and J. H. Bateson. Late Paleozoic Lavas in Maya Mountains, British Honduras, and Their Possible Regional Significance. Am. Assoc. Petrol. Geol. Bull., v. 56, No. 5, May 1972, pp. 955–956.

Table 1.—Central American Areas: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 [p]
BRITISH HONDURAS			
Limestone [e]	146,000	268,900	276,000
Marl [e]	105,000	90,000	180,000
Sand and gravel [e]	193,000	220,000	303,000
COSTA RICA			
Cement	178,500	212,532	260,537
Diatomite [e]	19,000	21,000	21,000

See footnotes at end of table.

Table 1.—Central American Areas: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
COSTA RICA—Continued			
Fertilizer materials, manufactured:			
Nitrogenous, gross weight	40,000	57,149	47,620
Mixed and unspecified, gross weight	60,000	69,256	56,735
Gold e troy ounces	500	500	500
Lime e	10,400	11,000	11,500
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	488	694	666
Kerosine do	141	164	167
Distillate fuel oil do	839	1,266	1,323
Residual fuel oil do	527	858	748
Liquefied petroleum gas do	4	2	—
Salt, marine	7,551	10,950	11,497
Stone, sand and gravel:			
Limestone and other calcareous material e	250,000	391,000	401,210
Sand and gravel e	136,500	141,000	157,850
Other e	455,000	500,000	550,000
EL SALVADOR			
Aluminum metal, semimanufactures	908	970	1,089
Cement	166,694	167,000	217,830
Fertilizers, manufactured	64,565	e 95,901	86,000
Gold, fine troy ounces	2,301	3,503	2,861
Gypsum	5,552	NA	NA
Iron and steel, steel semimanufactures	16,662	17,443	22,292
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	305	784	800
Kerosine do	163	258	250
Jet fuel [1] do	—	81	78
Distillate fuel oil do	310	935	830
Residual fuel oil do	357	931	1,121
Liquefied petroleum gas do	50	173	203
Salt	31,357	30,432	29,325
Silver, fine troy ounces	153,516	215,210	177,144
Stone, limestone and seashells	387,686	275,800	341,273
GUATEMALA			
Antimony, mine output, metal content	261	1,771	1,177
Cement thousand tons	225	227	150
Feldspar	2,500	e 2,500	e 2,000
Gypsum	7,710	e 7,900	e 120
Iron ore and concentrate [2]	1,618	NA	NA
Lead:			
Mine output, metal content	500	e 500	e 220
Metal, including secondary	75	90	22
Lime	21,990	e 22,000	e 22,000
Mica	—	—	1,197
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	936	1,512	1,629
Kerosine and jet fuel do	380	670	734
Distillate fuel oil do	1,562	1,517	1,787
Residual fuel oil do	1,702	1,691	1,903
Liquefied petroleum gas do	107	114	92
Quartz	17,770	NA	e 18,000
Stone, sand and gravel, crushed and broken:			
Limestone thousand tons	312	NA	e 600
Other (volcanic ash)	44,180	NA	e 54,000
Zinc, mine output, metal content	—	506	308
HONDURAS			
Antimony, mine output, metal content	343	146	30
Cadmium, mine output, metal content	49	1	244
Cement	150,549	162,000	194,014
Gold troy ounces	3,333	2,701	2,021
Gypsum	9,205	r e 10,000	15,806
Lead, mine output, metal content	15,965	17,967	20,724
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	898	692	712
Jet fuel do	48	66	64
Kerosine do	230	238	252
Distillate fuel oil do	1,524	1,208	1,178
Residual fuel oil do	2,127	1,852	1,784
Liquefied petroleum gas do	52	70	90
Refinery fuel and losses do	256	88	74
Total do	5,135	4,214	4,154
Salt e	27,000	r 27,000	27,000
Silver thousand troy ounces	3,816	3,642	3,595
Stone:			
Dimension stone, marble	1,401	NA	NA
Crushed and broken	244,374	NA	303,524
Zinc, mine output, metal content	20,040	22,894	23,295

See footnotes at end of table.

Table 1.—Central American Areas: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972 p
NICARAGUA			
Cement	136,000	73,795	119,000
Copper, mine output, metal content	3,361	5,808	2,788
Gold, mine output, metal content ---troy ounces---	115,173	123,359	110,672
Gypsum and anhydrite, crude	e 30,000	25,210	26,000
Lead, ore and concentrate, metal content	---	671	4,281
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels---	927	890	945
Kerosine and jet fuel ---do---	253	222	251
Distillate fuel oil ---do---	933	968	845
Residual fuel oil ---do---	922	1,105	1,134
Liquefied petroleum gas	110	140	151
Salt, marine	14,000	18,000	e 20,000
Silver, mine output ---troy ounces---	216,838	269,775	476,717
Zinc, ore and concentrate, metal content	---	4,056	17,495
PANAMÁ			
Cement	180,000	191,869	271,000
Clays and clay products:			
Crude clay, n.e.s ---thousand cubic meters---	NA	114,683	e 94,850
Products ---do---	NA	152,911	e 20,000
Iron and steel: Magnetite sands (gross weight)	NA	300,000	77,074
Lime ---thousand cubic meters---	NA	2,294	---
Stone, sand and gravel:			
Limestone ---do---	NA	4,129	(3)
Other ---do---	NA	703,391	e 170,266
Salt	7,110	7,866	10,978
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels---	3,280	3,012	3,063
Kerosine and jet fuel ---do---	e 1,735	2,776	2,941
Distillate fuel oil ---do---	5,240	2,527	5,398
Residual fuel oil ---do---	12,650	17,396	15,070
Other ---do---	2,185	1,251	857
Refinery fuel and losses ---do---	910	1,873	1,007

e Estimate. p Preliminary. r Revised. NA Not available.

1 Sales.

2 Used in cement manufacture, except for 18 tons in 1970.

3 Figure not reported in volumetric units but in gravimetric units of an estimated 189,700 metric tons.

COSTA RICA

Overseas Mineral Resources Development Co. (OMRD), a Japanese organization, was to conduct a geochemical survey of nonferrous mineral resources in Costa Rica.[4] The survey, with copper as its primary target, had the interest and cooperation of the Government of Costa Rica.

New import regulations were implemented on October 20 for the purpose of reducing Costa Rica's balance of trade deficit. The list of essential import items was cut from 420 to 85. In general, raw materials, agricultural tools, and spare parts for certain trucks and buses could be imported and paid for with foreign exchange purchased at the official rate of CR¢6.65 per U.S. dollar. All other goods must be paid for with foreign exchange purchased at the rate of CR¢8.60 per U.S. dollar. As an incentive to the export of nontraditional products, foreign exchange earnings on such items could be sold to the Central Bank at an average rate of CR¢7.60 to the dollar. All foreign exchange dealings were to be through the Central Bank of Costa Rica.

The idea for an International Bank of Development and Commerce to establish an international financial district in Costa Rica was suggested. Multinational companies would be afforded a tax haven in exchange for investment in the Bank; the Bank would be obligated to invest 50% of its capital and income in Costa Rica agricultural and business enterprises. The Bank would be capitalized at $30 million, and the Government of Costa Rica would hold an interest in voting shares. To attract multinational companies and foreign investment funds, the Bank would adopt liberal policies in regard to the organization and registration of corporations; confidentiality of all finan-

[4] Japan Metal Bulletin. V. 2, No. 40, Oct. 2, 1972, p. 2.

cial transactions would be guaranteed; and income earned from sources outside Costa Rica would be exempt from local taxes.

The financial district would be self-contained and physically isolated; the district would be semiautonomous and governed by three members from the Bank and two from the Government of Costa Rica.

Table 2.—Costa Rica: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms	95	67	Guatemala 26; El Salvador 24; Nicaragua 8.
Iron and steel, including alloys, all forms	6,104	10,150	Nicaragua 5,007; Guatemala 1,785; El Salvador 1,675.
Other metals, nonferrous, all forms, n.e.s	97	73	West Germany 47; United States 20.
NONMETALS			
Abrasives, natural	3	---	
Asbestos	10	---	
Cement	6	---	
Clays and clay products	156	134	Nicaragua 121.
Diatomite and other infusorial earth	33	58	El Salvador 52; Panamá 6.
Fertilizer materials, manufactured:			
Nitrogenous	13,110	38,923	Mexico 25,319; Guatemala 4,651.
Phosphatic	20	---	
Other, including mixed	19,309	23,049	Panamá 11,671; Nicaragua 5,093; Colombia 3,042.
Lime	39	---	
Pigments, mineral, crude	41	14	All to Panamá.
Salt	12	10	Nicaragua 6; El Salvador 4.
Stone, sand and gravel:			
Dimension stone	158	290	Mainly to Panamá.
Other stone	203	49	Nicaragua 34; Panamá 14.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products thousand 42-gallon barrels	355	682	Panamá 464.

Table 3.—Costa Rica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum, including alloys, all forms	2,313	1,387	Panamá 378; Mexico 269; El Salvador 226.
Copper:			
Copper sulfate	22	20	United Kingdom 12; West Germany 7.
Metal, including alloys, all forms	445	554	Canada 183; United States 169; Japan 107.
Iron and steel:			
Scrap	6	---	
Pig iron, ferroalloys, and similar materials	29	101	Mainly from West Germany.
Steel, primary forms	22,657	12,529	France 6,445; Belgium-Luxembourg 5,541.
Semimanufactures	72,102	60,464	Japan 41,498; West Germany 6,963.
Lead, including alloys, all forms	132	106	West Germany 61; United States 16; Denmark 14.
Nickel, including alloys, all forms	4	7	West Germany 3; United States 3.
Platinum-group metals, including alloys, all forms troy ounces	8,038	6,109	All from United States.
Silver, including alloys, all forms do	27,489	24,820	Do.
Tin, including alloys, all forms long tons	r 26	20	West Germany 9; United States 7.
Zinc, including alloys, all forms	2,624	1,409	Japan 724; Mexico 575; Canada 100.

See footnotes at end of table.

Table 3.—Costa Rica: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Other:			
Ore and concentrates of base metals, n.e.s	535	375	United States 251; Mexico 105.
Metals, including alloys, all forms	7	8	Japan 3; United States 3; West Germany 1.
NONMETALS			
Abrasives, natural, n.e.s	50	48	West Germany 17; United States 13; Italy 4.
Asbestos	736	673	Canada 604; United States 59.
Boron materials, oxide and acid	31	20	United States 17; Belgium-Luxembourg 3.
Cement	6,699	4,871	Japan 2,805; Nicaragua 1,839.
Clays and products (including refractory brick):			
Crude	962	901	United States 518; United Kingdom 347.
Products	5,967	2,862	Nicaragua 1,876; United States 613.
Diamond, industrial ——carats	470,000	155,000	United States 85,000; Mexico 25,000.
Diatomite and other infusorial earth	218	276	United States 173; Mexico 99.
Feldspar, fluorspar, cryolite	181	96	Mainly from United States.
Fertilizer materials, crude and manufactured:			
Nitrogenous	52,985	83,406	United States 35,389; Colombia 12,481; Netherlands 9,719.
Phosphatic	24,462	19,743	United States 18,052; Belgium-Luxembourg 1,068.
Potassic	21,401	37,127	United States 34,679; West Germany 2,286.
Other, including mixed	40,975	20,124	Netherlands 11,868; United States 5,756.
Graphite, natural	4	1	Mainly from United States.
Gypsum and plasters	6,724	8,146	Nicaragua 7,830; West Germany 198.
Lime	225	397	Mainly from Nicaragua.
Mica, all forms	1	1	All from the United States.
Pigments, mineral, including processed iron oxides	3	---	
Precious and semiprecious stones, except diamond ——kilograms	141	103	West Germany 51; Australia 35; Switzerland 14.
Salt, including brine	9,637	9,960	Mainly from Nicaragua.
Stone, sand and gravel	372	188	Guatemala 63; Nicaragua 55; Italy 43.
Sulfur, elemental, all forms	98	106	Poland 47; Belgium-Luxembourg 32; West Germany 20.
Talc, steatite, soapstone, pyrophyllite	333	351	Italy 296; United States 34.
Other nonmetals, n.e.s	(1)	9	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, native	2	---	
Carbon black and gas carbon	951	1,361	Colombia 600; Mexico 354; United States 191; Venezuela 126.
Coal and coke, including briquets	253	306	West Germany 139; Colombia 105.
Natural gas liquids thousand 42-gallon barrels	r 66	79	Nicaragua 40; Venezuela 22.
Petroleum:			
Crude and partly refined ——do——	r 2,092	2,710	All from Venezuela.
Refinery products:			
Gasoline ——do——	263	215	Curaçao and Aruba 126; Panamá 59.
Kerosine ——do——	r 220	70	Curaçao and Aruba 45 Venezuela 17.
Distillate fuel oil ——do——	r 571	539	Venezuela 248; Curaçao and Aruba 202.
Lubricants ——do——	r 94	94	United States 44; Curaçao and Aruba 23.
Mineral jelly and wax ——do——	18	18	United States 12; Japan 5.
Other, bitumen and other residues ——do——	72	122	Venezuela 61; Colombia 31; United States 29.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	653	936	Mainly from United States.

r Revised.

1 Less than ½ unit.

COMMODITY REVIEW

Metals.—*Copper.*—Tormex Mining Developers, Ltd., planned a survey of its 84 square kilometer concession. Surface indications revealed porphyry copper mineralization similar to that of the Cerro Colorado prospect in Panamá, which was being appraised by Canadian Javelin, Ltd.

Gold.—Tormex was awaiting approval of its application for a concession on a 20-square-kilometer tract containing gold-bearing quartz. Preliminary examination gave average values of 0.04 ounce of gold per ton. The company was also reportedly examining other large, low-grade gold properties that could be mined by open pit methods.[5]

Nonmetals. — *Cement.* — A new cement plant was planned for the vicinity of San Jose under the joint auspices of Costa Rican investors and a Spanish consortium. The new company, Calhidra, S.A.,[6] planned to erect a plant with an initial capacity of 100,000 tons per year at a cost of about $17 million. The state will provide $11 million of the cost and $6 million was to be raised from external sources.

EL SALVADOR

Comisión Ejecutiva Hidroelectrica del Rio Lempe (CEL) was arranging financing for expansion of electric power generation and transmission facilities in El Salvador. Growth of electric power consumption averaged 11.5% per year during the last 10 years; it was expected that the growth rate would be sustained at the same level for another 10 years.

In addition to the 135-megawatt hydroelectric Cerron Grande plant northeast of San Salvador, CEL arranged for construction of a 45-megawatt geothermal plant at Ahuachapán, about 37 miles west of San Salvador. This plant was based on a study of the geothermal field previously made by the United Nations Development Program. Safeguards were planned to protect the environment from effluent of the geothermal wells.

Minas San Cristóbal, S.A., continued its gold-silver production, but details of the operation were not available.

Some interest was reported in petroleum exploration in the coastal region.

GUATEMALA

Possible development of copper and nickel prospects, and the discovery of what appears to be commercial deposits of petroleum, indicated a quickened tempo of development for the Guatemalan mineral industry.

Various steps were being taken to control, and increase, Guatemala's energy supplies. Bonds were sold to raise money to purchase the 96.4% interest held in Empresa Eléctrica by Boise Cascade Corp. Upon acquisition of Empresa Eléctrica on May 23, the Government appointed a new Board of Directors.

Instituto Nacional de Electrification (INDE) furthered its plan for hydroelectric power development on the Chixoy River by signing a contract for a feasibility study, to be financed by the International Bank for Reconstruction and Development (IBRD). The study was to be carried out by a consortium of United States, Swiss, and German companies over a period of 15 months. INDE planned a multistage development with eventual capacity of up to 400,000 kilowatts; each development unit was planned for capacity of 30,000 up to 100,000 kilowatts. Total cost of the project was estimated at $30 million.

INDE was to call for bids to install two steam generators of 50,000 kilowatts each at Escuintla. The units were to be sited near the Texaco refinery, which will supply fuel. Total cost for installation of the generators was estimated at $20 million, with completion date set for the end of 1974.

INDE also received proposals from five firms to construct a geothermal generating plant of 50,000 kilowatts. The companies will not bid on the project in the usual manner, but INDE will select the firm offering the most attractive technical proposal and then negotiate price.

A study of the lead-zinc mineralization in the country regarding the type of deposits observed was published.[7]

[5] Mining Journal. V. 279, No. 7158, Oct. 27, 1972, p. 332.

[6] Mining Journal. V. 279, No. 7160, Nov. 10, 1972, p. 377.

[7] Kesler, S. E., and P. E. Ascarrunz-K. Guatemalan Lead-Zinc Mineralization: Magmatic-Hydrothermal or Mississippi Valley Type? Geol. Soc. America, Abstracts With Programs, 1972 Annual Meetings, v. 4, No. 7, p. 561.

COMMODITY REVIEW

Metals.—*Antimony.*—Yaxcal Wellman and Co. Ltd. was mining and exporting antimony concentrates of about 40% antimony content. The mine is situated at LaCumbre, Ixtahuacán, Huehuetenango. Tungsten values were associated with the ore. The mine employed approximately 70 persons; total investment was about $1.25 million.

Copper.—Basic Resources International Ltd., was progressing on its efforts to put its Oxec copper property into production. Reserves had been previously reported at 1.3 million tons of ore averaging 2.6% copper. Work began on the production shaft in August 1972, and it was expected that the concentrating plant would be completed in August 1973. Rio Tinto-Patino, S.A., agreed to purchase concentrate for a period of 10 years. Other contracts were made with Sheridan Geophysics, Ltd., of Canada, to operate the mine and mill, and with Incontra, Ltd., of Switzerland, to act as sales agent for the concentrate. The two companies will loan the funds to put the property into production; the loans were to be repaid out of concentrate sales, or stock.[8]

Manganese.—Flamenco Hartleben and Co. reportedly held the rights to a manganese deposit; it was estimated that the deposit could be brought into production with an investment of $450,000. It was possible that any investment capital would be supplemented by credits from the Central American Development Bank.

Nonmetals. — *Silica.* — Industria Centroamericana de Vidrio, S.A. (Cavisa) formed a subsidiary company to invest about $2 million over the next several years to produce a greater quantity of domestic raw materials for its use. It was expected that the locally produced proportion of raw materials in its products would increase from 55% to 90%.

Sulfur.—Azufres de Guatemala, Ltd. (Azufres) paid $300,000 for equipment and concessionary rights to exploit the sulfur-bearing muds of Lake Ixpaco, Santa Rosa; the purchase was made from a company which had previously failed to get into production several years ago.

Plans called for investment of $1 million, of which at least half was to come from the Central American Development Bank. It was estimated that about 500,000 tons of sulfur was available, and production will be at a rate of 35,000 tons annually for export. Longer range plans call for establishment of a sulfuric acid plant, and for a fertilizer plant later.

Azufres was formed as a Guatemalan subsidary by the Canadian-based Ixpaco Industries Ltd., to ensure duty-free entry of its products into the Central American Common Market nations.

Mineral Fuels.—*Petroleum.*—Basic Resources International, Inc., made what may be the first commercial discovery of oil in Central America. The discovery well, completed in June, is located on the Chixoy River in Alta Verapaz near the Mexican border. The discovery well tested at the rate of 1,300 barrels of 35.3-degree gravity oil from a depth of 2,415 feet. A second well was subsequently drilled about 1,800 feet west of the discovery. It flowed at the rate of 1,800 barrels of 35-degree gravity oil from an approximate depth of 2,400 feet.

The original drilling of the Tortugas Salt Dome was a joint project between Basic and Monsanto Co. to explore for sulfur. Seventeen such tests were drilled, some of which had shows of sulfur as well as oil. Because of the changing market situation for sulfur, Monsanto dropped out of the program. Basic continued its search for oil, with Monsanto retaining certain rights to oil discovered below 6,000 feet in the concession area.[9]

HONDURAS

The Government of Honduras recognized the need for foreign investment to supplement domestic development capital. Public sentiment was inclined toward the view that foreign capital should take a minority interest and domestic enterprise a majority interest; this was similar to the growing nationalistic attitude toward investment in natural resources in many countries. The National Development Bank assists foreign businessmen who want to invest in Honduras. Under certain conditions industries may receive exemptions from all, or part, of the normal income and business taxes for

[8] Skillings' Mining Review. V. 61, No. 38, Sept. 16, 1972, p. 4.

[9] Wall Street Journal. V. 180, No. 11, July 18, 1972, p. 2.

up to 10 years; exemptions, or some relief, from certain import duties may also be granted.

When expendable material is to be acquired, government policy encourages local purchases; there was no such policy in regard to procurement of raw materials, and foreign firms could make direct imports.

COMMODITY REVIEW

Metals.—*Silver, Gold, Lead, and Zinc.*—On December 14, 1972, the Board of Directors approved an amendment to change the name of New York and Honduras Rosario Mining Co. to Rosario Resources Corp. (Rosario). It was thought that the new name would better reflect the expanding geographic scope and product variety of the company's business.

Records were set during 1972 for ore milled (284,854 metric tons) and for production of lead, zinc, and cadmium in concentrates.

Production from El Mochito mine for 1971 and 1972 is shown in the following tabulation:

	Silver (troy ozs.)	Gold (troy ozs.)	Lead (metric tons)	Zinc (metric tons)
1971				
Lead concentrates	2,085,826	1,287	15,165	2,248
Zinc concentrates	1,034,046	1,013	2,213	19,887
Doré bullion	389,020	401	---	---
Total	3,508,892	2,701	17,378	22,135
1972				
Lead concentrates	2,289,369	1,358	17,985	3,064
Zinc concentrates	781,255	762	1,859	21,037
Doré bullion	304,075	344	---	---
Total	3,374,699	2,464	19,844	24,101

Cadmium contained in concentrates amounted to about 220 tons and 245 tons in 1971 and 1972, respectively.

Assured and probable reserves in the main mine area were calculated at 1.9 million tons of ore grading 12.3 ounces of silver and 0.007 ounce of gold per ton; lead and zinc content was 10.72% and 11.55%, respectively. Exploration of the San Juan ore body revealed 2.8 million tons of ore grading 2.6 ounces of silver and 0.002 ounce of gold per ton; lead, zinc, and copper content was 2.68%, 6.93%, and 0.32%, respectively. At current metal prices, the ore was considered profitable.

Combined resources for both mines total 4.8 million tons averaging 6.6 ounces of silver and 0.004 ounce of gold per ton; lead content was 5.95%, zinc 8.81%, and copper 0.19%.

The No. 6 shaft at El Mochito was sunk to the 2225 level; this will open development and mining of the 1850, 1975, and 2100 levels. The shaft and pumping complex should be completed by late 1973.

A geochemical anomaly was discovered 2 miles east of the main mine. Ore-grade material bore some resemblance to that originally found when El Mochito was discovered. Drilling and trenching will be carried out during 1973 on this new "Soledad Mine" prospect.

Asarco Exploration Co., the Honduras affiliate of American Smelting and Refining Co., exercised its option to withdraw from its joint exploration contract with Rosario. Under the contract Asarco was paying 90% of the costs of driving a 16,000-foot adit at the San Juancito mining property near Tegucigalpa. Asarco had driven about one-half of the contract length and ceased operations under a clause permitting it to suspend operations for 1 year. Asarco must renew its exploration efforts within that period or concession rights and exploration costs revert to Rosario.[10]

Minerales, S.A. (MINSA), which is affiliated with Noranda Mines Ltd. through Noranda's Empresa Minera de el Setentrión, was drilling on the Pochota silver-gold prospect near Aramecina. Exploration had been completed near Colcal in the Department of Ocotepeque and at Pinolapa in the Department of Comayagua.

Inter-American Development Corp. of Houston, Tex., was reported to have completed a 20-ton-per-day mill at its El Matasano site in the Department of Santa Barbara. Production was to consist of concentrates containing silver, lead, zinc, and copper.

Cía Minera Los Angeles was acquired by National Resources Development Co. in 1971. The property had a 50-ton-per-day mill to produce silver-lead-zinc concentrates. Development work reportedly added to produce silver-lead-zinc concentrates. Development work reportedly added to known reserves, and work to reach lower levels was in progress.[11]

[10] Skillings' Mining Review. V. 61, No. 24, June 10, 1972, p. 14.

[11] Mining Journal. V. 278, No. 7123, Feb. 25, 1972, p. 155.

NICARAGUA

Mining was not an important contributor to the economy of Nicaragua, but gold and base metal production may become significant. Lead-zinc output appeared to be well established, and further exploration was expected to add to known reserves.

A new law governing the relationship between Nicaragua commercial agents and foreign suppliers came into effect on February 18, 1972. The legislation provides strong protection for local agents and substantial indemnities to agents of foreign firms wishing to terminate or change their representation. Essentially, a foreign principal may unilaterally terminate such a business agreement only if the local agent (1) is proved guilty of a crime against the principal or his interest, (2) is responsible by negligence for a continued decrease in sales or distribution, or (3) is responsible for acts that adversely effect the sale or distribution of products, or (4) goes bankrupt. The burden of proof for and of the above circumstances lies with the foreign company; penalties payable by the foreign company were to be determined on a sliding scale depending upon the length of time the agent-company relationship had existed.

The first increase in the minimum wage law since 1968 was put into effect early in the year. The increases ranged from 3.8% to 17.8%; household workers received the larger increase. The mining industry was little affected by the new rates because mine wages were normally above the minimum.

Managua was devastated by an earthquake on December 23. No damage was sustained by the oil refinery near the capital.

COMMODITY REVIEW

Metals. — *Copper.* — During 9 months ended June 30, 1972,[12] La Luz Mines Ltd. milled 490,565 tons of ore, 23% less than during the previous 9-month period, and grade of ore declined from 0.69% copper to 0.50% copper. Metal in concentrates produced amounted to 1,636 tons, compared with 2,915 tons produced during the preceding 9-month period. Revenue per pound of copper (including gold and silver) rose from 58 cents to 67 cents, and operating and administration costs per ton of ore milled declined from $3.99 to $2.35.

Gold.—Empresa Minera de el Setentrión, in which Noranda Mines Ltd. had a 61% interest, mined and treated 116,000 tons of ore averaging 0.7 ounce of gold per ton. Progress in the control of the hot water in the Panteon vein allowed further development. Panteon supplied 75% of the tonnage treated in 1972 and had 90% of the yearend reserves, which totaled 254,000 tons carrying an average gold content of 0.68 ounce per ton. Noranda received dividends of $848,000 from Setentrión in 1972.

Lead and Zinc.—The name of the Neptune Gold Mining Co. was shortened to Neptune Mining Co. in order to reflect the current emphasis on output other than gold; namely, lead and zinc. Neptune is owned by American Smelting and Refining Co. 51.8%; Rosario Resources Corp., 36%; and other interests, 12.2%.

Mining facilities at the Vesubio location operated at near capacity—about 500 tons per day for base metal ore, and 100 tons per day for gold ore. Grade in the upper levels at the lead-zinc mine lowered the average, but improvement was shown as mining progressed to deeper levels. Reserves at the lead-zinc mine were put at 1.2 million tons of ore grading 12.58% zinc, 2.16% lead, and 0.28% copper, with 0.09 ounce of gold and 0.48 ounce of silver per ton.

Gold production reportedly declined because of depletion of reserves. Development work was underway for mining the lower levels of the Pioneer and Venus veins, which should allow gold production for a few more years.

Nonmetals. — *Limestone.* — A limestone quarrying operation in Nicaragua was described.[13] The quarry was located about 90 miles southeast of Managua, only 3 miles from the border with Costa Rica. The quarry is situated on a hill where limestone boulders are exposed; the boulders are wedged out by hand, and occasionally some boulders must be drilled for blasting. The boulders are reduced to 6- to 8-inch size by sledgehammer and stockpiled. Five locations are worked by one man to each area, and total output of limestone is about 1,600 tons per year. When enough stock is accumulated the lumps are taken by oxcart to the kilns. After calcining, the lime is sent to two

[12] La Luz Mines Limited. Interim Report; Nine Months Ended June 30, 1972. 2 pp.

[13] Brewis, A. A. C. A Limestone Operation in Nicaragua. Cement, Lime and Gravel, v. 47, No. 9, September 1972, pp. 207–208.

grinding units. These units were made by modifying grass-cutting machinery by turning the blades sideways. The material stays in the machine until it is fine enough to be blown up a delivery duct to the stockpile for hand bagging. The lime thus produced was sold to local sugar refiners.

A sample of the pulverized limestone was analyzed in the United Kingdom with the following results: $CaCO_3$, 97.85%; $MgCO_3$, 1.50%; SiO_2, 0.52%; Al_2O_3, 0.08% and Fe_2O_3, 0.12%.

Limestone was produced elsewhere in Nicaragua from many small deposits; it was used in the manufacture of cement, and calcined for use in paint and for glazing ceramic sanitary ware.

Mineral Fuels.—The only petroleum refinery in Nicaragua, located near Managua, is operated by Esso Standard Oil, S.A., Ltd. It was able to supply the western half of the country, which contained about 90% of the population. The refinery did not produce certain greases, aviation gasoline, and a few other products which were imported.

Industries on the east coast were reported to consume about 240,000 barrels of products annually, mostly diesel fuel. Transportation and economic factors prevented distribution of domestically refined products, necessitating imports to these consumers.

The Esso refinery produced about 9,300 barrels of refined products and 500 barrels of asphalt per day; in 1972 production of heavy hydroformate aromatics was started.

Fifteen U.S. firms held a total of 28 valid oil exploration permits covering areas both onshore and offshore. Seismic work was being conducted off the Pacific Coast. The offshore area on both coasts was essentially all held under lease. Three tests were drilled in 1971, but all were abandoned; one test reportedly contained noncommercial shows of oil. No drilling was reported during 1972.

Construction of a 250,000-barrel-per-day refinery was under consideration; the facility would be located at Monkey Point (Punta Mico) on the southeast coast. Interest in the refinery was to be held by Nicaraguan and U.S. investors. Production would consist primarily of low-sulfur fuel oil and naphtha, much of which would be exported to the United States.

PANAMÁ

Mineral production in Panamá consisted chiefly of construction materials, iron ore, and petroleum refinery products. Minor quantities of metallic minerals may be produced from time to time but do not appear in the annual statistical record. Over the period 1969–72 the mining industry contributed an average of $2.5 million to the average gross domestic product (GDP) of $937 million.

The construction sector was strong insofar as demand was concerned, but was hampered by lack of adequate supplies of cement, steel, and sand. Imports of cement from Taiwan totaled 1 million sacks, and steel imports of 3,000 tons during a 6-month period did not meet the demand. Production of beach sand 50 miles from Panamá City was criticized by the tourist authorities, and suspension of such mining was under consideration on environmental grounds. It was possible that imports of sand might become necessary.[14]

[14] Engineering News-Record. V. 189, No. 12, Sept. 21, 1972, p. 114

Table 4.—Panamá: Foreign trade in selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity		1970	1971
EXPORTS			
Petroleum refinery products	thousand 42-gallon barrels	7	7
IMPORTS			
Aluminum metal, including alloys, all forms		1,712	1,680
Cement, hydraulic		109	45,261
Copper metal, including alloys, all forms		216	238
Fertilizer materials, manufactured:			
Nitrogenous		23,929	21,611
Other and mixed		23,249	28,578
Iron and steel:			
Primary steel forms (ingots, blooms, billets, slabs, sheet bars and similar materials)		14,632	26,136
Semimanufactures		47,097	47,106
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	26,284	28,052
Refinery products:			
Distillate fuel oil	do.	133	133
Residual fuel oil	do.	150	84
Lubricants	do.	49	53
Other[2]	do.	31	25
Salt		5,067	8,304

[1] Data presented in this table are compiled from official Panamanian trade returns; 1970 figures differ from those given in the previous edition of this chapter, which were compiled from trade statistics of trading partner countries.

[2] Partial figure; additional imports were recorded, but statistics on quantities imported were not published (only a value figure was given).

COMMODITY REVIEW

Metals.—*Copper.*—Canadian Javelin Ltd. (CJL),[15] through its subsidiary Javelin Copper Corp., continued prospect drilling at its Cerro Colorado copper property. About 115 holes have been drilled, equivalent to a total aggregate length of 15 miles.

Total resources may amount to 1 billion tons of ore-grade copper mineralization; gold, silver, and molybdenum also occur in amounts that may contribute to byproduct profitability. Preliminary estimates based on studies completed to yearend 1972 on various parts of the deposit suggest 80 million tons of ore at 1.1% copper in one instance, and 500 million tons grading 0.75% copper in another.

Development studies made to date indicate the feasibility for an initial 30,000-ton-per-day open pit mine and flotation mill; this phase would be expanded by addition of three 30,000-ton units at 3-year intervals. It was reported that a number of foreign and U.S. companies interested in the concentrates had investigated the possibility of providing financing.

About 70% of the mineralization occurs in feldspar porphyry and 30% in andesite. The terrain is rugged, and the main airlift was supplied by helicopters which were also used to spot rigs on the less accessible sites. Fixed-wing aircraft supplied fresh food and other necessities daily to the drilling crews; where possible, rigs were skidded along contour trails to new locations and supplies were packed in from distribution points.

It was reported that the Government of Panamá was near agreement for the rights to the Petaquilla copper deposit, which was discovered in 1968. Six Japanese companies were negotiating for further examination of the deposit, which could lead to development.

Iron Ore.—The first shipment of magnetite sand, 20,400 tons, was made in February. Hierro Panamá S.A., owned by Minera de Chame, S.A., and Sumitomo Metal Inc. of Japan, operated the mining enterprise. The company intends to ship 25,000 tons of ore per month assaying 65% iron. The mine is on the Chame Peninsula on the Pacific side of the country, west of the entrance to Panamá Bay.

Iron and Steel.—Talleres Progreso, a Spanish company, presented a plan to the Panamá Government for construction of a steel mill having a capacity of 125,000 tons per year.

[15] World Mining. V. 9, No. 2, February 1973, pp. 32–37.

The Mineral Industry of Other South American Areas

By J. R. Welch,[1] Robert A. Whitman,[1] and Avery H. Reed [2]

CONTENTS

ECUADOR [3]

The most significant mineral industry development during 1972 was the continued success in exploration and development of the country's eastern oilfields. During 1972, Ecuador produced about 29 million barrels of crude oil,[4] and it is expected that the country will shortly become South America's second biggest exporter after Venezuela.

On July 28, 1972, the Quito Press announced that negotiations would begin between Ecuador and Brazil for Brazil to explore for and develop petroleum in Ecuador's El Oriente region in association with Ecuador. Texaco Petroleum Co., operator for the Texaco-Gulf combine, found oil in eastern Oriente and is preparing to bring it into production. Texaco Petroleum has nearly finished the 318-mile trunk pipeline from Lago Agrio fields across the Andes to Port Esmeraldas and expects to carry about 250,000 barrels per day over the mountains to market.

Other operators have moved into the El Oriente region where the hostile jungle environment causes the cost of wells to be as expensive as offshore wells. The World Ventures Group has drilled five wildcats, and four found oil—at Yuturi, Tiputini, Tivacuno and Primavera. Total potential flow at the four discoveries was 1,042 barrels per day after an expenditure of $9.3 million. World Ventures has suspended drilling for the time being. Last year, the Anglo/Superior/Union/Chevron (ASUC) group ventured into El Oriente to drill the first wildcat on a huge concession lying south of Texaco Petroleum and World Ventures. This first hole was successful and flowed 1,653 barrels per day of low-sulfur crude from below 10,000 feet.

Another combine in El Oriente is Cayman Corp. and its partners, City Investing Co. and Southern Union Production Co. So far, the company has drilled three successful holes but more drilling is needed to appraise the size of the Cayman finds.

On August 15, a Texaco tanker left Ecuador for a Panamanian refinery after having taken on the first 314,000 barrels of crude oil produced from the Texaco-Gulf concession in the Ecuadorean Oriente. As a result, Ecuador's adverse balance of payments of the previous years was reversed. By the end of the year the export of crude was averaging 220,000 barrels per day.

During the year a United Nations paper on the Development of Natural Resources was published. It reported that a silver deposit at San Bartolomé was defined by followup work on a geochemical anomaly in zinc in stream sediments though there was

[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.
[2] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.
[3] Prepared by J. R. Welch.
[4] U.S. Embassy, Quito, Ecuador. State Department Airgram A-85, June 19, 1973, 2 pp.

Table 1.—Other South American Areas: Production of mineral commodities

Area, commodity, and unit of measure	1970	1971	1972 p
ECUADOR [1]			
Cadmium, mine output, metal content—kilograms	e 1,040	941	NA
Cement, hydraulic—thousand metric tons	458	462	482
Clays, kaolin—do	771	554	e 550
Copper, mine output, metal content—metric tons	510	564	e 600
Gas, natural:			
Gross production—million cubic feet	10,176	9,620	5,328
Marketable production e—do	500	500	500
Gold, mine output, metal content—troy ounces	8,520	11,028	e 11,000
Natural gas liquids:			
Natural gasoline—thousand 42-gallon barrels	85	NA	119
Liquefied petroleum gases—do	48	NA	50
Total—do	133	NA	169
Petroleum:			
Crude oil—do	1,444	1,354	28,579
Refinery products:			
Gasoline—do	2,667	3,501	3,572
Jet fuel—do	612	153	--
Kerosine—do	490	373	400
Distillate fuel oil—do	1,842	2,009	2,235
Residual fuel oil—do	2,827	3,021	2,878
Lubricants—do	3	2	1
Other—do	60	17	424
Refinery fuel and losses—do	218	609	607
Total—do	8,719	9,685	10,117
Silver, mine output, metal content—troy ounces	69,761	72,158	e 73,000
Sulfur, elemental from ores—metric tons	6,352	e 6,000	e 6,000
Zinc, mine output, metal content—do	127	126	e 130
FRENCH GUINEA			
Columbite-tantalite—kilograms	1,020	NA	1,145
Gold, mine output, metal content—troy ounces	2,347	2,315	997
GUYANA [1]			
Aluminum:			
Bauxite, dry equivalent, gross weight—thousand metric tons	4,417	4,234	3,727
Alumina—do	r 317	310	289
Diamond:			
Gem e—thousand carats	24	19	20
Industrial e—do	37	29	29
Total—do	61	48	49
Gold, mine output, metal content—troy ounces	4,433	1,409	4,026
PARAGUAY			
Cement, hydraulic—thousand metric tons	63	81	75
Clays:			
Kaolin e—metric tons	600	1,200	4,000
Other e—thousand metric tons	450	470	510
Gypsum—metric tons	6,000	e 12,000	e 11,000
Lime—do	21,000	23,556	24,263
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	482	450	527
Jet fuel—do	40	48	49
Kerosine—do	150	121	140
Distillate fuel oil—do	395	467	476
Residual fuel oil—do	216	263	253
Other—do	48	2	34
Refinery fuel and losses—do	108	117	84
Total—do	1,439	1,468	1,563
Pigments, natural mineral, ocher e—metric tons	40	45	60
Sand, including glass sand—thousand metric tons	450	e 431	e 451
Stone:			
Dimension—do	72	e 67	e 72
Crushed and broken:			
Limestone (for cement and lime)—do	r 130	e 156	e 146
Other—do	1,500	e 1,520	e 1,320
Talc, soapstone and pyrophyllite—metric tons	120	e 160	e 220
SURINAM			
Aluminum:			
Bauxite, gross weight—thousand metric tons	6,022	6,718	e 6,902
Alumina—do	1,014	1,276	e 1,270
Metal, primary—do	55	54	56

See footnotes at end of table.

Table 1.—Other South American Areas: Production of mineral commodities—Continued

Area, commodity, and unit of measure	1970	1971	1972 p
SURINAM—Continued			
Cement—thousand metric tons	--	49	e 50
Clays, common e—metric tons	3,200	3,200	3,300
Gold, mine output, metal content—troy ounces	1,137	643	e 600
Sand and gravel:			
Sand:			
Common e—thousand metric tons	120	120	130
Stone sand—do	17	13	e 13
Gravel—do	e 10	e 10	210
Stone, crushed and broken—do	141	e 140	e 150
URUGUAY			
Aluminum, secondary—metric tons	e 400	e 400	40
Cement, hydraulic—thousand metric tons	501	388	465
Clays, type unspecified—metric tons	172,505	300,166	321,656
Coke, gashouse—do	17,386	15,122	13,565
Feldspar—do	1,105	1,208	971
Fluorspar—do	--	--	47
Gas, manufactured—million cubic feet	920	933	923
Gem stones, semiprecious:			
Agate—metric tons	2 79	2 1	55
Amethyst—do	2 17	--	--
Gypsum—do	--	--	47
Iron and steel:			
Iron ore (for cement production)—do	1,150	3,300	1,210
Steel, crude—do	16,232	e 16,000	--
Steel semimanufactures—do	41,200	46,500	45,550
Lime—thousand metric tons	61	48	e 50
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	2,252	2,156	2,132
Jet fuel—do	176	184	170
Kerosine—do	1,308	1,306	1,382
Distillate fuel oil—do	2,610	2,681	2,470
Residual fuel oil—do	5,346	5,205	5,133
Lubricants—do	3	3	2
Other—do	586	507	473
Refinery fuel and losses—do	676	556	181
Total—do	12,957	12,598	11,943
Sand and gravel:			
Sand:			
Common—thousand metric tons	1,578	1,355	1,965
Glass—do	17	128	124
Gravel e—do	220	220	--
Stone:			
Dimension—do	3 35	23	3 32
Crushed and broken:			
Alum schist—metric tons	497	317	310
Dolomite—thousand metric tons	41	18	19
Limestone—do	909	883	e 880
Quartz—metric tons	798	786	810
Other (including ballast)—thousand metric tons	775	1,171	1,279
Sulfur, elemental, byproduct e 4—metric tons	120	117	114
Talc, soapstone and pyrophyllite (ground)—do	1,634	852	1,323

e Estimate. p Preliminary. r Revised. NA Not available.

1 In addition to the commodities listed, a variety of crude construction materials (common clays, sand, gravel, and stone) undoubtedly is also produced, but output is not reported and available information is inadequate to make reliable estimates of output levels.

2 Exports.

3 Consists partly of exports.

4 Recovered from refinery gases.

little or no surface expression of the mineralization. It was further reported that a limited evaluation by diamond drilling and tunneling indicated 20 million tons averaging 2 ounces of silver per ton.

Prospection Limited, a mining and geological consulting group of Toronto, Canada, completed the first phase of surface examination and core drilling of a copper-molybdenum deposit in the province of Loja, southern Ecuador. Results of the initial drilling indicated a deposit containing about 50 million tons of porphyry-type copper-molybdenum mineralization with accompanying low gold values. Further drilling is being considered.

Trade data which appeared in the 1971 chapter is the most recent information available.

FRENCH GUIANA [5]

The gradual phasing out of gold mining during the 1970-1972 period, together with the lack of information on clays or sand and gravel operations indicate that mining was at a low level at best.

The French Government approved exploration of extensive bauxite deposits in 1971. The approval involved three concessions held by Compagnie Minière Alcoa de Guyane (C.M.A.G.), which is owned by Aluminum Company of America (Alcoa). Exploration and development was to be carried out by a company of which 75% is owned by C.M.A.G. and 25% by Péchiney of France, under C.M.A.G. management.

The initial exploration was in the Kaw mountain area. Until and unless C.M.A.G. finds reserves of over 100 million tons, the bauxite was to be processed in Paranam, Surinam, by a subsidiary of Alcoa. Development of the ore bodies was expected to provide 500 jobs, with at least 200 jobs remaining after the start of mining. This will be a significant boost to the economy of a population totaling only 50,000.

GUYANA [6]

The first full year of bauxite operations under the management of the government-owned Guyana Bauxite Co. (Guybau) was believed to be satisfactory, considering the weak world market for metallurgical-grade bauxite and alumina. Production of bauxite declined by about 12% from that of 1971. There was a 7% decrease in the production of alumina from that of 1971.

Sales of better than 250,000 tons of alumina included about 100,000 tons to the U.S.S.R. and 30,000 tons to the People's Republic of China. Guybau closed its alumina plant for 7 weeks during the summer of 1972 because of market conditions.

Terra Surveys Ltd. of Ottawa, Canada, was to start a survey of Guyana covering 35,000 square miles, including 3,000 square miles of the Takutu Basin, to determine the oil potential of the area. The survey, financed by a Canadian Government loan of about $1.1 million, also should help to indicate any magnetic iron ore deposits and to identify new areas of bauxite mineralization.

Gold mining recovered to the levels reached in 1968 and 1970, and production was three times the amount reported in 1971. There were about 49,000 carats of diamond mined in 1972, which was 2% above the total for 1971.

Various press reports of exploration for oil were made but there was no firm announcement of any discoveries. The Government of Guyana in November granted an offshore exploration concession of 3,789 square miles to the Deutsche Erdolversorgungsgesellschaft M.b.H. (Deminex). Tests of this area made in the winter of 1970-1971 by Deminex were encouraging. Continental Oil Co., Ada Exploration Corp., and Texas Pacific Oil Co., Inc., participated with Deminex in the earlier tests.

[5] Prepared by Robert A. Whitman.
[6] Prepared by Robert A. Whitman.

Table 2.—Guyana: Exports and reexports of mineral commodities
(Metric tons unless otherwise specified)

Commodity		1970	1971
Aluminum:			
Bauxite:			
Dried		2,339,858	2,085,605
Calcined		712,817	699,693
Oxide (alumina)		328,760	306,775
Mineral fuels and related materials	value	$14,305	$38,549
Precious and semiprecious stones, uncut, and cut but not set [1]	value	$1,687,130	$1,203,315

[1] Includes pearls.

Table 3.—Guyana: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum metal, including alloys, all forms		278	103
Copper metal, including alloys, all forms		44	NA
Iron and steel metal: Pig iron, crude steel and semimanufactures		29,611	72,241
NONMETALS			
Cement		52,040	94,915
Fertilizer materials, manufactured:			
Nitrogenous		25,691	29,218
Phosphatic		3,205	NA
Potassic		2,547	3,251
Limestone	value	$211,073	$133,367
Salt		3,266	3,427
Sodium and potassium compounds, n.e.s.:			
Caustic soda (sodium hydroxide)		15,608	34,796
Sulfuric acid		1,060	1,005
Other:			
Building materials of asphalt, asbestos, and fiber-cement, and unfired nonmetals n.e.s.		2,191	1,289
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	371	310
Kerosine	do.	209	265
Distillate fuel oil	do.	705	588
Residual fuel oil	do.	2,286	2,225
Lubricants	do.	39	52
Asphalt and road oil	do.	NA	37

NA Not available.

PARAGUAY [7]

Paraguay is a large, landlocked country in the interior of South America, just north of Argentina. The area is 157,000 square miles, about the size of California. The economy is mainly pastoral. There are few developed mineral resources.

Mineral production in Paraguay increased to record levels in 1972. The total value increased 18% to $24,160,000. The value of nonmetals increased 9% to

[7] Prepared by Avery H. Reed.

Table 4.—Paraguay: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum metal, all forms		81	190
Copper metal, all forms		162	219
Iron and steel, all forms		11,845	16,920
Lead metal, all forms		47	81
Tin metal, all forms	long tons	4	4
NONMETALS			
Cement, hydraulic		3,676	1,226
Salt		22,739	23,166
Crude minerals and manufactures, not further described		3,926	5,636
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural		9,636	5,026
Coal, lignite, briquets and other solid fuel		55	84
Petroleum:			
Crude oil	thousand 42-gallon barrels	1,439	1,305
Refinery products:			
Gasoline	do.	r 95	79
Kerosine	do.	10	38
Distillate fuel oil	do.	165	18
Residual fuel oil	do.	13	25
Lubricants	do.	27	33
Total	do.	310	193

r Revised.

[1] In addition to the commodities listed individually, Paraguay reported the importation of "precious stones and metals" totaling 2.9 metric tons in 1970 and 52.6 metric tons in 1971.

$8,916,000 and was 7% above the 1970 record. The value of petroleum refinery products increased 24% to $15,244,000. New annual records were set for the output of clays, lime, and petroleum products.

There were few mineral exports. Leading imports were crude oil, asphalt, salt, and iron and steel.

Paraguay continued to develop its extensive water power resources on the Paraná and Paraguay Rivers. The Acaray hydroelectric complex on the Paraná River was completed and power was sold to Argentina. The Itaipu project with Brazil calls for the world's largest hydroelectric dam, 5,400 feet long and 560 feet high, costing $2 billion. The Yacyrete-Apipe project with Argentina calls for a dam across the main stream of the Paraná River costing $1.1 billion. Plans for a dam at Corpus, between these two dams, are on the drawing board.

COMMODITY REVIEW

Nonmetals.—*Cement.*—Cement shipments decreased to 75,370 tons, 7% below the 1971 record high. The proposed new hydroelectric dams will require a great expansion of cement capacity. The Itaipu dam will require more than 10 million cubic yards of concrete.

Clays.—Output of common clay for cement and heavy clay products increased 9% above the 1971 record high to 510,000 tons. Kaolin output was 4,000 tons.

Gypsum.—Gypsum output was 11,000 tons, 8% below the 1971 record. Lime production increased to 24,260 tons, 3% above the 1971 record.

Stone.—Crushed stone production decreased 13% below the 1971 record, and was 1,466,000 tons valued at $3,299,000.

Mineral Fuels.—Total refinery output was 1,563,000 barrels, compared with 1,468,000 barrels in 1971. Production of residual fuel oil was 253,000 barrels.

SURINAM [8]

Exports of bauxite were down 3% in 1972 compared with 1971, but this decrease was offset by an increase of over 9% in the export of alumina and 11% in the export of aluminum metal. Over 96% of the bauxite went to the United States and Canada; 67% of the alumina went to the United States and the Netherlands; and 80% of the aluminum metal went to Argentina or to unspecified European countries.

Reynolds Metals Co. (Reynolds) continued to prospect for bauxite in its concession areas in the Bakhuys mountains in western Surinam. An integral part of the concession agreement between the Suri-

[8] Prepared by Robert A. Whitman.

Table 5.—Surinam: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite	r 3,408,723	3,596,769	United States 3,075,229; Canada 369,352; West Germany 39,731.
Oxide (alumina) and hydroxide	r 791,657	1,166,718	United States 464,582; Netherlands 308,398; Norway 160,546.
Metal, including alloys, all forms	r 54,000	47,673	Italy 10,484; Argentina 9,984; Japan 9,085.
Copper metal, including alloys, unwrought	67	5,175	Netherlands 4,575; West Germany 600.
Gold, troy ounces	32	--	
Iron and steel, primary forms and semi-manufactures	r 83	3,232	Mainly to West Germany.
Lead metal, including alloys, unwrought	55	3,048	Belgium 1,700; Netherlands 1,215; West Germany 133.
Mercury, 76-pound flasks	15	3	All to Netherlands.
Other: Ore, slag and ashes, n.e.s.	107	7,040	Netherlands Antilles 7,000; West Germany 40.
NONMETALS			
Sand, clays, earth	11,075	3,050	All to Netherlands Antilles.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products, lubricants, 42-gallon barrels	r 82	424	Guadeloupe 386.

r Revised.

Table 6.—Surinam: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum metal, including alloys, all forms		r 376	295
Copper metal, including alloys, all forms		r 70	115
Gold metal, unworked or partly worked	troy ounces	3,253	9,644
Iron and steel:			
Metal:			
Pig iron and crude steel		2,411	1,326
Semimanufactures		r 12,365	10,889
Lead metal, including alloys, all forms		r 31	34
Magnesium metal, including alloys, all forms		46	46
Tin metal, including alloys, all forms	long tons	10	13
Zinc metal, including alloys, all forms		r 11	3
NONMETALS			
Abrasives, natural, n.e.s		5	5
Cement		30,326	28,147
Chalk		253	260
Clays and clay products:			
Crude sand, clay and earth		r 45	32
Products		r 2,107	1,540
Diatomite and other infusorial earth		25	46
Fertilizer materials:			
Nitrogenous		r 4,974	8,263
Phosphatic		r 366	861
Potassic		121	30
Mixed		r 353	532
Lime		7,552	28,849
Pyrite (gross weight)		--	4
Salt		1,517	1,584
Stone:			
Dimension:			
Crude		r 5	58
Worked		80	57
Broken and other		479	53,268
Other nonmetals, n.e.s.:			
Asbestos, mica, graphite, and magnesite		4	125
Other, n.e.s		40,557	3,579
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		r 2,463	5,495
Coal, all grades, including briquets		30,154	31,523
Petroleum refinery products:			
Gasoline:			
Aviation	thousand 42-gallon barrels	19	10
Other	do.	220	230
Kerosine	do.	55	47
Distillate fuel oil	do.	r 740	627
Residual fuel oil	do.	3,072	3,269
Lubricants	do.	45	44
Mineral jelly and wax	do.	1	1
Other:			
Nonlubricating oils, n.e.s	do.	2	1
Liquefied petroleum gas	do.	54	46
Bituminous mixtures, n.e.s	do.	1	14
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		r 42	44

r Revised.

nam Government and Reynolds is construction of the Kabalebo Dam. The Government of Surinam had requested the assistance of the United Nations Development Program for a Special Fund Project, the "Feasibility Study of the Kabalebo Hydroelectric Scheme." The Governing Council of the United Nations approved this request in January 1972. The World Bank is the executing agency, and the contractor for the project is a joint venture, Norconsult of Norway and Electro Watt of Switzerland. Until such time as Reynolds can show 50 million tons of commercial-grade bauxite, Surinam was not expected to proceed with building a railroad from the area to the port of Apoera on the Corantijn River. Enlarging and modernizing this port is another part of the overall project.

Early in March the Billiton Mine Workers Union struck the Billiton mine for higher wages for the 1,500 workers. The strike had little effect on the total production for the year.

Table 7.—Bauxite, alumina, and aluminum shipments from Surinam
(Metric tons)

Company	1970	1971	1972
BAUXITE			
Suriname Aluminum Co.:			
United States and Canada	2,103,790	1,972,307	1,778,099
Western Europe	135,893	138,792	114,510
Other	18,947	10,446	4,400
Total	2,258,630	2,121,545	1,897,009
N. V. Billiton Mij.:			
United States	1,038,294	1,097,565	1,052,791
Canada	111,648	369,334	521,510
Western Europe	4,788	20	--
Other	80	3,277	5,092
Total	1,154,810	1,470,196	1,579,393
Grand total	3,413,440	3,591,741	3,476,402
ALUMINA			
Suriname Aluminum Co.:			
United States	217,253	414,512	429,944
Western Europe	220,839	293,704	369,188
Mexico	--	14,955	--
Africa	--	--	40,155
Total	438,092	723,171	839,287
N. V. Billiton Mij.:			
United States	[1] 70,156	50,811	144,499
Western Europe	325,881	369,373	294,692
Eastern Europe	59,834	25,179	--
Total	455,871	445,363	439,191
Grand total	893,963	1,168,534	1,278,478
ALUMINUM			
Suriname Aluminum Co.:			
United States	--	8,279	4,232
Western Europe	52,535	17,829	27,642
Near East	--	--	3,371
Far East	--	9,085	2,243
Other	828	12,480	15,526
Total	53,363	47,673	53,014

[1] United States and Canada.

URUGUAY [9]

Mineral output in Uruguay expanded 17% and established a new annual record high. Total value increased 27% to $40 million and was 11% above the 1970 record. The expansion was mainly due to an increased output of cement, clays, sand, and crushed stone.

Uruguay is a small country on the east coast of South America. It has 72 thousand square miles and more than 2 million people. It is a pastoral country with an economy based on wool and meat. There are few mineral resources other than construction materials.

Plans for constructing Palmar hydroelectric dam on the Rio Negro have been suspended. Construction of the $500 million Salto Grande hydroelectric dam on the Uruguay River was approved and will start in 1973.

Uruguay has little foreign trade. Crude oil is imported and refined for domestic use. There are few mineral exports.

COMMODITY REVIEW

Cement output increased 20% to 465,000 tons but was 10% below the 1968 record high. Output of clays, mainly for cement, was a record 322,000 tons.

Production of sand increased 41% to 2,090,000 tons but was 17% below the 1969

[9] Prepared by Avery H. Reed.

record. Output of crushed stone was a record 2,179,000 tons.

Plans were approved for the construction of a petroleum buoy, a tank farm 20 miles east of Punta del Este, and a 96-mile pipeline from the tank farm to the refinery at Motevideo. The total cost will be more than $15 million. Output of petroleum refinery products was about the same as in recent years, 5% below 1971.

The Mineral Industry of Albania, Denmark (Including Greenland), Iceland, and Switzerland

By Joseph B. Huvos,[1] F. L. Klinger,[2] David G. Willard,[3] and Richard F. Stevens, Jr.[2]

CONTENTS

ALBANIA [4]

In 1972, Albania was the world's fourth largest producer of chromite ore, accounting for 10.8% of the world's output. Other mineral commodities were also produced, but of lesser importance by world standards; these included nickeliferous iron ore, crude oil and refinery products, copper ore, blister copper and copper wire, some lignite, cement, natural asphalt, and natural gas.

Information on the performance of the mineral industry was scarce. Official Albanian sources indicated only plan fulfillment or relative growth rates in few areas.

In 1972, major developments in the mineral industry were new plant construction performed largely with aid from the People's Republic of China (PRC). Among the new projects were the Fierza hydroelectric station on the Drin River, and the steel works and the petroleum refineries in Elbasan. Other new plant projects were a copper concentrator for Pukë, an expansion of the glass factory at Korcë, and a quartz processing plant at Shishtavec (Kukës District).[5]

According to the fifth 5-year plan for 1971–75, industrial prodution is slated to reach 12.8 billion leks[6] in 1972.

PRODUCTION

Production figures for Albania's mineral commodities were not available for 1972, but estimates were made based upon published data on growth rates of key commodities.

The production of metals and fossil fuels increased, while fertilizer production remained stationary during the reference year, as additional productive capacity was still under construction.

TRADE

In 1972, minerals and mineral products accounted for approximately 70% of Albania's exports, an increase of 10.5% over the total of the previous year.[7] Only chrom-

[1] Foreign mineral specialist, Division of Fossil Fuels—Mineral Supply.
[2] Physical scientist, Division of Ferrous Metals—Mineral Supply.
[3] Economist, Division of Nonmetallic Minerals—Mineral Supply.
[4] Prepared by Joseph B. Huvos.
[5] Zeri i Popullit (The Voice of the People). Jan. 1, 1973, p. 1.
[6] Values have not been converted from Albanian currency units (leks to U.S. dollars) owing to the wide variation between the official exchange rate (lek 5.00=US$1.00) and those actually used for some transactions.
[7] Die Wirtschaft des Ostblocks (Bonn). Albanian Minerals for Exports. Apr. 30, 1973.

Table 1.—Other European Countries: Production of mineral commodities

Area,[1] commodity, and unit of measure	1970	1971	1972 p
ALBANIA [2]			
Cement, hydraulic ——thousand metric tons	345	393	e 432
Chromium, chromite, gross weight ——do	r 466	502	e 573
Coal, lignite ——do	r 606	675	e 965
Copper:			
Mine output, metal content [3] ——metric tons	r 5,600	5,900	6,320
Smelter output (blister) ——do	r 5,600	5,900	e 6,320
Fertilizer materials, manufactured:			
Nitrogenous ——thousand metric tons	76	90	NA
Phosphatic ——do	110	111	NA
Gas, natural, gross production——million cubic feet	3,457	4,453	e 5,032
Iron and steel:			
Iron ore, nickeliferous, gross weight——thousand metric tons	r 400	400	e 420
Semimanufactures (rolled angles, shapes and sections) metric tons	22,900	34,000	NA
Petroleum: [4]			
Crude Oil:			
As reported ——thousand metric tons	1,487	1,657	1,844
Converted ——thousand 42-gallon barrels	9,921	11,057	12,306
Refinery products:			
Gasoline ——do	649	746	e 835
Kerosine and jet fuel ——do	116	155	e 175
Distillate fuel oil ——do	1,041	1,082	e 1,210
Residual fuel oil ——do	2,021	1,933	e 2,165
Lubricants ——do	43	43	e 50
Other:			
Petroleum wax and jelly ——do	120	118	e 130
Asphalt and bitumen ——do	4,209	4,364	e 4,890
Petroleum coke ——do	77	33	e 35
Unspecified ——do	141	307	e 345
Total ——do	8,417	8,781	e 9,835
DENMARK [2]			
Cement, hydraulic ——thousand metric tons	2,604	2,733	2,873
Clays, kaolin, crude and washed e ——metric tons	18,000	18,000	18,000
Coal, lignite ——thousand metric tons	135	(5)	—
Coke, gashouse ——do	183	135	e 113
Diatomaceous materials:			
Diatomite e ——do	r 8	r 7	7
Moler e ——do	r 200	r 200	200
Fertilizer materials, manufactured:			
Nitrogenous, gross weight [6] ——do	94	88	95
Phosphatic, gross weight [6] ——do	526	564	611
Mixed and unspecified, gross weight ——do	250	229	242
Iron and steel:			
Iron ore (less than 42% iron), gross weight ——do	26	15	15
Pig iron and blast furnace ferroalloys ——do	215	228	203
Crude steel [7] ——do	473	471	498
Steel semimanufactures ——do	452	434	423
Lead metal, secondary (including alloys) [6] ——do	10,050	10,022	9,362
Lime (quicklime and agricultural) [6] ——do	179	179	199
Peat fuel e ——do	r 5	r 5	5
Petroleum refinery products:			
Gasoline ——thousand 42-gallon barrels	11,008	12,342	12,087
Jet fuel ——do	584	536	488
Kerosine ——do	752	884	868
Distillate fuel oil ——do	21,358	24,640	25,237
Residual fuel oil ——do	31,795	31,322	27,772
Other ——do	4,775	4,876	4,749
Refinery fuel and losses ——do	5,162	3,150	3,609
Total ——do	75,434	77,750	74,810
Salt [6] ——thousand metric tons	436	133	306
ICELAND			
Aluminum smelter production, primary ——metric tons	37,958	41,000	45,560
Cement, hydraulic ——thousand metric tons	85	100	130
Diatomite ——metric tons	13,239	19,400	22,000
Fertilizer materials, manufactured, nitrogenous:			
Gross weight ——do	22,621	24,230	27,500
Nitrogen content ——do	r 2,641	2,835	3,217
Pumice ——do	11,000	24,000	17,217
Sand and gravel:			
Calcareous ——thousand cubic meters	144	120	127
Other sand and gravel ——thousand tons	4,826	4,715	5,300
Stone:			
Dimension ——thousand metric tons	65	52	82
Crushed and broken ——do	136	223	65

See footnotes at end of table.

Table 1.—Other European Countries: Production of mineral commodities—Continued

Area,[1] commodity, and unit of measure	1970	1971	1972 [p]
SWITZERLAND [2]			
Aluminum smelter production, primary ---metric tons--	91,490	94,000	83,638
Cement, hydraulic ---thousand metric tons--	4,797	5,220	5,713
Coke, gashouse ---do---	164	104	91
Gas, manufactured ---million cubic feet--	13,981	13,637	14,278
Gypsum [e] ---thousand metric tons--	100	100	100
Iron and steel:			
Pig iron and blast furnace ferroalloys ---do---	28	32	27
Electric furnace ferroalloys ---do---	9	23	21
Crude steel ---do---	524	532	543
Steel semimanufactures ---do---	545	550	565
Lime ---do---	145	142	150
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels--	7,149	7,183	6,282
Jet fuel ---do---	1,096	984	920
Kerosine ---do---	54	39	23
Distillate fuel oil ---do---	16,457	15,860	16,792
Residual fuel oil ---do---	11,215	10,976	10,803
Other ---do---	2,267	2,430	2,735
Refinery fuel and losses ---do---	3,342	2,828	3,000
Total ---do---	41,580	40,300	40,555
Salt ---thousand metric tons--	333	291	256

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

[1] In addition to the areas listed, Greenland (a Territory of Denmark), covered textually in this chapter, presumably has continued to produce small quantities of crude construction materials and may have produced other minerals, but output is unreported.

[2] In addition to the commodities listed, a variety of crude construction materials (common clay, sand, gravel, and stone) is undoubtedly produced, but output is unreported and available general information is inadequate to make reliable estimates of output levels.

[3] Smelter output used as an estimate of mine output inasmuch as there is no evidence of ore and/or concentrate exports.

[4] Petroleum data converted to barrels from metric tons using the following factors: crude petroleum—6.672; gasoline—8.50; kerosine and jet fuel—7.75; distillate fuel oil—7.46; residual fuel oil—6.66; lubricants—7.00; petroleum wax and jelly—7.87; asphalt and bitumen—6.06; petroleum coke—5.50; other—7.00. The tonnage figures for "other" were derived by subtracting the tonnages for individual products reported from a reported total refinery product figure, which may have excluded refinery fuel.

[5] Revised to none.

[6] Sales.

[7] Apparently excludes shipyards' production of steel castings.

ite was important by world trade standards. Crude oil, bituminous flux, natural bitumen, nickeliferous iron ore, blister and electrolytic copper, and copper wire constitued the bulk of the remaining mineral exports.

Exports of mineral products are expected to rise by 11% in 1973, and will include diesel oil, kerosine, and sulfur, in addition to the commodities previously mentioned.

Coke, iron and steel products (including other semimanufactures), phosphate rock, and potash were the main imported minerals.

Among Albania's trade partners in 1971, the PRC ranked first, with an estimated value of $125 million. There was a $65 million trade surplus in favor of the PRC, presumably the result of Chinese deliveries under aid credits. Albania provided chromium ore, crude oil, natural bitumen, nickeliferous iron ore, and copper in exchange for oil industry equipment, machinery, and rolled steel.

It was reported that the Albanian State Export Co. (Exportal) handles 70% of Albania's mineral product exports, which were directed towards Sweden, Belgium, France, Greece, Switzerland, Austria, Italy, Japan, and other countries.

COMMODITY REVIEW

Metals.—*Chromium Ore.*—In 1972, Albania's estimated chromium ore production increased by 14%. Among world producers, Albania ranked fourth with chromium ore production amounting to 10.8% of the world total.

Albania's official reported chromite ore production is slated to reach 900,000 tons by the end of the current 5-year plan in 1975.[8] Chromium ores of excellent quality

[8] Zeri i Popullit (The Voice of the People). Nov. 5, 1971.

Table 2.—Albania: Foreign trade in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity		1970	1971
EXPORTS			
Chromite		452,000	484,000
Copper:			
Blister and refined, unwrought		1,354	2,809
Wire		1,833	2,460
Nickeliferous iron ore, gross weight		390,000	370,000
Petroleum:			
Crude oil:			
As reported		81,000	143,000
Converted	thousand 42-gallon barrels	540	954
Refinery products, bituminous flux	do	4,103	4,236
IMPORTS			
Aluminum, unwrought and semimanufactures		373	NA
Iron and steel semimanufactures: [2]			
Bars, rods, and sections		5,100	NA
Plates and sheets		37,800	
Hoop and strip		400	
Rails and accessories		500	
Pipes and tubes		7,500	
Refractory brick		864	NA
Petroleum refinery products: [3]			
Gasoline	thousand 42-gallon barrels	128	170
Distillate and residual fuel oils	do	177	141

NA Not available.

[1] Compiled from official Albanian trade returns unless otherwise specified.

[2] Compiled from trade returns of trading partner countries, as reported in The Statistical Office of the United Nations. Supplement to the World Trade Annual, 1970 edition, Walker and Company, New York, 1972, and from official trade returns of Czechoslovakia and Poland.

[3] Source: United Nations World Energy Supplies 1968–71, New York, 1973, 187 pp.

are found in many parts of Albania. The four principal chromium ore deposits are located in the following areas: (1) the vicinity of Pogradec, near Korcë; (2) the Klos Area, near Mat; (3) the Lataj zone, near Elbasan; and (4) near the town of Kukës in northern Albania. Deposits are often in the form of irregular lenticles found at shallow depths.

The average Cr_2O_3 content of the deposits is around 42% and the FeO content is about 13%. Several chromite concentrating plants were under development in 1971. A plant at Bulshizë was commissioned in 1971. No additional information was reported on the development of the previously reported ferrochrome plant under construction at Laç.

Chromite ore is one of Albania's leading export products. About 80% of the production of chromite ore was exported in 1971. The first year chromite concentrate was exported from Albania was 1972.

Since 1957, chrome ore has been shipped to Yugoslavia's Manochrom enterprise for processing into chrome firebrick. Shipments were 5,000 tons in 1957 and 80,000 tons in 1972, and plans are to ship 100,000 tons by 1975. The chrome firebrick is returned to Albania for use in the nonferrous industry.[9]

Copper.—Albania's estimated blister copper production increased in 1972 by 7.1% over that of 1971, while it was reported that estimated copper ore production increased by 4%.

Albania has substantial copper deposits in the northern part of the country. Copper ore deposits were reported near Derven, Bulshizë, Erzen, Velë, Narel, Kabash, Klos, Dedaj, Firzë, Iballë, Orosh, and Qerat in the Pukë-Mirditë zone, and the Kukës and Skhodër Areas. Other deposits were reported at Kamenicë and Rehovë, near Korçë. Copper ores, mostly sulfides, were estimated at 50 million tons of low-grade ore. Presently mined ores, however, have an average copper content of 3%.

Copper ores are processed mainly at three locations: Kurbnesh, Spac, and Rreps, where concentration is by froth flotation. Other concentrators may be operating at Rubik, Kukës, and Gjegjan, but no details on these operations are available. Smelter and blister copper production was reported at Rubik, Kukës, and Gjegjan. The country's only known electrolytic refinery for converting blister is at Rubik. Some of the electrolytic copper is processed into wire in

[9] Engineering and Mining Journal. V. 17, No. 6, June 1972, p. 306.

the Skhodër wire mill, which was built with the PRC help.

A typical analysis of Albanian blister copper was as follows, in percent:

Copper	99.45
Silver	.108
Gold	.002
Sulfur	.15
Tin	.007
Antimony	.002
Iron	.018
Lead, Zinc, Cadmium, Arsenic, Nickel	less than .01

Iron Ore, Nickeliferous.—Estimated production of nickeliferous iron ore increased by 4.8% in 1972.

Albania's nickeliferous iron ore reserves were estimated at 20 million tons in 1956, the last year for which data were available.[10] The deposits are all located in the Librazhd-Pogdradec Area. According to official publications, there are three types of ores: (1) a so-called ferronickel ore containing about 51% iron; (2) nickel silicates, with a higher proportion of silica and magnesia; and (3) nickeliferous bauxites. Only the first is mined and is reported to contain 1% nickel and 0.06% cobalt. It is essentially a laterite from the weathering of Jurassic age ultrabasic igneous rock, found often as a residual concentration on lower hill slopes. It is largely surface mined.

Iron and Steel.—There is no published information on Albania's iron and steel production. It was reported that work continued on construction of a major metallurigcal complex at Elbasan, which was to be partially commissioned in 1975. At the new plant, 800,000 tons of nickelferous iron ore will be processed into 250,000 tons of unspecified steel products. A rolling mill was reported to be processing imported Chinese steel at Elbasan.

Nonmetals.—*Cement.*—In 1972, estimated cement output of Albania increased by 10% over that of 1971. It was reported that the Fush-Kruje cement plant, enlarged in 1972 by an unspecified productive capacity, was commissioned during the year.

Fertilizer Materials.—The country's estimated nitrogenous fertilizer production was unchanged in 1972. Albania's nitrogen fertilizer plants include an ammonium nitrate plant at Laç and a urea plant reportedly under construction at Fier.

Estimates of Albania's phosphatic materials production in 1972 were unchanged. A granulated superphosphate plant was previously reported to be operating at Laç. Albania imports phosphate rock for superphosphate production. Imports of phosphate rock in 1972 amounted to 60,000 tons, equaling those of 1971.

All of Albania's potash fertilizer consumption in 1972 was imported and amounted to an equivalent of 2,000 tons of potassium oxide.

Mineral Fuels.—Albania's total estimated energy production in 1972 amounted to 3.091 million tons in standard coal equivalent and was comprised of lignite (12.9%), crude oil (79.5%), and other sources (7.6%), which included mainly hydroelectric energy.

Total energy production in Albania in 1971, the last year for which detailed data are available,[11] amounted to 2.329 million tons in standard coal equivalent, a gain of 2.0% over the output of 1970. Of the total national energy production, 13.3% was derived from lignite, 83.7% from crude petroleum, and 3.0% from other sources.

Albania's primary energy consumption in 1971 and plan figures for 1975 production, in million metric tons coal equivalent and percent, based on published data for growth rates, are as follows: [12]

[10] Metal Bulletin. No. 5499, May 15, 1970, pp. 27, 31.
[11] United Nations (New York). World Energy Supplies for 1968–1971. Statistical Papers, Series J, No. 16, 1973.
[12] Work cited in footnote 11, and official Albanian publications.

Commodity	1971 (consumption) Quantity [1]	Standard coal equivalent (million metric tons)	Percent	1975 (planned production) Quantity [1]	Standard coal equivalent (million metric tons)	Percent
Solid fuels	0.656	0.328	23.8	1.25	0.625	14.3
Crude oil and refining products	.755	.982	71.2	2.7	3.510	80.0
Other	1.104	.069	5.0	2,000	.250	5.7
Total energy	XX	1.379	100.0	XX	4.385	100.0

XX Not applicable.
[1] Solid fuels, and crude oil and refining products given in million metric tons; "Other" (principally hydroelectric) given in million kilowatt hours.

The apparent discrepancy between energy production and consumption may be that Albania did not report data on petroleum products used for purposes other than energy production, such as bituminous flux, which forms a substantial fraction (40% to 50%) of the refinery products made from Albanian crude, and which, according to plans, is expected to be exported in 1973 in amounts up to 1 million tons.

As in previous years, crude oil was Albania's principal source of energy. In the future, however, a larger share of the national energy requirements is to come from hydroelectric power.

Published data indicate an expected average annual increase of 12% in the total national energy consumption. Albania is a net exporter of crude oil and petroleum products, and is expected to increase exports in 1973 by 11%.

Asphalt and Bitumen (Natural).—Albania's estimated natural asphalt and bitumen production increased 7.7% in 1972 over that of 1971.

Asphalt and bitumen deposits are found in a triangular area between the Kundësi Mountain at the village of Selenice and the Vijosë River between the villages of Karbunarë, Treblovë, and Asmen. Asphalt occurs mainly in limestone formations and sands of Miocene and Pliocene origin, and is mostly in a semiliquid state, having a fusion point of 118° F and a specific gravity of 1.1. Typical hydrocarbon content is 33%.

Coal.—In 1972, Albania's estimated lignite output increased by 43% over that of the previous year. According to published officials plans, Albania's lignite production will increase to 1.25 million tons in 1975.

Albania's lignites are mostly of relatively high quality, ranging from the common varieties with a marked woody texture to lignites with physical properties resembling asphaltic probitumens or even asphaltities. The country's most important lignite deposits are found in the following areas: (1) a triangular plateau with apexes at Tirana, Elbasan, and Lushnjë in the Krrabë Mountains; (2) the Vijosë River Valley, mainly at Memaliaj near Tepelenë; (3) the Pogradec-Korçë Area, mainly at Mborje, Drenovë, and Alarup; and (4) Priskë, near Tirana.

Albania has not published reserves of lignite in the above areas.

Albania's lignites have a calorific value that sometimes exceeds 4,900 kilocalories per kilogram. A typical analysis of an Albanian lignite is as follows, in percent:

Fixed carbon	42
Volatile matter	40
Ash	8
Moisture	10
Sulfur	6

It has been reported that the mines of Kraba and Memaliaj, formerly considered exhausted, were reactivated after the discovery of workable reserves.

Natural Gas.—In 1972, Albania's estimated natural gas production increased by 13% over that of 1971. The presence of natural gas in the Kucovë and Patos oilfields was known already in the 1940's, when undisclosed quantities were used at the Kucovë powerplant. At present, natural gas is used assumedly as a feedstock in producing nitrogenous fertilizer in Laç.

Petroleum.—In 1972, Albania's estimated crude oil production increased 11.3% over that of 1971.

Although Albania has not published estimates of petroleum reserves, the most recent (1969) available information places Albanian crude reserves at 14 million tons.[13]

Albania's oil-bearing region is located in the southwest, within a triangle formed by Vlorë, Berate, and Durrës. Crude oils from the Stalin and Patos Fields have an asphaltic base. They have a density of 7.87 pounds per gallon. The approximate yield of Albanian crude oil, reported some years ago was as follows, in percent:

Gasoline	13	Asphalt	40
Kerosine	8	Sulfur	3
Gas oil	18	Residuals	18

Albania was a net exporter of crude oil and petroleum products in 1972. Among exported products, bituminous flux had the largest share, with amounts estimated at about 1 million tons for the year.

Apparent consumption of crude oil and crude oil products was estimated to have increased by 11% during 1972. Crude oil was used equally for power generation and for petrochemical products.

Albania's refining capacity was estimated at about 2 million tons per year and was located at Stalin, Cerrik, and Patos, while work assumedly continued with Chinese help on the Fieri petroleum refinery, due

[13] World Oil. V. 173, No. 5, October 1971, p. 119.

to come onstream with a nominal capacity of 1.5 million tons per year in the current fifth 5-year plan.

Albania has a pipeline system that connects the oilfields and refineries to the seaport of Vlora.

Primary electric energy from sources other than those mentioned above accounted for 7.6% of Albania's total energy production in 1972. Work continued on the 400-megawatt Drin River hydroelectric project. This and other projects will treble Albania's power-generating capacity by 1975 compared to that of 1970.

DENMARK (INCLUDING GREENLAND) [14]

There were several developments of significance to the small mineral industry of Denmark and Greenland in 1972. Commercial production of crude oil began in the Danish sector of the North Sea. A large new cement-production facility was completed at Rordal, and a new fertilizer plant was nearing completion at Fredericia. Det Danske Staalvalsevaerk A/S announced plans to build an electric steelworks and to expand steel-rollng facilities. In Greenland, the small coal mine on Disko Island was closed, but production of lead-zinc-silver ore at Marmorilik was scheduled to start in 1973. In other developments, tentative agreement was reached on division of the Continental Shelf between Greenland and Canada, and Denmark became a member of the European Community (EC) on January 1, 1973.

PRODUCTION

Volume indices of production for the various branches of the Danish mineral industry in 1971 and 1972 were not available. Data on the volume of sales (in kroner) of Danish-produced commodities and services,[15] however, indicated an average gain of 15% in the nonmetallic-mineral-processing sector in 1972, compared with 1971, with significant gains registered in the cement, brick, glass, stone, and concrete-products industries. The relatively high volume of sales of construction materials tended to confirm other indicators of increased activity in the nonmetals sector in 1972, such as increased production and exports of cement and gains in building construction. In other sectors, the volume of sales in mining and quarrying was up 6%; in the fertilizer industry, 9%. Sales in the basic metals industry were unchanged from the 1971 level, and a decline of 11% was apparent in the petroleum-refining sector.

Average hourly earnings of wage earners in the mining and minerals-processing industries increased from about 8.5% to nearly 11% in the 12 months ending in November 1972. The average increase for all industry during the same period was 11.4%.

Total employment in different sectors of the mineral industry in November 1971 is shown in the following tabulation:

Sector	November 1971	
	Total employment [1]	Number of firms [1]
Mining and quarrying	1,669	82
Nonmetallic mineral processing	26,002	549
Iron, steel, and other metal works	7,953	87
Fertilizer (manufactured)	1,664	5
Petroleum refining	609	3
Other fuel processing	1,754	96
All industry	411,447	6,805

[1] Firms employing more than five persons.
Source: Statistiske Efterretninger. V. 65, No. 30, May 3, 1973, pp. 571–573.

Partial data for November 1972 indicated a decline of about 300 employees in the mining and quarrying sector, an increase of about 600 in nonmetallic mineral processing, and little or no change in employment in the basic metals or oil-refining industries.

TRADE

Denmark's exports and imports of mineral commodities [16] in 1972 were valued at an estimated $335 million and $1,284 million, respectively.[17] As in 1971, petroleum

[14] Prepared by F. L. Klinger.
[15] Statistiske Efterretninger. V. 65, No. 42, June 26, 1973, pp. 808–813.
[16] Including the following numerical divisions of the Standard Industrial Trade Classification (S.I.T.C.): 27, 28, 32, 33, 51, 56, 66, 67, and 68.
[17] Converted from values in Danish kroner (DKr) published in Månedsstatistik over Udenrigshandelen, No. 12, December 1972, pp. 1204–1213. According to the International Monetary Fund, the average rate of exchange in 1972 was DKr 6.837 = US$1.00.

products and nonmetallic mineral products were the leading export commodities, in terms of value, with petroleum products and iron and steel being the principal imported items. A reduction of about $40 million in the value of imports of solid and liquid fuels in 1972 was largely offset by increased imports of iron and steel. The volume of imports in 1972 was depressed to some extent by an import surcharge of 10%. The surcharge was reduced to 7% in July, and was scheduled to drop to 4% at the end of the year and to terminate on March 15, 1973.

Mineral commodity trade with countries of the European Free Trade Association (EFTA) comprised 56% of the value of Denmark's exports of mineral commodities and 35% of the value of imports. Trade with the EC comprised 25% of the value of exports and 34% of the value of imports. Denmark's membership in EFTA was scheduled to terminate January 1, 1973, at which time the country officially becomes a member of the EC.

Detailed statistics of trade in 1970 and 1971 are shown in tables 3 and 4.

Table 3.—Denmark: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide and hydroxide [1]	87	37	United Kingdom 11; West Germany 9; United States 4.
Metal, including alloys:			
Unwrought, including scrap	3,406	3,664	Sweden 1,659; Belgium-Luxembourg 1,130; West Germany 528.
Semimanufactures	4,490	6,666	Sweden 3,275; West Germany 877; United Kingdom 844.
Antimony metal, including alloys	54	21	Venezuela 10; Peru 5.
Copper:			
Matte	3	--	
Metal, including alloys:			
Scrap	5,437	5,744	Belgium-Luxembourg 3,815; West Germany 1,038; Sweden 666.
Unwrought	1,837	2,738	West Germany 1,794; Sweden 421.
Semimanufactures	2,230	2,714	United Kingdom 1,114; Sweden 865; Norway 194.
Iron and steel:			
Ore and concentrate	20,904	9,716	West Germany 6,489; United Kingdom 2,472; Netherlands 740.
Roasted pyrite	111,401	98,780	All to West Germany.
Metal:			
Scrap	24,313	34,540	West Germany 16,252; Sweden 8,641; Norway 7,225.
Pig iron, including cast iron	1,632	635	United Kingdom 579; Sweden 50.
Sponge iron, powder and shot	242	98	West Germany 81; Sweden 13.
Spiegeleisen	(2)	--	
Ferroalloys	--	29	Sweden 22.
Steel, primary forms	3,104	2,717	Norway 2,113; Sweden 345.
Semimanufactures:			
Bars, rods, angles, shapes and sections	105,630	122,393	United Kingdom 42,673; West Germany 41,420; Sweden 23,567.
Universals, plates and sheets	133,831	113,974	Sweden 45,269; West Germany 32,980; Norway 27,740.
Hoop and strip	1,195	1,553	Sweden 1,456.
Rails and accessories	7,793	4,655	France 2,926; Italy 1,544.
Wire	1,930	2,100	Sweden 1,654; Finland 339.
Tubes, pipes and fittings	12,160	13,959	Sweden 8,848; Iceland 941; Norway 862; United Kingdom 816.
Castings and forgings, rough	6,976	9,560	Sweden 6,366; West Germany 1,066.
Total semimanufactures	269,515	268,194	
Lead metal, including alloys:			
Scrap	15	153	Sudan 85; Sweden 68.
Unwrought	3,793	3,868	Norway 1,043; United States 582; Sudan 575.
Semimanufactures	121	177	Finland 68; Iceland 41; Norway 38.
Magnesium metal, including alloys, all forms	61	96	United States 86; Sweden 10.
Manganese oxides	(2)	1	Mainly to Sweden.
Nickel metal, including alloys, all forms	250	174	West Germany 101; Sweden 32.

See footnotes at end of table.

Table 3.—Denmark: Exports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Silver:			
Waste and sweepings thousand troy ounces	952	1,289	West Germany 492; Sweden 251; United Kingdom 251.
Metal, including alloys, all forms do	167	498	West Germany 424; Finland 48.
Tin metal, including alloys:			
Scrap long tons	3	--	
Unwrought do	r 1,291	1,597	Hungary 373; Bolivia 228; Italy 190.
Semimanufactures do	r 55	79	Sweden 65.
Titanium dioxide	123	111	United States 54; Yugoslavia 21; People's Republic of Yemen 17.
Zinc:			
Oxide	19	28	Kuwait 15; Iceland 4; West Germany 3.
Metal, including alloys:			
Scrap, including blue powder (dust)	2,907	2,839	Norway 1,254; West Germany 729; Belgium-Luxembourg 467.
Unwrought and semimanufactures	415	462	Sweden 180; Netherlands 48; Norway 37; West Germany 35.
Other:			
Ash and residue containing nonferrous metals	6,541	5,732	Netherlands 1,896; West Germany 1,546; Sweden 1,458.
Oxides, hydroxides, and peroxides of metals, n.e.s	18	14	Kenya 5; West Germany 5.
Base metals, including alloys, all forms, n.e.s	3	13	West Germany 5; Sweden 4.
NONMETALS			
Asbestos	64	54	Sweden 17; Norway 12; Yugoslavia 10; Kuwait 8.
Cement	158,820	227,561	Ireland 55,235; Dominican Republic 49,896; Israel 21,187; Sweden 19,857.
Chalk	22,019	19,145	Sweden 9,390; Norway 4,382; Finland 2,341.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s	6,040	4,514	Finland 1,272; Sweden 1,224; Spain 338.
Products:			
Refractory [3]	50,212	55,072	United Kingdom 12,405; West Germany 9,594; Netherlands 7,153.
Nonrefractory	93,418	96,089	West Germany 74,555; Norway 15,202; Sweden 4,508.
Cryolite	33,173	27,936	NA.
Diamond, gem, not set or strung value, thousands	$50	$26	Belgium-Luxembourg $15; West Germany $7.
Diatomite and other infusorial earth	100,348	65,048	West Germany 38,812; United Kingdom 12,776; Sweden 4,860.
Feldspar and fluorspar	35	404	Sweden 233; Hungary 130.
Fertilizer materials:			
Crude:			
Phosphatic	961	(2)	NA.
Other	474	353	Sweden 342; Netherlands 10.
Manufactured:			
Nitrogenous	30	37	Iceland 17; Sweden 13; Netherlands 7.
Phosphatic	34,525	277	East Germany 260; Netherlands 16.
Potassic	5	9	Norway 8.
Other, including mixed	416	550	Sweden 314; Italy 163; Netherlands 31.
Ammonia	6,623	900	Sweden 887.
Lime	22,993	21,517	Norway 16,526.
Pigments, mineral, including processed iron oxide	5,959	8,532	West Germany 64; Finland 60.
Salt	5,959	8,532	Sweden 6,351; Norway 1,905.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	91,577	83,339	West Germany 83,232.
Worked	570	914	West Germany 473; Sweden 413.
Dolomite, chiefly refractory grade	36	29	United Kingdom 19; Kuwait 5.
Gravel and crushed rock thousand tons	2,834	3,518	West Germany 3,460; Sweden 27.
Limestone (except dimension)	116,229	113,516	Sweden 62,238; West Germany 36,505; Norway 13,132.
Quartz and quartzite	8	80	Sweden 42; West Germany 32.
Sand, excluding metal bearing	135,790	139,581	Sweden 111,843; West Germany 12,247; Norway 9,291.
Sulfuric acid	7,540	28	Iceland 11; Sweden 10.

See footnotes at end of table.

Table 3.—Denmark: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Talc, steatite, soapstone and pyrophyllite	142	78	Iceland 42; Norway 10; Nigeria 6.
Other nonmetals, n.e.s.:			
Crude	1,674	859	West Germany 573; Finland 170; Sweden 116.
Slag, dross, and similar waste, not metal bearing	44,558	37,753	West Germany 31,277; Norway 6,476.
Oxides and hydroxides of magnesium, strontium and barium	9	2	Finland 1.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	77	119	West Germany 52; Norway 27; Finland 18.
Carbon black and gas carbon	308	444	Sweden 248; Norway 79; Finland 67.
Coal and coke, including briquets	85,875	56,245	Sweden 34,041; Norway 19,052; West Germany 3,151.
Peat including peat briquets and litter	4,800	3,638	West Germany 2,195; Arab Republic of Egypt 900.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	r 4,398	4,974	Sweden 4,064; United Kingdom 395; Norway 390.
Kerosine and jet fuel ——do——	255	339	Sweden 243; Norway 64.
Distillate fuel oil ——do——	3,025	3,911	Sweden 3,283; Norway 523.
Residual fuel oil ——do——	5,029	5,532	Sweden 4,039; Norway 844; United Kingdom 258.
Lubricants ——do——	146	145	Norway 111; Sweden 16; West Germany 5.
Other ——do——	r 330	431	Norway 299; Finland 112.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	653	7,454	Sweden 6,948; Norway 292.

r Revised. NA Not available.
[1] Including synthetic corundum.
[2] Less than ½ unit.
[3] Including those of magnesite, diatomite, and other refractory materials.

Table 4.—Denmark: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide [1]	681	555	United States 338; West Germany 114; France 67.
Metal, including alloys:			
Scrap	1,449	842	U.S.S.R. 372; Sweden 286; United Kingdom 69; West Germany 69.
Unwrought	10,605	9,428	Norway 7,531; United Kingdom 959; Canada 303.
Semimanufactures	26,204	28,580	Sweden 5,285; West Germany 3,988; Switzerland 3,529; United Kingdom 3,391.
Antimony metal, including alloys, all forms	22	88	People's Republic of China 65; United Kingdom 17.
Cadmium oxide and hydroxide	15	11	Sweden 3; West Germany 3.
Chromium oxide and hydroxide	907	324	West Germany 200; France 81.
Cobalt metal, including alloys, all forms	17	21	Belgium-Luxembourg 18.
Copper metal, including alloys:			
Scrap	886	515	Sweden 369; Iceland 77.
Unwrought	4,680	3,856	Belgium-Luxembourg 3,681; Sweden 133.
Semimanufactures	31,707	26,062	Sweden 9,445; Belgium-Luxembourg 4,730; United Kingdom 3,834.
Iron and steel:			
Ore and concentrates	3,230	557	Sweden 541.
Roasted pyrite	3,951	6,728	Norway 6,701; Netherlands 24.
Metal:			
Scrap	29,090	2,698	Sweden 1,446; East Germany 826.
Pig iron, including cast iron [2]	r 33,125	18,057	East Germany 5,627; Norway 3,820; U.S.S.R. 3,780.
Steel, primary forms	18,053	17,731	Norway 13,093; Sweden 985.
Ferroalloys	176,461	139,150	Norway 62,505; West Germany 42,224; Finland 17,669.
Semimanufactures:			
Bars, rods, angles, shapes, sections [3]	420,406	418,498	West Germany 127,882; Belgium-Luxembourg 64,844; France 47,311.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Semimanufactures—Continued			
Universals, plates, and sheets	618,239	582,990	West Germany 197,947; Sweden 114,626; United Kingdom 72,562.
Hoop and strip	93,106	70,085	West Germany 32,364; Belgium-Luxembourg 18,993; Sweden 6,945.
Rails and accessories	19,800	18,696	France 10,213; West Germany 3,545; Belgium-Luxembourg 3,504.
Wire	7,249	4,469	West Germany 1,807; Sweden 1,715; United Kingdom 546.
Tubes, pipes, and fittings	174,789	148,430	West Germany 45,580; United Kingdom 29,916; Sweden 12,184.
Castings	2,293	2,410	United Kingdom 1,277; Netherlands 850; West Germany 171.
Total semimanufactures	1,335,882	1,245,578	
Lead:			
Oxides	1,058	1,102	Mexico 425; Sweden 187; West Germany 161.
Metal, including alloys:			
Scrap	7,547	4,360	Norway 2,688; Kenya 459; Czechoslovakia 203.
Unwrought	11,345	13,831	Sweden 4,808; Territory of South-West Africa 3,792; United Kingdom 3,067.
Semimanufactures	874	1,092	West Germany 796; United Kingdom 126.
Magnesium metal, including alloys, all forms	159	136	Norway 109; Sweden 20.
Manganese:			
Ore and concentrate	11,562	5,763	People's Republic of China 2,200; Republic of South Africa 1,578; West Germany 1,056.
Oxides	1,872	2,552	Japan 1,401; Netherlands 768; Belgium-Luxembourg 266.
Mercury ——76-pound flasks	592	325	Sweden 119; West Germany 52; Yugoslavia 44.
Molybdenum metal, including alloys, all forms	6	7	West Germany 4; Austria 3.
Nickel:			
Ore and matte	9	4	United Kingdom 3; Sweden 1.
Metal including alloys:			
Unwrought, including scrap	96	99	United Kingdom 80; Canada 12.
Semimanufactures	592	661	West Germany 378; United Kingdom 128.
Platinum-group metals and silver, including alloys, all forms:			
Platinum group thousand troy ounces	17	15	West Germany 6; Switzerland 4.
Silver ——do	3,585	2,945	West Germany 1,138; United Kingdom 913.
Tin metal, including alloys:			
Scrap ——long tons	750	313	Netherlands 59; Norway 56; Italy 54.
Unwrought ——do	1,225	1,019	People's Republic of China 723; Thailand 86; Bolivia 63.
Semimanufactures ——do	89	88	United Kingdom 56; West Germany 26.
Titanium oxides	7,972	6,227	Norway 1,650; Netherlands 1,357; United Kingdom 906.
Tungsten metal, including alloys, all forms	16	19	West Germany 9; Sweden 7.
Zinc:			
Oxide	2,582	2,029	West Germany 914; East Germany 430; Netherlands 364.
Metal, including alloys:			
Blue powder and scrap	772	734	United Kingdom 448; Norway 251.
Unwrought	15,264	11,006	Norway 3,663; Netherlands 3,316; Finland 1,312.
Semimanufactures	6,470	6,900	Poland 2,945; Yugoslavia 2,304; Belgium-Luxembourg 830.
Other:			
Ore and concentrate of base metals, n.e.s	1,024	1,002	Australia 802; United Kingdom 71; Netherlands 67.
Ash and residue containing nonferrous metals	2,340	1,798	Sweden 904; West Germany 810.
Metals, including alloys, all forms:			
Metalloids	2,103	2,115	West Germany 804; Netherlands 684; Sweden 375.
Alkali, alkaline earth and rare-earth metals	329	239	West Germany 227.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Other—Continued			
Metals, including alloys, all forms—Continued			
Pyrophoric alloys	5	5	United Kingdom 2.
Base metals, including alloys, all forms, n.e.s	79	203	People's Republic of China 65; Republic of South Africa 52.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	6,717	5,799	West Germany 3,120; Iceland 1,942; Netherlands 361.
Dust and powder of precious and semiprecious stones	14	6	Switzerland 2; United States 2.
Grinding and polishing wheels and stones	1,250	1,161	Sweden 335; Austria 284; West Germany 266.
Asbestos	28,690	26,798	Canada 13,946; Cyprus 4,808; Republic of South Africa 3,893.
Barite and witherite	847	1,371	West Germany 844; Ireland 419; People's Republic of China 105.
Boron:			
Crude natural borates	2,077	2,073	United States 1,380; Turkey 600.
Oxides and acids	216	174	Turkey 60; France 42; Belgium-Luxembourg 38.
Cement	4,375	6,505	United Kingdom 3,307; West Germany 1,348; Finland 864.
Chalk	4,924	2,828	West Germany 1,749; Sweden 514; France 512.
Clays and clay products (including all refractory brick):			
Crude clays, kaolin and other clays	80,917	71,796	United Kingdom 42,508; Czechoslovakia 11,420; West Germany 7,305.
Products:			
Refractory (including nonclay bricks)	31,770	34,637	West Germany 11,943; Austria 9,550; Sweden 7,127.
Nonrefractory	61,988	57,627	West Germany 28,133; Sweden 8,981; Japan 7,378.
Diamond:			
Gem, not set or strung thousand carats	5	4	Belgium-Luxembourg 2.
Industrial do	40	140	West Germany 125.
Diatomite and other infusorial earth	4,354	3,306	United States 1,697; Iceland 743; West Germany 370.
Feldspar, leucite and nepheline syenite	10,953	9,363	Norway 8,561; Sweden 406; United Kingdom 350.
Fertilizer materials:			
Crude:			
Nitrogenous	13,269	12,031	All from Chile.
Phosphatic	318,665	313,027	Morocco 178,936; U.S.S.R. 92,022; Tunisia 42,044.
Potassic	1,080	735	All from West Germany.
Manufactured:			
Nitrogenous	204,812	142,753	Norway 111,364; West Germany 27,366; Romania 3,619.
Phosphatic:			
Thomas (basic) slag	580	532	All from West Germany.
Other	24,875	21,771	Netherlands 12,167; France 4,510; Belgium-Luxembourg 2,975.
Potassic	229,006	256,112	West Germany 167,593; East Germany 56,447; U.S.S.R. 24,451.
Other, including mixed	396,360	387,639	Norway 294,070; West Germany 76,796; Belgium-Luxembourg 15,951.
Ammonia	172,111	213,736	Trinidad and Tobago 84,493; Norway 52,878; United States 52,824.
Fluorspar	3,781	2,487	France 1,006; East Germany 700; Republic of South Africa 570.
Graphite, natural	233	212	West Germany 101; Norway 100.
Gypsum and plaster	242,415	239,751	Poland 149,707; France 77,032; West Germany 10,405.
Lime	3,945	3,923	West Germany 2,542; Poland 1,067.
Magnesite	8,572	7,468	Austria 4,959; Czechoslovakia 823; Spain 688.
Mica:			
Crude, including splittings and waste	429	381	Norway 148; United Kingdom 118; Republic of South Africa 105.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Mica—Continued			
Worked, including agglomerated splittings	117	58	West Germany 25; Belgium-Luxembourg 16.
Pigments, mineral:			
Natural, crude	364	466	Cyprus 248; West Germany 138; France 55.
Iron oxides, processed	3,683	3,913	West Germany 3,390; Spain 331.
Precious and semiprecious stones, except diamond ——kilograms	5,436	10,581	West Germany 5,082; Brazil 4,956.
Pyrite	165,395	144,530	Spain 98,564; Portugal 45,965.
Salt	454,206	133,853	West Germany 85,470; East Germany 15,529; Poland 14,299.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous (including marble)	8,808	8,818	Norway 3,361; Sweden 3,323; Italy 1,958.
Slate	16,881	13,358	Norway 7,327; Switzerland 2,610; Sweden 1,420.
Other (granite, gneiss, etc.)	115,529	182,087	Sweden 176,907; Portugal 3,252.
Worked, all types	51,274	50,291	Portugal 33,172; Sweden 10,078; West Germany 4,956.
Dolomite, chiefly refractory grade	32,255	29,898	Norway 23,405; West Germany 3,606; Sweden 1,572.
Gravel and crushed rock	469,476	551,049	Sweden 433,513; Norway 107,582.
Limestone (except dimension)	70,428	71,187	Sweden 64,866; Potland 4,990.
Quartz and quartzite	6,701	6,631	Sweden 3,107; Norway 2,345.
Sand, excluding metal bearing	131,373	122,717	Belgium-Luxembourg 108,488; West Germany 6,543; Sweden 4,757.
Sulfur:			
Elemental, all forms	11,142	15,308	France 7,987; West Germany 3,416; Belgium-Luxembourg 1,354.
Sulfur dioxide and sulfuric acid	4,071	4,195	West Germany 1,815; Norway 1,754; East Germany 518.
Talc, steatite, soapstone, and pyrophyllite	17,828	13,659	Norway 8,797; West Germany 2,115; Finland 1,017.
Other nonmetals, n.e.s.:			
Crude	35,071	41,855	West Germany 33,389; Sweden 4,900; United States 1,728.
Slag, dross and similar waste, not metal bearing	22,438	8,012	United Kingdom 4,765; West Germany 3,246.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,710	1,601	United States 866; West Germany 615.
Carbon black	3,847	3,648	United Kingdom 1,043; West Germany 1,025; United States 645.
Coal and coke including briquets thousand tons	3,616	2,448	Poland 1,769; U.S.S.R. 529; West Germany 59.
Gas, hydrocarbon, liquefied ——do——	109	106	West Germany 38; Sweden 21; U.S.S.R. 16; Netherlands 11.
Peat, including peat briquets and litter	13,209	15,057	Sweden 14,266; West Germany 394; Finland 378.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 74,244	78,212	Kuwait 21,033; Saudi Arabia 19,447; Nigeria 15,409.
Refinery products:			
Gasoline ——do——	7,631	7,913	United Kingdom 2,765; Netherlands 2,026; Italy 1,070.
Kerosine and jet fuel ——do——	4,789	4,776	Netherlands 1,621; United Kingdom 1,533; Italy 1,202.
Distillate fuel oil ——do——	29,300	24,944	United Kingdom 14,177; Netherlands 2,899; Sweden 1,196.
Residual fuel oil ——do——	32,019	30,602	United Kingdom 12,960; Sweden 3,148; U.S.S.R. 3,129; Netherlands 2,846.
Lubricants ——do——	r 720	691	United Kingdom 314; Netherlands 129; Sweden 92.
Mineral jelly and wax ——do——	108	133	West Germany 104; Indonesia 10.
Other ——do——	r 1,711	1,957	Netherlands Antilles 748; West Germany 533; Netherlands 329.
Total ——do——	r 76,278	71,106	

r Revised.

[1] Not including synthetic corundum.

[2] Including spiegeleisen, grit, sponge, and powder of iron and steel.

[3] Including wire rod.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—Output of crude steel by Det Danske Staalvalsevaerk A/S (DDS) in 1972 was 471,000 tons, about 8% more than in 1971. Production of rolled products was slightly less than in 1971; output of plates and other flat products increased, while production of bars, sections, and other rolled items declined. The company's production continued to be based almost entirely on domestic scrap.

DDS announced plans to build an electric steelworks adjacent to its present open-hearth plant. The new works will replace the open-hearth plant and will be built in two stages, each of which will include installation of two 100-ton electric steel furnaces and one continuous-casting machine. The first stage of construction, which will include installation of a continuous slab caster, is estimated to cost about $75 million and is scheduled for completion by 1976. At that time, the new plant will have a production capacity of 500,000 tons of crude steel per year, and the output capacity of the present plate mill will be increased to be same amount. The second stage will raise production capacity of the steelmaking plant to 1 million tons per year, add a continuous caster for billets, and will increase output capacity of the present bar-and-section mill to 450,000 tons annually. Principal contractors involved in the new project are the Danish firms of Højgaard & Schultz A/S and Kampsax A/S, and Demag AG of West Germany. The new works was expected to increase DDS employment by about 300 persons.

Danish imports of iron and steel, as crude forms and semimanufactures, increased by about 15% in 1972, to approximately 1.64 million tons compared with 1.42 million tons in 1971. Apparent consumption was about 1.3 million tons, compared with 1.1 million tons in 1971. Total stocks of iron and steel on December 31, 1972, essentially unchanged from a year earlier, totaled 893,000 tons, including 154,000 tons of metal in crude forms, 407,000 tons of semimanufactures, and 332,000 tons of scrap.

Lead and Zinc.—At Marmorilik, Greenland, construction of the Black Angel lead-zinc-silver mine and related facilities was continued by Greenex A/S in 1972. About 450 men were working at the site. The concentrator, which will have a processing capacity rated at 1,650 tons of ore per day, was expected to start production in late 1973. Port facilities will provide for loading of vessels up to 35,000 tons, and storage of up to 95,000 tons of zinc concentrate and 21,000 tons of lead concentrate. In October 1972, Greenex arranged with a London banking group for a 7-year, $41 million Eurodollar loan that will permit completion of the construction project and provide working capital. Sales or smelting contracts have already been negotiated for the bulk of concentrate scheduled to be produced during the first several years of operation. Cominco Ltd., which owns 62% of Greenex, reported that over 4 million tons of ore reserves, containing more than 20% combined lead and zinc, had already been outlined by exploration and that further work was expected to at least double this figure.

According to statistics published by the Organization for Economic Cooperation and Development (OECD), Denmark's consumption of refined lead was 27,000 tons in 1970 and 22,200 tons in 1971. The corresponding figures for consumption of zinc metal were 12,400 tons in 1970 and 9,100 tons in 1971. Danish official statistics indicated that domestic stocks of unwrought, semimanufactured, and scrap metal on December 31, 1972, included 7,552 tons of lead and 3,877 tons of zinc; both figures were about the same as 1 year earlier.

Uranium.—The Danish Atomic Energy Commission and the Geological Survey of Greenland continued studies of uranium deposits in the Kvanefjeld Area of southwest Greenland. It was reported that about 30 million tons of low-grade ore (containing 320 grams uranium per ton) lie close to the surface and might be suitable for commercial exploitation.

Other Metals.—Trade in aluminum and copper increased in 1972. Net imports of aluminum, including alloys, in the form of ingot, semimanufactures, and scrap, totaled about 32,600 tons compared with 28,500 in 1971; the corresponding figure for copper was 27,500 tons (19,000 in 1971). Net imports of silver in unwrought and semimaufactured forms totaled 102,300 kilograms in 1972.

Nonmetals.—*Cement and Other Construction Materials.*—Compared with 1971 totals, domestic sales of cement increased

5% in 1972 to 2.87 million tons, and exports increased about 12% to 256,000 tons. Aalborg Portland Cement Co. installed a new 774-foot rotary kiln at its Rordal plant, increasing output capacity of the plant by more than 50% to 7,000 tons per day. The new kiln was part of the first stage of a $115 million expansion program that is expected to be completed by the company in 1976.

The increase in sales and exports of cement was accompanied by increased activity in building construction in 1972. Although the volume[18] of buildings completed was about the same as in 1970 and 1971, the volume of buildings under construction at yearend was about 25% more than a year earlier.

Imports of cement, industrial limestone, and sheet glass increased substantially in 1972, but imports of gypsum, clay, and stone, sand, and gravel declined. Imports of asbestos were essentially unchanged. Exports of most construction materials were less than in 1971. Hoffman & Sonner A/S, of Copenhagen, the operator of one of the largest gravel quarries in Denmark, placed an order valued at more than $400,000 with a British distributor for delivery of a Manitowoc 4600 dragline and ancillary equipment. Elsewhere, the Aalborg Portland Cement Co. began calcining refractory-grade bauxite in a rotary kiln at Mariager, Jutland. The bauxite is a low-iron grade from Guyana. Production capacity of the kiln was reported to be about 75,000 tons per year.

Cryolite.—Danish trade statistics indicated that exports of cryolite in 1972 totaled 17,870 tons, valued at approximately $5.7 million. This was a decline of more than 35% in quantity, and value, compared with 1971 figures. The export tonnage was considerably less than shipments of cryolite reported from Greenland (59,000 tons in 1972); the balance may have been stockpiled.

Fertilizer Materials.—Production of manufactured fertilizer by Superfos A/S was 840,000 tons in 1972, slightly less than in 1971. Construction of a second new phosphorus-potassium (PK) fertilizer plant, with production capacity of 300,000 tons per year, was expected to be completed by the company at Fredericia in mid-1973. A similar plant was recently completed at Norresundby. A sulfuric-acid plant with a daily output capacity of 750 tons was also under construction at Fredericia.

Imports of fertilizer materials by Denmark in 1972 included 324,000 tons of crude phosphate rock, 100,000 tons of calcium nitrate, 225,000 tons of potassium chloride, and 442,000 tons of other (manufactured) materials. Most of these imports were for domestic consumption. Exports of superphosphate totaled nearly 50,000 tons in 1972, compared with less than 300 tons exported in 1971.

Consumption of nitrogen in Denmark during the 1971–72 agricultural year was approximately 307,000 tons, 8% more than in 1970–71. Consumption of potassium and phosphorus increased slightly, to approximately 158,000 tons and 59,000 tons, respectively.

Mineral Fuels.—*Coal and Coke.*—Imports of coal and coke in 1972 were 2,187,000 tons and 121,325 tons, respectively, slightly less than imports in 1971. Most of the coal continued to be supplied by Poland and the Soviet Union and was principally used for generation of electricity.

In Greenland, the small coal-mining operation at Qutdligssat on Disko Island was closed in April 1972 after producing 4,500 tons since January 1. The last reported annual production was 18,000 tons in 1970.

Imported coal supplied about 5% of Denmark's primary energy requirements in 1971, with the balance provided by imported liquid fuels. Domestic production of lignite, which supplied a small part of the fuel consumed for generation of electricity, ceased in 1970. Some trends in the use of coal in Denmark are shown by the following statistics on annual deliveries to various consuming sectors, in thousand metric tons:

Consuming sector	1960	1965	1971
Electric powerplants	1,239	1,760	1,301
Domestic heating	973	673	449
Industry	602	558	155
Gasworks	618	461	150
Railroads	140	18	1
Total listed	3,572	3,470	2,056

Source: Statistical Office of the European Communities (Luxembourg). Energy Statistics. V. 5, 1972, pp. 21–22.

[18] As indicated by total area in square meters.

Stocks of solid fuels reported in Denmark on December 31, 1972 included 2,146,000 tons of coal, 8,300 tons of coke, and 6,500 tons of brown coal and lignite.

Petroleum.—Commercial production of crude oil was begun in July 1972 by Dansk Undergrunds Consortium (DUC) from the Dan Field, about 120 miles west of Esbjerg in the Danish sector of the North Sea. Production of oil by yearend was variously reported at 73,000 tons to 94,000 tons. Annual production from the field was expected to be about 500,000 tons, about 3% of Denmark's oil requirements. The oil, reported to be high-quality, low-sulfur crude, was produced by five wells from Upper Cretaceous chalk formations at a depth of approximately 2,000 meters below the seabed. The oil was loaded into tankers through a 1.5-kilometer submarine pipeline for shipment to refineries in Denmark. The first shipment of crude was delivered to Gulf Oil Refining A/S at Stigsnaes, but it was expected that approximately equal amounts of the oil would be refined at the Stigsnaes plant and the refinery of A/S Dansk Shell at Fredericia. The Gulf and Shell companies each have a 30% share of DUC.

DUC planned to drill another hole on the Dan Field structure in 1973, to further evaluate the production capability of the oil-bearing formation. Additional exploration wells and seismic surveys were also planned in both onshore and offshore areas.

The Greenland Geological Survey was exploring the seabed off the west coast of Greenland in 1972 to supplement information gained from oil and gas exploration work by private companies. All exploration permits granted to private companies reportedly expired by May 31, 1972, but negotiations were planned with interested companies to undertake more intensive prospecting work. No drilling oprations have been reported to date. Discussions between Denmark and Canada, on division of the Continental Shelf between Greenland and the arctic islands of Canada, were continued in 1972. A tentative agreement was reached, based on the median-line principle, and was submitted to the respective governments for consideration.

Imports of crude oil by Denmark in 1972 totaled 9.75 million tons, about 8% less than in 1971. Saudi Arabia supplied 29% of the total, with Oman, Kuwait, Iran, and Nigeria each supplying between 14% and 18%. Total throughput of crude oil in Denmark's three refineries was about 10.15 million tons in 1972, compared with 10.6 million tons in 1971. Total throughput capacity for crude oil at the end of 1971 was approximately 10.9 million tons, of which about 41% was installed at Stigsnaes, 32% at Kalundborg (Dansk Esso A/S), and 27% at Fredericia.

Imports of petroleum products in 1972 increased by more than 2 million tons compared with 1971, with imports of fuel oils up by 1.8 million tons. The United Kingdom remained the principal supplier, but its share of the market in 1972 was substantially reduced owing to increased receipts from Common Market countries. Danish exports of petroleum products increased about 12% from the 1971 level, owing mainly to an 18% rise in exports of fuel oils.

Inland consumption of petroleum products in 1971 and 1972 is shown by the accompanying tabulation, in thousand metric tons:

	1971	1972
Aviation fuels	634	712
Gasoline	1,594	1,640
Kerosine	205	198
Gas/diesel oil	6,078	6,398
Residual fuel oil	7,853	8,421
Other	754	705
Total	17,118	18,074

Source: Organization for Economic Cooperation and Development (OECD) (Paris). Provisional Oil Statistics, by Quarters. 4th Quarter, 1972, 1973, p. 22.

Of the total tonnage of petroleum products consumed in 1971, the domestic heating sector accounted for about 42%, industry 21%, electric powerplants and gasworks 20%, and transportation 17%.

ICELAND [19]

Iceland's production of mineral commodities rose strongly for the fourth consecutive year in 1972, contributing its share to the general economic boom enjoyed by the country. Higher output of aluminum and cement contributed the largest gains, but most recorded mineral products surpassed their 1971 levels. Further growth is anticipated in 1973 due to completion of the Icelandic Aluminium Co. Ltd. (ISAL) smelter expansion late in 1972.

Mining's contribution to the country's trade dropped considerably in 1971 as a result of oversupply in the world aluminum market and the necessity to stockpile more than half of the year's smelter output. Mineral imports continued to rise, on the other hand, under the impetus of the country's booming economy.

Further developments continued to center around industries that will make use of Iceland's inexpensive hydroelectric power. A ferroalloy plant was among the projects being considered. The proposed sea chemicals complex remained under study. Offshore geophysical studies and satellite photographic studies were conducted. These studies will add to knowledge of the island's geology and mineral resources.

Government Policies and Programs.—Policies of the Government elected in 1971 remained highly favorable to foreign investment in new industry because of the recognized need to diversify Iceland's economy away from its dependence on the fishing industry. In particular, the Government is interested in attracting electric-power-intensive industries that can take advantage of, and provide a market for, the very inexpensive power from proposed government hydroelectric projects.

An important factor in the investment climate will be the outcome of negotiations for a new trade agreement with the European Community (EC), which, if successful, will give Iceland's industries access to the Common Market countries under favorable trade terms. Settlement with Great Britain and West Germany of the hotly disputed question of Iceland's extension of its fishing limit to 50 miles is the only remaining barrier to conclusion of the trade agreement.[20]

Establishment of a law regulating offshore mineral exploration was under discussion in the Ministry of Industry. There is no such law at present, and passage of new legislation on the subject in the near future is considered likely.[21]

PRODUCTION

Increases in ouput of aluminum and cement paced the gain in mineral production in 1972. ISAL's smelter production rose 11% to 45,560 tons from 41,000 tons in 1971. A nationwide construction boom enabled cement production to post a 30% gain to 130,000 tons from the previous year's level of 100,000 tons. Output of sand and gravel, likewise showed a sharp increase. Other mineral industries recording higher production levels included diatomite and nitrogenous fertilizers.

Mineral production value rose an estimated 17% above the previous year's level, from $34.0 million in 1971 to $39.8 million in 1972. Both figures exclude production of clay products, for which value data are unavailable. Increased physical output accounted for 65% of the gain, the remainder resulted from inflation. Higher aluminum output was responsible for the majority of the increase, while cement and diatomite were next in size of gains. Recorded production values of all other mineral commodities except stone were up from those of the previous year.

Further growth in mineral output is likely in 1973 as ISAL's 120 new aluminium pots come onstream. Initial construction of the Sigalda hydroelectric project, if begun on schedule in mid-1973, may give a further boost to the production of building materials.

Statistics on Iceland's mineral production are included in table 1.

TRADE

Aluminum exports declined sharply in 1971 as a result of weakness in the world market, according to the latest available statistics. The majority of the smelter output, all of which is normally exported, had to be stockpiled. A correspondingly drastic reduction occurred in the country's total

[19] Prepared by David G. Willard.
[20] U.S. Embassy, Reykjavik, Iceland. State Department Airgram A-87, Oct. 24, 1972, p. 4.
[21] U.S. Embassy, Reykjavik, Iceland. State Department Telegram 779, July 1972, 1 p.

mineral commodity exports, the greatest part of which consists of aluminum shipments.

Exports of diatomite were up in value, but added less than $2 million to the country's trade balance. The only other mineral related products exported were scrap metals.

Full employment and a booming economy gave a sizable boost to mineral imports. Refined petroleum products constituted the largest category of imported minerals in value, followed by bauxite, crude metal shapes, and manufactured fertilizers.

Reduced aluminum exports and increased mineral imports resulted in a worsening of Iceland's balance of mineral trade. The country's need to import practically all mineral commodities consumed results in a normally deficit mineral trade balance. Increased aluminum exports had narrowed the gap in 1970, but the 1971 deficit was the largest in several years. Resumption of aluminum shipments should bring about considerable improvement in the mineral trade balance in 1972. Balances of total commodity trade and mineral trade in 1969 through 1971 were as follows in million dollars:

	1969	1970	1971
Total commodity trade:			
Exports	107.5	146.4	150.1
Imports	123.2	157.1	220.7
Balance	−15.7	−10.7	−70.6
Mineral commodity trade:			
Exports	6.7	r 21.4	12.1
Imports	27.7	31.3	39.6
Balance	−21.0	r −9.9	−27.5

r Revised.

Table 5.—Iceland: Mineral commodity trade

(Metric tons unless otherwise specified)

Commodity		1970	1971
EXPORTS			
METALS			
Aluminum metal, including alloys, unwrought		33,520	16,718
Iron and steel metal, scrap		4,821	NA
NONMETALS			
Diatomite		13,589	17,079
IMPORTS			
METALS			
Aluminum:			
Bauxite		58,693	93,185
Metal and alloys, unwrought and semimanufactures		608	998
Copper and alloys, unwrought and semimanufactures		135	193
Iron and steel, semimanufactures		15,362	29,180
Lead and alloys, unwrought and semimanufactures		226	224
Silver and platinum, all forms	value, thousands	$66	$94
NONMETALS			
Cement		--	3,012
Clay products:			
Refractory		1,022	1,808
Nonrefractory		887	1,039
Cryolite and chiolite		1,150	250
Fertilizers, manufactured		31,343	41,406
Gypsum and plaster		--	6,041
Lime		--	1,162
Pigments, titanium oxides		289	658
Salt		42,928	52,017
Other building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s		1,173	586
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		4,585	5,420
Coal, anthracite and bituminous		1,664	1,351
Petroleum refinery products:			
Gasoline, motor	thousand 42-gallon barrels	454	550
Kerosine and white spirit	do	490	387
Distillate fuel oil	do	2,349	2,239
Residual fuel oil	do	536	651
Lubricants	do	34	43
Other:			
Nonlubricating oils, n.e.s	do	6	7
Bituminous mixtures, n.e.s	do	6	5
Liquefied petroleum gas	do	7	6
Total	do	3,882	3,888

NA Not available.

COMMODITY REVIEW

Aluminium.—Expansion of the ISAL smelter at Straumsvik to a capacity of 77,000 tons per year was scheduled for completion in the fall of 1972. There were no plans for further expansion of the facility.[22] However, the Iceland Government is interested in the establishment of another aluminum smelter on the island.[23]

Nitrogenous Fertilizers.—Expansion of the State Fertilizer Plant at Reykjavik continued during the year with assistance of a loan from the United States Government.[24]

Perlite.—The Government would like to establish a perlite mine to exploit a government-owned deposit located on the east coast of the island. That deposit and another northwest of Reykjavik have been explored in the past, but only minor production has taken place. Feasibility studies were being conducted during 1972. Johns-Manville Corp. which operates the diatomite plant at Lake Myvatn, has offered technical assistance, but is not currently interested in equity participation in the project.[25]

Petroleum.—Plans for a petroleum refinery in Iceland, which had been given some consideration by the Government despite its doubtful economic feasibility, have been indefinitely shelved. The refinery would have eliminated about 45% of the country's mineral imports, which petroleum products now constitute, but the local market is too small to support such a facility.[26]

Sea Chemicals.—Results of the feasibility study on the proposed sea chemicals complex at Reykjanes were not published as expected in 1972, but the Government is known to be giving serious consideration to the project. Reportedly, the complex would produce sodium chloride, calcium chloride, potassium chloride and magnesium chloride, and possibly other chemicals as well.[27]

Other Minerals.—Discussions were held during the year between the Iceland Government and several companies concerning the establishment of mineral processing industries that would take advantage of the island's inexpensive hydroelectric power. At a potential cost of 20 cents to 30 cents per kilowatt hour, following completion of the Sigalda and one or two other hydroelectric projects, the country's power will rate among the world's cheapest. One, and possibly two, ferroalloy plants were under serious study, and consideration was being given to other similar projects.[28]

A geophysical study of the Denmark Strait and Reykjanes Basin, off the west and southwest coasts of Iceland, was conducted jointly by Icelandic, Danish, and U.S. scientists during 1972. Included were studies of sediment thickness and structure, morphological form, crustal configuration, magnetic stratigraphy, and studies of the structure and origin of rocks dredged from those parts of the Continental Shelf.[29]

Photography of Iceland taken from the first experimental Earth Resources Technology Satellite (ERTS–1), under the Earth Resources Observations Systems (EROS) program, were made available to Iceland by the U.S. Government. Regular satellite photography of this type will be useful in monitoring volcanic and glacial activity, snowcover, water supplies, and grassland conditions, and will provide other data valuable for mapping and resources management purposes.[30]

SWITZERLAND [31]

Because of its lack of significant indigenous resources and its landlocked location, the mineral industry of Switzerland in 1972 continued to be primarily represented by processing facilities that imported raw materials and exported finished mineral products. The modest domestic production of some nonmetallic commodities from indigenous resources continued during the year; cement and lime production rose 9% and 5%, respectively, while domestic salt production decreased 12%. Swiss production of refined aluminum, based entirely upon imported raw materials, decreased 11% during 1972, but continued to supply the country's needs and provided a small excess that was exported as aluminum ingot and semifabricated products. The petroleum refining and

[22] Mining Journal. V. 279, No. 7143, July 14, 1972, p. 25.
[23] Page 6 of work cited in footnote 20.
[24] U.S. Embassy, Reykjavik, Iceland. State Department Airgram A–7, Jan. 18, 1972, 1 p.
[25] Industrial Minerals. Perlite: New Sources to Meet Growing Demand but Consumption Undergoing Change. No. 57, June 1972, pp. 16, 25.
[26] Pages 6 and 7 of work cited in footnote 20.
[27] Pages 6 and 7 of work cited in footnote 20.
[28] Pages 6 and 7 of work cited in footnote 20.
[29] Department of State, Washington, D. C. Telegram No. 121707, July 1972, 3 pp.
[30] U.S. Department of the Interior. Iceland Helped by Space Imagery. Press Release, Apr. 10, 1973, 4 pp.
[31] Prepared by Richard F. Stevens, Jr.

steel industries, which were also based upon imported raw materials, met a major portion of the Swiss requirements for these processed mineral commodities. During 1972, production of ingot and rolled sheet steel increased 4% and 3%, respectively, while production of steel castings decreased 29%. The imported crude oil used as petroleum refinery feed stock decreased 5% while the major Swiss refinery output, distillate fuel oil, rose 6% during the year.

The estimated Swiss gross national product (GNP) rose to a new record high of 115.3 billion Swiss francs (SFr), about $35.7 billion, representing a growth rate of 14.4%.

The main constraint to expanded output in 1972 was the extreme labor shortage caused, in part, by the Federal Government's limitation on the number of foreign workers in Switzerland. Because of this restriction the total labor force grew by only 0.6% during the year and there was an average of 20 jobs available for every person looking for work. Labor productivity increased 4.2% and industrial production rose 2.1% in 1972. Since the overall expansion of domestic production and a 9.2% rise in imports failed to meet the high level of domestic demand, prices, as measured by the Consumer Price Index, increased 6.9% during the year.

Driven by a resurgence of domestic demand, the real Swiss GNP, measured in terms of 1972 prices, increased 4.7% from a revised real GNP of 3.9% in 1971.[32] Thus, inflation continued to grow and accounted for 9.7% of the total record growth during the year.

Faced with an accelerating inflationary spiral, the Swiss Federal Assembly took a series of progressively tougher anti-inflationary actions during 1972 and early in 1973. Fiscal and monetary reserves were tightened, foreigners were prohibited from purchasing Swiss securities and property (including real estate), Swiss nationals were required to obtain prior approval of the Swiss National Bank before borrowing abroad, and for about 2 weeks at midyear, the Swiss franc was allowed to float on the international monetary market.

Petroleum, the country's basic energy source, provided about 60% of the nation's total energy consumed during 1972. Consumption of petroleum products increased 4.6% and totaled 105.1 million barrels during the year. Preliminary data indicated that although imports of crude oil increased about 3.6% to 40.4 million barrels in 1972, Libya continued to be the major source and supplied about half of the total crude oil imports. The other significant sources of 1972 Swiss crude oil imports were Algeria and Nigeria. During the year, imports of refinery products increased 2.7% and totaled 63.8 million barrels, almost all of which was obtained from sources in the European Community (EC), mainly from West Germany, Italy, France, and the Netherlands.

Hydroelectric and nuclear power accounted for about 30% of the total 1972 Swiss energy; coal provided about 4%, fuel wood provided 2%; and imported natural gas supplied the remainder.

Since the country's economically exploitable water power resources have now been completely harnessed, Switzerland's only choice to meet its rapidly growing demand for electrical energy, at least 5% annually, is to build nuclear and thermal (fossil fuel) powerplants.[33] Two nuclear power stations are now in operation and supply about 20% of the current Swiss electrical energy requirements. In addition to a third nuclear plant that was nearing completion, several additional atomic powerplants are in an advanced stage of planning and are tentatively scheduled for completion by 1980. Two of these nuclears reactors will be built at Kaiseraugst (850 megawatts) and at Leibastadt (850 megawatts). The most likely sites for the other reactor plants are Gösgen (600 to 700 megawatts), Graben (2 at 880 megawatts), Rüthi (800 to 900 megawatts), and Verbois (800 megawatts). As a result of complaints filed by conservation groups who feel that the nuclear reactors would have an adverse effect on wildlife and the ecological balance, these reactor systems are not expected to be completed and become operational before 1984.

The country's landlocked location in Western Europe and its absence of substantial mineral resources caused the Swiss mineral economy to be highly dependent upon international trade to supply raw and semi-

[32] U.S. Embassy, Bern, Switzerland. Economic Trends Report—Switzerland. State Department Airgram A-181, Apr. 18, 1973, 9 pp.

[33] U.S. Embassy, Bern, Switzerland. Power Equipment and Electrical Equipment. State Department Airgram A-435, Oct. 20, 1972, pp. 16–18.

———. Nuclear Energy Plants—Latest Developments. State Department Airgram A-523, Dec. 21, 1972, 2 pp.

processed mineral materials. During 1972, the importation of raw materials increased 6.3%, imports of consumer goods rose 15.2%, imports of capital goods increased 10.9%, while energy and lubricant imports declined. The high domestic demand produced a 9.2% rise in the value of imports during 1972.

The relationship between Swiss mineral commodity trade and total commodity trade is indicated in the following tabulation, which also shows the disparity in the balance of trade:

	Value (million dollars)		Mineral share of commodities total trade (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1969	r 274	4,610	5.9
1970	r 275	5,120	5.4
1971	274	5,768	4.8
Imports:			
1969	r 993	5,266	18.9
1970	r 1,258	6,471	19.4
1971	1,267	7,154	17.7
Trade balance:			
1969	r −719	−656	XX
1970	r −983	−1,351	XX
1971	−993	−1,386	XX

r Revised. XX Not applicable.

During 1971, nonferrous metal exports (excluding ores, concentrate, and scrap), primarily wrought aluminum products, represented about 39% of the total Swiss mineral exports by value, or almost $107 million. Precious and semiprecious stones, including industrial diamond, accounted for 28%, or $76 million, of the total mineral exports. The Western European countries of the EC and the EFTA continued to be the major recipients of Swiss mineral exports during 1971.

The largest major group of mineral commodity imports in 1971, mineral fuels, primarily crude petroleum, contributed 34%, or $437 million, to total Swiss mineral imports. Imports of iron and steel, valued at about $381 million, contributed 30% and nonferrous imports valued at $207 million represented 16% of the total. Imports of gems and semiprecious stones were valued at $86 million in 1971, or almost 7% of the total reported mineral imports. EC countries continued to be the major sources of most of the 1971 Swiss mineral imports.

Preliminary data indicated that Switzerland imported about 78,500 tons of ferrous scrap in 1972 compared with 27,500 tons in 1971, while exporting about 92,500 tons compared with 31,000 tons exported in 1971.[34] It is estimated that the Swiss steel industry produces some 550,000 tons per year of raw steel and consumes about 400,000 tons per year of home-purchased scrap and over 100,000 tons per year of its own works' scrap. Although there is an embargo on scrap from Switzerland, export licenses are granted when material is not taken up by local consumers.

Data on petroleum and petroleum products were converted from metric tons to U.S. barrels of 42 gallons by using the conversion factors given in the report "International Petroleum Annual, 1971."[35] The apparent consumption of refined petroleum products in Switzerland, approximately 38.4% of which was domestically refined from imported crude oils and the remainder of which was imported as refined products, is indicated in the following tabulation, in millions of barrels:

Product	1971	1972 p	Percent change
Motor and aviation gasoline	20.1	22.8	+13.4
Kerosine and jet fuel	4.4	6.0	+36.4
Distillate fuel oil	51.3	51.7	+ .8
Residual fuel oil	15.8	16.4	+ 3.8
Lubricants (including greases)	.6	.6	--
Other refined products	5.4	4.0	−25.9
Refinery fuel and loss	2.8	3.0	+ 7.1
Total [1]	100.5	105.1	+ 4.6

p Preliminary.
[1] Data may not add to totals shown because of independent rounding.

Source: U.S. Bureau of Mines. International Petroleum Annual, 1971. March 1973, 32 pp.

The Swiss chemical industry continued to expand during 1972 and worldwide sales, including those of Swiss subsidiaries abroad, exceed $5 billion.[36] Exports of chemicals rose by over 16%, a rate which compared favorably with the 11% average growth rate reported for the entire industrial field. Highest sales increases were registered by organic chemicals, dyestuffs, pharmaceuticals, plastics, synthetic flavors, and inorganic chemicals, which were exported primarily to West Germany, France, the United Kingdom, Italy, the United States, and Japan. Chemi-

[34] Metal Bulletin (London). Switzerland. No. 5803, May 25, 1973, p. 32.
[35] U.S. Bureau of Mines. International Petroleum Annual, 1971. March 1973, 32 pp.
[36] U.S. Embassy, Bern, Switzerland. Industrial Outlook Report—Chemicals, 1972—Switzerland State Department Airgram A-338, Aug. 14, 1973, 13 pp.

cal imports increased 6% and came primarily from other European countries. During the year the Swiss chemical industry invested over $400 million in chemical research and development activities, and about $415 million in new plant and equipment. All of these investments were entirely self-financed.

The combined sales of Switzerland's three major chemical producers, Sandoz, Hoffman-LaRoche, and Ciba-Geigy expanded about 10% in 1972. The country's 420 chemical enterprises, which employed 67,000 people domestically, were operated at capacity throughout the year. The People's Republic of China reportedly entered into a contract with Ciba-Geigy for the supply of significant quantities of insecticides.

The absence of a significant domestic market and the lack of indigenous raw materials continued to render Swiss chemical producers highly dependent upon foreign trade. A wide variety of raw and semifinished chemicals are imported for use as the basic materials in chemical production operations.

Between 75% and 95% of the Swiss chemical production is customarily exported. During 1972, exports of Swiss chemicals rose by about 16%, compared with a 7% increase in 1971. Imports of chemical raw materials and semifinished products increased 6% in 1972 and were supplied principally by West Germany, France, the United Kingdom, the United States, Italy, and the Netherlands. Tables 6, 7, and 8 indicate the value of Swiss foreign trade in chemicals during 1972.

Table 6.—Major exports of Swiss chemicals—1972

(Million dollars)

Country	Organic chemicals	Paints, pigments, and dyestuffs	Pharmaceuticals	Plastics	Cosmetics and perfumes	Other chemicals	Total
EC:							
France	113.1	23.9	4.4	9.4	5.9	13.2	169.9
Germany, West	85.8	32.4	24.1	17.3	11.8	27.4	198.8
Italy	42.5	18.8	15.2	5.3	3.0	10.8	95.6
Other (Belgium-Luxembourg and Netherlands)	12.7	11.6	27.2	3.8	2.2	8.3	65.8
EFTA:							
United Kingdom	60.4	28.7	6.9	7.3	4.6	14.7	122.6
Other	21.1	27.9	58.4	21.2	12.7	22.4	163.7
Other:							
Japan	27.1	24.7	20.7	1.7	3.6	2.5	80.3
United States	33.1	28.5	.7	5.8	10.3	11.4	89.8
Other countries	173.6	156.0	122.0	19.5	17.0	107.4	595.5
Total	569.4	352.5	279.6	91.3	71.1	218.1	1,582.0

Source: U.S. Embassy, Bern, Switerland. Industrial Outlook Report—Chemicals, 1972—Switzerland. State Department Airgram A-338, Aug. 14, 1973, pp. 7, 13.

Table 7.—Major imports of Swiss chemicals

(Million dollars)

Country	Organic chemicals	Plastics	Inorganic chemicals	Pharmaceuticals	Total [1]
EC:					
Belgium-Luxembourg	9.0	7.9	1.9	5.5	47.1
France	41.4	18.5	11.5	7.3	132.8
Germany, West	97.7	78.4	25.1	26.0	337.2
Italy	30.9	14.1	2.8	1.9	53.4
Netherlands	18.2	16.2	2.8	3.3	61.2
EFTA:					
United Kingdom	28.0	15.6	6.9	7.2	90.9
Other	9.3	14.5	3.0	4.5	45.8
United States	34.5	14.3	3.2	5.5	77.4
Other countries	30.8	2.7	18.9	2.1	75.2
Total	299.8	182.2	76.1	63.3	921.0

[1] Data may not add to totals shown because of incomplete detailed information and possible duplication.

Source: U.S. Embassy, Bern, Switzerland. Industrial Outlook Report—Chemicals, 1972—Switzerland. State Department Airgram A-338, Aug. 14, 1973, pp. 7, 13.

Table 8.—Swiss exports and imports of chemicals by commodity group—1972

(Million dollars)

Commodity group	Swiss tariff chapter	Exports	Imports
Inorganic chemicals	28	26.8	76.1
Organic chemicals	29	569.4	299.8
Pharmaceuticals	30	279.6	63.3
Fertilizers	31	.5	20.1
Dyes and paints	32	352.5	89.1
Essential oils (cosmetics and perfumes)	33	71.1	36.3
Soaps	34	34.8	25.0
Albumicidal substances	35	3.9	9.3
Explosives	36	2.6	2.5
Photographic chemicals	37	.4	3.5
Miscellaneous chemicals	38	131.4	50.3
Plastics materials	39	91.3	182.2
Other chemicals not included in the above groups	--	17.7	63.5
Total	XX	1,582.0	921.0

XX Not applicable.

COMMODITY REVIEW

Metals.—*Aluminum.*[37]—As a result of the suspension of part of Alusuisse's electrolytic production operations at Chippis, total output of the Swiss aluminum smelters fell almost 12% in 1972. While there continued to be a surplus of aluminum ingot production, the semifabricating and foilworks industries operated at full capacity and were sold out for 2 to 3 months in advance.

Magnesium.[38]—The major Swiss magnesium processing companies, their locations, and their products are given in the following tabulation:

Company	Location	Products
SA Pour la Fabrication du Magnésium.	1920 Martigny	Magnesium powder and ingot.
Magnesium Druckguss Moessner	Alpnach/Kantton Oberwalden.	Magnesium castings.
George Fisher AG	8,200 Schaffhausen	Do.
Injecta AG	5723 Teufenthal	Do.
Wagner Maschinenund Werkzeugbau AG.	9104 Waldstatt	Do.

Nonmetals.—*Cement.*—Cementfabrik Holderbank planned to start construction of a new plant at Rekingen, Aargau, in 1973, with an annual capacity of 700,000 tons. Completion was scheduled for 1975. Société des Chaux et Ciments de la Suisse Romande planned installation of a third kiln at its Eclépens plant, with a daily capacity of 1,500 tons. The kiln will replace two smaller units when completed by mid-1974. Bundner Cementwerke AG was installing a new kiln at its Untervaz plant, which was expected to be in operation by early 1974.

Clays.—*Refractories.*—Although some indigenous clays were used for refractory materials, most of the required material was imported. Raw and calcined clays were received from France and West Germany. Dolomite and magnesite were imported, respectively, from Italy and Austria. About 40,000 tons of refractory materials was imported, mainly from West Germany (all types), Austria (basic), and Italy (special shapes). Exports of refractory goods were minimal. The principal Swiss refractory manufacturers were Tonwerk Lausen AG of Lausen, Kohler AG of Biel-Bienne, and Gunnar Romegialli AG of Winterthur.

Mineral Fuels.[39]—*Natural Gas.*—The country's largest (751,000 cubic meters) aboveground storage installation was put into operation at Mellingen in June. Investigations are being conducted to evaluate the possible development of underground storage sites for imported natural gas in connection with Switzerland's extensive stockpiling program.

In November, the Swiss Government

[37] Swiss Aluminum Ltd. (Alusuisse). 1972 Annual Report. Zurich, Switzerland, 43 pp.

Wohnlich, J. Switzerland. Aluminium (Düsseldorf, West Germany). V. 49, No. 1, January 1973, pp. 66–68.

[38] Metal Bulletin Monthly (London). Magnesium Directory. No. 23, November 1972, p. 9.

[39] Mona Palmer Publishing Company. Switzerland. Ch. in World Petroleum Report 1973. New York, 1973, p. 40.

granted permission to Gaznat SA to construct a spur from the natural gas pipeline to be built from the Netherlands to Italy. This spur will tap the pipeline in Valais Canton and transport gas down the Rhone River to Bex, near Lake Geneva (Lac Léman). Bex will be the terminal for future spurs to Geneva and other areas of western Switzerland.

Petroleum.—Late in the year Aquitaine Bern (SNPA) reported finding indications of crude oil at a depth of 4,000 meters in its Linden No. 1 well in Bern Canton. Raffinerie Rheinthal AG announced plans to construct a distillation column and storage facilities for about 600,000 tons (over 4 million barrels) of fuel oil at Senwald, near the Liechtenstein border and the eastern branch of the Central European Pipeline (CEL). The fuel oil will be pumped through the CEL from northern Italy and taken through a projected spur line for further processing at Sennwald to avoid pollution.

Table 9.—Switzerland: Exports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Oxide and hydroxide	141	142	United States 25; Italy 22; Japan 18; West Germany 18.
Metal, including alloys:			
Unwrought	14,442	16,975	West Germany 8,158; Italy 4,422; United Kingdom 1,586.
Semimanufactures	30,980	33,270	Denmark 3,596; Sweden 2,981; United Kingdom 2,868.
Antimony metal, including alloys, all forms	11	2	Mainly to Austria.
Arsenic trioxide, pentoxide and acids	3	(1)	NA.
Chromium, oxide and hydroxide	17	46	West Germany 45.
Columbium and tantalum metal, including alloys, all forms	2	2	Poland 1.
Copper:			
Matte	503	3	Netherlands 3.
Metal, including alloys:			
Scrap	12,911	8,029	West Germany 3,822; Italy 1,917; Austria 1,000.
Unwrought	r 3,483	2,958	Italy 1,480; West Germany 1,346.
Semimanufactures	8,314	7,570	United States 1,593; Israel 1,044; Italy 1,028; Austria 850.
Gold metal, unworked or partly worked thousand troy ounces	753	639	West Germany 430; Italy 53; Austria 50.
Iron and steel:			
Ore and concentrate	r 5,091	5,506	West Germany 5,497.
Metal:			
Scrap	26,695	30,016	Italy 17,748; West Germany 5,870; France 3,622.
Pig iron, ferroalloys and similar materials	12,317	6,771	West Germany 2,771; Italy 1,782; Austria 1,399.
Steel, primary forms	7,029	2,448	All to Italy.
Semimanufactures	95,951	104,281	West Germany 24,417; Austria 16,864; Italy 13,275; United States 8,763.
Lead:			
Oxides	1	(1)	NA.
Metal, including alloys, all forms:			
Scrap	7,165	6,089	Italy 5,877; West Germany 96.
Unwrought and semimanufactures	470	787	Italy 268; Austria 211; France 132.
Magnesium metal, including alloys, all forms	97	137	West Germany 89.
Mercury 76-pound flasks	87	87	France 58.
Nickel:			
Matte, speiss and similar materials	r 203	1	All to West Germany.
Metal, including alloys, unwrought and semimanufactures	r 2,059	1,486	West Germany 572; France 166; Italy 136.
Platinum-group metals and silver, including alloys:			
Platinum group thousand troy ounces	113	128	Italy 54; France 29.
Silver do	9,253	22,000	West Germany 13,881; Italy 1,894; France 1,217.

See footnotes at end of table.

Table 9.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Tantalum	2	2	Poland 1.
Tin metal, including alloys:			
Scrap ——long tons	106	144	West Germany 78; France 61.
Unwrought and semimanufactures ——do	r 244	124	Austria 32; West Germany 31; France 24.
Titanium oxides	29	27	West Germany 12; France 8; Netherlands 3.
Zinc metal, including alloys:			
Scrap	1,271	1,496	Italy 1,057; France 256; West Germany 100.
Unwrought and semimanufactures	176	196	Belgium-Luxembourg 118; Austria 31; France 27.
Other:			
Ore and concentrate of molybdenum, tantalum, vanadium, zirconium	101	808	Italy 556; West Germany 181; Yugoslavia 50.
Ash and residue containing nonferrous metals	19,801	20,665	West Germany 7,697; Italy 6,562; Belgium-Luxembourg 3,139.
Oxides, hydroxides and peroxides of metals, n.e.s	76	46	West Germany 11; New Zealand 9; Austria 6.
Metals, including alloys, all forms:			
Metalloids	r 6,914	4,532	West Germany 2,989; Spain 950; Poland 300.
Base metals, including alloys, all forms, n.e.s	r 47	44	West Germany 20; Belgium-Luxembourg 11.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	22	17	France 7; West Germany 7.
Dust and powder of precious and semiprecious stones	r 3,818	2,047	Thailand 997; West Germany 451; France 211.
Grinding and polishing wheels and stones	818	838	West Germany 240; United Kingdom 176; Algeria 57; France 57.
Asbestos	66	94	West Germany 36; United Kingdom 18; Austria 17.
Boron materials:			
Crude natural borates	19	--	
Oxide and acid	2	3	NA.
Cement	80,832	84,092	West Germany 67,984; France 14,516.
Chalk	r 52	101	West Germany 58; France 38.
Clays and clay products (including all refractory brick):			
Refractory (including nonclay bricks)	1,181	1,134	Austria 422.
Nonrefractory	56,154	56,296	West Germany 22,801; France 18,858; Austria 11,713.
Cryolite and chiolite	1	(1)	NA.
Diamond:			
Gem, not set or strung value, thousands	$20,451	$25,652	France $6,364; West Germany $6,158; Belgium-Luxembourg $3,971.
Industrial ——do	$2,076	$1,145	West Germany $282; United Kingdom $226; France $190.
Diatomite	130	125	Austria 77; Italy 37.
Feldspar and fluorspar	962	321	West Germany 200; Sweden 67; Peru 45.
Fertilizer materials, manufactured, nitrogenous	4	54	Angola 25; Belgium-Luxembourg 20.
Graphite, natural	28	4	Austria 1; West Germany 1.
Gypsum and plasters	2,370	4,059	Austria 3,884; France 106.
Lime	2,283	3,272	France 2,408; West Germany 846.
Magnesite	51	29	West Germany 21; France 4.
Mica:			
Crude, including splittings and waste	74	82	Ireland 24; West Germany 18; Peru 12.
Worked, including agglomerated splittings	258	322	Sweden 57; United Kingdom 55; Netherlands 25.
Pigments, mineral, including processed iron oxides	91	54	Peru 32; France 9.

See footnotes at end of table.

Table 9.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Precious and semiprecious stones, except diamond:			
Natural ---thousand carats--	29,545	23,380	Italy 5,620; West Germany 4,945; United Kingdom 2,610.
Manufactured ---do---	241,665	310,360	West Germany 94,610; France 48,495; Austria 34,090; Italy 28,975.
Salt and brine	1,456	7	West Germany 3.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	r 18,342	11,367	Austria 5,757; West Germany 2,107; Belgium-Luxembourg 1,255.
Caustic potash, sodic and potassic peroxides	r 4	2	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	42,093	39,529	West Germany 28,560; Italy 6,016; Austria 2,219.
Worked	9,171	10,360	West Germany 9,323; Austria 364.
Dolomite	59	51	West Germany 11; Austria 4.
Gravel and crushed rock	55,090	22,133	West Germany 15,291; France 3,309; Austria 2,205.
Limestone (except dimension)	2	17	West Germany 14; Italy 3.
Quartz and quartzite	31,517	29,529	Italy 22,574; West Germany 5,647.
Sand, excluding metal bearing	14,213	14,050	West Germany 6,041; France 5,702; Italy 1,798.
Sulfur:			
Elemental	129	235	West Germany 232.
Sulfur dioxide	369	129	Austria 129.
Sulfuric acid	13,645	15,035	West Germany 12,236; Italy 2,163; Austria 351.
Talc, steatite, soapstone, pyrophyllite	2,432	1,633	Italy 1,456; West Germany 144.
Other nonmetals, n.e.s.:			
Slag, dross and similar waste, not metal bearing	883	3,773	West Germany 3,203; France 317.
Bromine, iodine and fluorine	r 1	3	France 1; West Germany 1.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	3,216	919	West Germany 387; Austria 250.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	25	8	West Germany 1.
Carbon black	102	96	Arab Republic of Egypt 26; Italy 16; France 14.
Coal, all grades, including briquets	35,475	4,924	All to West Germany.
Coke and semicoke	28,805	13,055	Austria 7,579; Italy 4,335; West Germany 1,120.
Peat, including peat briquets and litter	261	273	Austria 184; West Germany 61.
Petroleum refinery products:			
Gasoline, motor thousand 42-gallon barrels--	132	97	Mainly to Austria.
Distillate fuel oil ---do---	154	30	Do.
Residual fuel oil ---do---	1,412	739	Do.
Lubricants ---do---	9	39	Italy 34.
Other:			
Petroleum coke ---do---	32	(1)	NA.
Bituminous mixtures, n.e.s. do---	2	1	NA.
Total ---do---	1,741	906	

r Revised. NA Not available.
1 Less than ½ unit.

Table 10.—Switzerland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	2,641	3,405	Italy 2,662; France 636; United Kingdom 80.
Oxide and hydroxide	176,185	181,148	France 89,642; Guinea 50,723; Surinam 38,323.
Metal, including alloys:			
Unwrought	22,119	6,181	Norway 1,986; Poland 1,723; France 715; Austria 476.
Semimanufactures	10,914	11,152	West Germany 3,696; Norway 1,692; Netherlands 1,104.
Antimony, including alloys, all forms	154	159	People's Republic of China 85; Japan 35; Belgium-Luxembourg 29.
Arsenic trioxide, pentoxide and acids	76	113	France 83; Hungary 30.
Beryllium, including alloys, all forms kilograms	r 47	138	West Germany 30.
Chromium:			
Chromite	3,019	5,016	Republic of South Africa 4,411.
Oxide and hydroxide	809	497	West Germany 330; Italy 95; United Kingdom 45.
Cobalt oxide and hydroxide	16	5	Belgium-Luxembourg 3.
Copper, including alloys:			
Scrap	397	432	Israel 240; United States 85; Austria 46.
Unwrought	r 51,930	42,575	Belgium-Luxembourg 11,256; West Germany 9,519; Zambia 7,990.
Semimanufactures	43,957	42,206	United Kingdom 18,693; West Germany 7,617.
Gold, unworked and partly worked thousand troy ounces	383	459	West Germany 407; United States 18.
Iron and steel:			
Ore and concentrate, including roasted pyrite	33,573	49,377	Mauritania 42,330; Italy 6,372; West Germany 602.
Scrap	51,166	27,490	West Germany 21,624; Austria 3,354.
Pig iron, including cast iron, sponge iron, spiegeleisen, powder and shot	91,341	69,589	West Germany 51,493; Canada 6,141; France 4,395.
Ferroalloys	18,472	17,106	Czechoslovakia 4,848; West Germany 3,619; Norway 2,333.
Steel, primary forms	307,075	227,789	West Germany 70,259; France 70,243; Belgium-Luxembourg 40,722.
Semimanufactures:			
Bars, rods, angles, shapes and sections:			
Wire rod thousand tons	89	91	France 33; West Germany 26; Austria 11.
Other bars and rods do	279	233	West Germany 77; Italy 60; France 40.
Angles, shapes and sections do	273	234	West Germany 81; Belgium-Luxembourg 66; France 65.
Universals, plates and sheets do	589	599	France 182; West Germany 174; Belgium-Luxembourg 65.
Hoop and strip do	208	185	Belgium-Luxembourg 51; West Germany 46; Austria 28.
Rails and accessories do	45	59	Austria 23; Belgium-Luxembourg 14; France 10.
Wire do	37	33	Austria 12; West Germany 10.
Tubes, pipes, and fittings do	180	158	West Germany 69; France 26; Austria 15; United Kingdom 13.
Castings and forgings, rough do	3	3	West Germany 1.
Total do	1,703	1,595	
Lead:			
Oxides	300	281	France 172.
Metal, including alloys:			
Scrap	11	10	West Germany 5; Belgium-Luxembourg 3.
Unwrought	26,028	22,794	United Kingdom 5,230; West Germany 3,878; France 2,890.
Semimanufactures	738	1,059	West Germany 964.
Magnesium, including alloys, all forms	1,504	1,005	Norway 574; United States 154; U.S.S.R. 147.
Manganese oxides	459	759	Japan 440.
Mercury 76-pound flasks	2,030	899	Spain 377; West Germany 203.
Molybdenum, including alloys, all forms	15	12	Austria 5.

See footnotes at end of table.

Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Nickel:			
Matte, speiss, and similar materials	2,213	1,795	Norway 494; United Kingdom 482; Canada 407; West Germany 189.
Metal, including alloys:			
Scrap	15	2	Mainly from United Kingdom.
Unwrought	2,010	1,649	Norway 494; United Kingdom 423; Canada 407.
Semimanufactures	1,835	2,067	United Kingdom 986; West Germany 628; France 188.
Platinum-group metals, including alloys, all forms ____thousand troy ounces__	r 129	125	West Germany 66; U.S.S.R. 25; United States 9.
Silicon, including alloys, all forms	476	262	Italy 250; Norway 10.
Silver, including alloys, all forms thousand troy ounces__	10,660	22,135	Belgium-Luxembourg 6,210; United Kingdom 4,926; United States 4,021.
Tantalum	5	4	West Germany 2; United States 1.
Tin:			
Oxides ____long tons__	43	22	United Kingdom 16.
Metal, including alloys, all forms:			
Scrap ____do____	r (1)	16	West Germany 8; Sweden 7.
Unwrought ____do____	930	947	Malaysia 497; Thailand 191; West Germany 45.
Semimanufactures ____do____	170	228	West Germany 111; Netherlands 73; United Kingdom 20.
Titanium oxides	8,732	9,660	West Germany 3,268; United Kingdom 2,432; France 1,802.
Tungsten:			
Ore and concentrate	30	40	Portugal 20; Thailand 20.
Metal, including alloys, all forms	99	108	West Germany 82; France 12.
Zinc:			
Oxide	1,692	2,094	West Germany 764; France 620; Netherlands 401.
Metal, including alloys:			
Scrap	21	7	Italy 7.
Blue powder	r 4,007	2,925	Belgium-Luxembourg 1,706; West Germany 702; United Kingdom 274.
Unwrought	27,367	25,864	West Germany 8,577; Belgium-Luxembourg 4,366; North Korea 2,880.
Semimanufactures	r 1,728	2,026	West Germany 914; Belgium-Luxembourg 829; Italy 88.
Other:			
Ore and concentrate of molybdenum, tantalum, vanadium, zirconium	3,034	2,242	Australia 1,831.
Ash and residue containing nonferrous metals	1,561	873	West Germany 477; France 149; Italy 123.
Oxides, hydroxides and peroxides of metals, n.e.s	1,157	1,494	West Germany 1,100; Hungary 192; United Kingdom 64.
Metals, including alloys, all forms:			
Metalloids	2,512	2,330	Netherlands 944; France 690; Italy 294.
Alkali, alkaline earths and rare-earth metals	396	447	West Germany 405; United States 40.
Pyrophoric alloys	13	13	West Germany 7.
Base metals, including alloys, all forms, n.e.s	r 716	623	Republic of South Africa 167; Japan 165; Belgium-Luxembourg 86.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	1,556	1,483	West Germany 669; Italy 460; Netherlands 133.
Grinding and polishing wheels and stones	1,701	1,624	West Germany 715; Austria 218; United Kingdom 213.
Asbestos	17,721	19,898	Canada 7,455; U.S.S.R. 5,353; Republic of South Africa 4,447.
Barite and witherite	2,606	2,403	West Germany 1,355; France 898; Italy 149.
Boron materials:			
Crude natural borates	1,343	3,012	United States 2,755; Netherlands 243.
Oxide and acid	468	1,171	U.S.S.R. 573; France 423.
Cement	49,972	120,931	Italy 43,963; West Germany 36,566; France 32,254.

See footnotes at end of table.

Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Chalk	18,013	17,652	France 15,172; West Germany 1,614; Italy 857.
Clays and products (including all refractory brick):			
Crude, n.e.s	206,211	183,079	West Germany 79,913; United Kingdom 49,814; France 33,376.
Cryolite and chiolite	745	981	Denmark 981.
Diamond:			
Gem, not set or strung value, thousands	$36,613	$37,989	Belgium-Luxembourg $12,327; France $5,204; United States $4,397.
Industrial ——do	$2,076	$1,960	Belgium-Luxembourg $673; West Germany $459; Netherlands $320.
Diatomite and other infusorial earth	r 2,034	2,778	United States 950; France 463; Hungary 411; Denmark 344.
Feldspar and fluorspar	15,719	13,731	France 5,225; West Germany 4,777; Italy 3,387.
Fertilizer materials:			
Crude:			
Nitrogenous	622	426	All from West Germany.
Phosphatic	11,191	17,055	Morocco 13,972; Belgium-Luxembourg 1,544; Tunisia 1,191.
Potassic	84,933	76,215	France 56,538; West Germany 11,263; East Germany 7,506.
Other	18,747	16,246	France 15,702.
Manufactured:			
Nitrogenous	7,806	20,394	Austria 7,937; West Germany 6,644; Italy 3,169.
Phosphatic:			
Thomas (basic) slag	184,833	181,406	France 118,095; Belgium-Luxembourg 62,683.
Other	18,168	16,767	France 5,911; Belgium-Luxembourg 4,467; Netherlands 1,664.
Potassic	23,038	21,000	West Germany 12,278; France 4,784; Israel 3,291.
Other, including mixed	54,544	66,625	West Germany 19,969; France 16,863; Belgium-Luxembourg 15,488.
Ammonia	10,579	10,383	Austria 10,034; West Germany 142; France 113.
Graphite, natural	399	377	West Germany 191; Austria 87; Italy 32; Norway 26.
Gypsum and plasters	79,148	111,043	West Germany 59,153; Austria 32,330; Italy 10,410.
Lime	26,671	26,823	Italy 14,512; West Germany 11,032; Austria 1,212.
Magnesite	4,012	4,498	Austria 4,341; France 57.
Mica:			
Crude, including splittings and waste	771	678	West Germany 320; United Kingdom 184; India 67.
Worked, including agglomerated splittings	258	327	France 255; Belgium-Luxembourg 62.
Pigments, mineral:			
Natural crude	422	367	West Germany 158; Austria 90; France 68.
Iron oxides, processed	2,807	2,770	West Germany 2,693.
Precious and semiprecious stones, except diamond:			
Natural ——thousand carats	373,615	294,575	Brazil 91,255; United States 76,175; West Germany 45,720.
Manufactured	131,510	139,820	France 131,055; West Germany 6,125.
Pyrite (gross weight)	17,520	52,342	Italy 25,341.
Salt and brine	3,034	1,898	France 1,245; Netherlands 392; Belgium-Luxembourg 125.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	11,133	8,683	France 3,345; West Germany 1,991; Italy 1,950.
Caustic potash, sodic and potassic peroxides	3,583	3,739	Italy 1,127; West Germany 983; France 856.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	49,579	41,807	Italy 20,252; Austria 14,122; France 5,850.
Other	51,555	91,123	West Germany 59,237; France 16,369; Italy 14,397.

See footnotes at end of table.

Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Dimension stone—Continued			
Worked:			
Slate	1,373	1,287	Italy 1,045.
Paving and flagstone	39,574	49,517	Italy 34,799; Austria 12,304.
Other	9,969	11,334	Italy 8,089; West Germany 1,224; France 996.
Dolomite	13,574	13,856	Italy 7,990; France 4,342; West Germany 705.
Gravel and crushed rock thousand tons	4,447	4,991	France 2,803; West Germany 1,288; Italy 556.
Limestone (except dimension)	44,284	53,649	France 50,636; Italy 2,004; West Germany 646.
Quartz and quartzite	24,417	10,010	Belgium-Luxembourg 3,214; West Germany 3,037; Italy 2,588.
Sand, excluding metal bearing	949,635	1,217,262	Italy 582,801; France 310,306; West Germany 158,400.
Sulfur:			
Elemental:			
Other than colloidal	64,739	50,895	United States 18,890; France 16,249; West Germany 11,983.
Colloidal	288	287	West Germany 247; France 40.
Sulfur dioxide	22	28	Italy 21.
Sulfuric acid	1,051	1,555	West Germany 768; France 476; East Germany 305.
Talc, steatite, soapstone, pyrophyllite	13,935	12,893	Austria 7,581; France 2,926; Italy 1,170; Norway 617.
Other nonmetals, n.e.s.:			
Crude	27,261	31,211	West Germany 18,585; France 8,188; Netherlands 1,522.
Slag, dross and similar waste, not metal bearing	30,971	72,043	Belgium-Luxembourg 30,711; France 22,713; West Germany 15,357.
Oxides and hydroxides of magnesium, strontium, barium	490	340	United States 100; West Germany 92; United Kingdom 54.
Bromine, iodine, fluorine	1,904	1,913	France 829; United Kingdom 495; Japan 244.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,199	3,226	Trinidad and Tobago 2,913; United States 222.
Carbon black	9,595	9,184	France 3,242; Netherlands 2,152; West Germany 1,594.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	398	277	Czechoslovakia 90; West Germany 87; France 44.
Briquets of anthracite and bituminous coal do	38	23	West Germany 14; France 5; Netherlands 4.
Lignite and lignite briquets do	103	76	West Germany 73; East Germany 2.
Coke and semicoke	289	190	West Germany 141; France 25; Italy 10.
Hydrogen, helium and rare gases	r 489	271	Italy 250; Norway 10.
Peat and peat briquets and litter	46,047	47,507	West Germany 41,676; Poland 4,127.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	40,653	39,045	Libya 19,081; Bahrain 5,747; Algeria 5,579; Kuwait 5,388.
Refinery products:			
Gasoline, motor do	11,662	14,200	Italy 5,169; France 3,620; West Germany 3,416.
Kerosine and white spirit do	722	684	Italy 278; France 194; West Germany 83.
Distillate fuel oil do	34,271	37,203	West Germany 9,773; France 9,646; West Germany 8,378.
Residual fuel oil do	5,805	5,429	France 2,374; West Germany 2,139.
Lubricants do	643	707	Italy 228; Netherlands 104; West Germany 101.
Mineral jelly and wax do	89	79	West Germany 49; France 7; East Germany 6.
Other:			
Petroleum coke do	273	258	United States 166; West Germany 87.
Bitumen and other residues do	1,531	1,716	France 691; West Germany 598; Italy 181.
Bituminous mixtures, n.e.s. do	35	35	West Germany 14; Italy 4; France 3.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	22,330	18,637	France 12,304; East Germany 4,513; West Germany 1,820.

r Revised.
1 Less than ½ unit.

The Mineral Industry of Other African Areas

By Staff, Bureau of Mines

CONTENTS

BOTSWANA [1]

The mineral industry of Botswana began to show some of its future potential with sharp increases in the value of 1972 production and trade in mineral commodities. This was attributed mainly to the diamond mine at Orapa, which reached a high level of output following startup operations in June 1971.

Progress in developing the copper-nickel deposit at Pikwe was reported with production scheduled to begin in late 1974. Development work also was in progress on a $4.3 million [2] colliery at Morupule 7.5 miles west of Palapye. Production of coal for the 60,000-kilowatt thermal power station, which was being constructed at Selebi-Pikwe, was expected to start in August 1973.

The Government of Botswana has provided an excellent climate for foreign private investment. Attractive investment incentives have been provided including generous allowances on capital investment. A tax allowance of 125% of approved training costs has been provided and further tax allowances in specific cases may be granted.

The Botswana Constitution prohibits nationalization except by the express provision of legislation, approved by the National Assembly. The constitution guarantees prompt payment of adequate compensation, and provides for appeal to the High Court in case of a dispute. Botswana has signed the International Convention on the Settlement of Disputes and also has signed an Investment Guarantee Agreement with the United States.

The only restriction on private foreign investment is that it must be approved by the Botswana Government. There are no limitations on repatriation of profits.

[1] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[2] Where necessary, values have been converted from South African Rand (R) to U.S. dollars at the rate of R1=US$1.42.

Botswana is a member of the Southern African Customs Union, which provides for protection of infant industry and for common external tariffs to protect significant industries in member states.[3]

Production of mineral commodities in 1972 was valued at $27.7 million compared with $7.7 million in 1971. The sharp increase was due to expanded output of diamond, which was valued at $27.6 million in 1972 compared with about $7.1 million in 1971. Manganese production, however, decreased drastically, owing mainly to the shutdown of the Anglo American Corp. mine at Kanye. Statistics on production are shown in table 1.

Development of the copper-nickel deposits at Selebi-Pikwe was continuing on schedule with two circular shafts sunk to a depth of 1,312 feet at midyear.[4] The shafts were being equipped in the footwall below the ore body. Ore will be hoisted in one shaft from a loading station at the bottom in 10-ton skips. The second shaft will be used for transporting men and materials. The shafts and headframes were expected to be equipped and all the main development of ore passes, pump stations and sumps, waste passes and main levels adjacent to the shafts completed by November 1972. A study was being conducted to establish the feasibility of open pit mining in a small part of the center of the ore body to provide a reliable supply of ore for the concentrator. The concentrator will process 5,500 tons per day, 7 days per week, to yield 545,000 tons of bulk concentrate per year, containing 3.3% nickel and 3.0% copper. Flash smelting and sulfur reduction processes used in the smelting plant were licensed by Outokumpu Oy of Finland. The Finnish company will provide technical assistance for plant construction and operation. Mine tailings and slag dumps have been virtually eliminated since much of the waste material produced will be used to fill voids caused by stoping.

The Anglo American Corp. Botswana began development work on a colliery that was expected to begin producing at a rate of 78,000 tons per year in August 1973.[5] Coal will be shipped by railway about 70 miles to the thermal powerplant and mine at Selebi-Pikwe. An underground mechanized mine was being developed in a 28-foot coal seam (No. 1) of the Karroo system. A mining area 9,843 feet along the strike of the seam and 2,297 feet along the dip of the coal has been blocked out. Room-and-pillar mining method will be employed with 129-square foot pillars left between 20-foot-wide headings 15 feet high. The mechanized mining section will consist of a coal cutter, drilling and blasting equipment, and a coal loader. Coal will be conveyed to a surface plant, where it will be crushed, screened and hand picked. Large lumps will be screened out, broken in a roll-crusher and stored for loading into railway cars. About 50 laborers will be employed initially. Production is scheduled to reach 210,000 tons of coal per year by 1977, to supply the Selebi-Pikwe powerplant, and eventually reach 1 million tons per year if other markets develop.

Botswana's only two manganese mines shutdown in 1972; however, one reopened and was producing on a small scale at year-end.[6] One mine, owned by Anglo American Corp. was located at Kanye and the Lobatse South mine, owned by Marble Mine Associate Industries of South Africa, was located on the border, near Zeerust, Republic of South Africa. Production from the two mines was small, consisting of 35,603 tons from the Kanye mine and 12,000 tons from the Lobatse South mine in 1971. Manganese producing areas in Botswana are highly faulted and the grade of manganese varies greatly. The high cost of transport from the Kanye mine to the rail head at Lobatse was a factor in closing down the marginal Kanye operation. Reportedly the manganese dioxide (MnO_2) content of ore produced at Kanye ranged from 45% to 68%, while that from the Lobatse South mine averaged around 46% MnO_2.

[3] U.S. Embassy, Gaborones, Botswana. State Department Airgram A-44, Apr. 4, 1973, 2 pp.
[4] Mining Magazine. Progress at Botswana's Pikwe-Selebi Project. V. 127, No. 3, September 1972, pp. 237-239.
[5] Mining Magazine. Morupule Colliery and Pikwe-Selebi Development. V. 127, No. 6, December 1972, pp. 521-523.
[6] U.S. Embassy, Gaborones, Botswana. State Department Airgram A-34, March 15, 1973. 3 pp.

Table 1.—Other African Areas: Production of mineral commodities

Country, commodity, and unit of measure [1]	1970	1971	1972 p
BOTSWANA [2]			
Diamond:			
Gem ——carats	r 46,359	82,191	360,440
Industrial ——do	r 417,236	739,723	2,042,496
Total ——do	r 463,595	821,914	2,402,936
Gem stones, semiprecious, rough, not further described——kilograms	12,584	104,642	100,289
Manganese ore and concentrate, gross weight ——metric tons	r 48,325	47,603	687
Talc ——do	36	130	--
BURUNDI [2 3]			
Lime ——do	120	e 140	150
Rare-earth metals, bastnaesite concentrate, gross weight ——do	300	e 275	250
Tin ore and concentrate:			
Gross weight ——long tons	62	e 65	154
Tin content ——do	48	e 50	111
CAMEROON [2]			
Aluminum metal, primary ——metric tons	52,372	50,693	46,200
Cement, hydraulic ——do	30,000	141,000	170,000
Gold, mine output, metal content ——troy ounces	235	96	e 80
Stone:			
Limestone ——metric tons	NA	NA	140,000
Marble ——do	NA	NA	140
Tin ore and concentrate:			
Gross weight ——long tons	59	30	--
Tin content ——do	35	22	--
CENTRAL AFRICAN REPUBLIC [2]			
Diamond:			
Gem e ——carats	313,591	284,342	345,907
Industrial e ——do	168,856	153,107	178,195
Total ——do	482,447	437,449	524,102
CHAD [2]			
Natron:			
Slabs e ——metric tons	3,200	3,500	NA
Broken e ——do	3,500	3,500	NA
CONGO (BRAZZAVILLE) [3]			
Copper, mine output, metal content ——do	129	1,647	1,371
Fertilizer materials, potash, crude, K_2O equivalent ——do	125,087	260,854	287,306
Gas, natural:			
Gross production e ——million cubic feet	r 353	r 530	3,000
Marketed production ——do	353	530	551
Gold, mine output, metal content ——troy ounces	2,669	2,974	2,082
Lead, mine output, metal content ——metric tons	53	29	473
Petroleum, crude ——thousand 42-gallon barrels	137	130	2,522
Tin, mine output, metal content ——long tons	r 47	47	47
Zinc, mine output, metal content ——metric tons	107	633	2,153
ETHIOPIA [2 4]			
Cement, hydraulic ——thousand metric tons	181	211	188
Clays, kaolin ——metric tons	10,453	10,285	26,584
Gold, mine output, metal content ——troy ounces	27,282	21,226	20,784
Gypsum and anhydrite, crude ——metric tons	4,650	3,582	4,650
Lime ——do	17,590	14,380	47,142
Limestone ——do	152,960	148,720	167,786
Petroleum refinery products:			
Gasoline ——thousand 42-gallon barrels	583	659	627
Jet fuel ——do	239	300	200
Kerosine ——do	--	4	--
Distillate fuel oil ——do	1,191	1,405	1,331
Residual fuel oil ——do	1,550	1,815	1,558
Liquefied petroleum gas ——do	27	39	37
Asphalt ——do	98	126	148
Other ——do	--	--	38
Refinery fuel and losses ——do	509	647	561
Total ——do	4,197	4,995	4,500
Platinum, mine output, metal content ——troy ounces	273	217	248
Pumice ——metric tons	8	--	8
Salt:			
Rock ——thousand metric tons	10	10	10
Marine ——do	260	290	291
Total ——do	250	280	281
GUINEA [2]			
Aluminum:			
Bauxite, gross weight ——do	2,490	2,630	e 2,600
Alumina ——metric tons	610,070	665,000	663,270

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country, commodity, and unit of measure [1]	1970	1971	1972 [p]
GUINEA [2]—Continued			
Diamond:			
Gem [e] ——thousand carats	22	22	25
Industrial [e] ——do	52	52	55
Total ——do	74	74	80
Gold, mine output, metal content [e] ——troy ounces	4,000	4,000	4,000
IVORY COAST [2]			
Cement, hydraulic ——thousand metric tons	400	500	583
Diamond:			
Gem [e] ——thousand carats	85,123	130,548	134,000
Industrial [e] ——do	127,685	195,822	200,000
Total ——do	212,808	326,370	334,000
Manganese ore and concentrate, gross weight ——metric tons	23,060	--	--
Petroleum refinery products:			
Gasoline ——thousand 42-gallon barrels	1,435	1,292	1,505
Jet fuel ——do	317	320	342
Kerosine ——do	375	388	310
Distillate fuel oil ——do	1,469	1,790	2,206
Residual fuel oil ——do	1,474	1,898	2,121
Other ——do	116	70	446
Refinery fuel and losses ——do	224	248	621
Total ——do	5,410	6,006	7,551
LESOTHO [2]			
Diamond:			
Gem ——carats	3,502	1,010	833
Industrial ——do	13,037	5,805	8,186
Total ——do	16,539	6,815	9,019
MALAGASY REPUBLIC [2]			
Abrasives, natural:			
Corundum ——kilograms	1,900	1,465	3,000
Garnet (industrial only) ——do	40,100	40,500	10,700
Beryllium, beryl concentrate, industrial grade, gross weight ——metric tons	52	60	9
Cement, hydraulic ——thousand metric tons	[r] 76	77	64
Chromium, chromite concentrate, gross weight ——metric tons	[r] 104,684	150,000	111,770
Clays, kaolin ——do	989	1,969	1,938
Feldspar ——do	1	1	2
Gem and ornamental stones:			
Agate ——kilograms	2,700	25,194	--
Amazonite ——do	10,500	7,208	1,200
Amethyst:			
Gem ——do	13	11	2
Geodes ——do	6,900	9,100	9,900
Apatite (ornamental only) ——do	1,500	--	--
Aragonite ——metric tons	829	867	1,268
Beryl:			
Gem ——kilograms	1	36	2
In quartz ——do	453	150	NA
Calcite (ornamental only) ——do	19,600	1,600	NA
Celestine ——do	7,700	12,800	37,100
Cipoline marble ——metric tons	1,429	1,122	521
Citrine, gem ——kilograms	19	13	10
Cordierite, gem ——do	100	--	--
Diopside, gem ——do	750	850	--
Garnet:			
Gem ——do	33	40	24
Other ornamental ——do	3,600	3,300	3,700
Jasper ——do	38,900	320	270
Labradorite ——do	45,100	7,900	12,500
Quartz:			
Rose quartz ——do	19,800	69,600	158,900
Geodes ——do	8,900	1,200	NA
Other ornamental ——do	15,100	45,100	18,600
Rhodonite ——do	33,200	56,000	31,100
Tourmaline:			
Black ——do	1,800	1,100	4,700
In quartz ——do	700	2,300	
Gold, mine output, metal content ——troy ounces	514	412	190
Graphite, all grades ——metric tons	19,870	20,025	18,155
Mica, phlogopite:			
Block ——do	39	34	58
Splittings ——do	878	443	341
Scrap ——do	19	111	187
Total ——do	936	588	586

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country, commodity, and unit of measure [1]	1970	1971	1972 [p]
MALAGASY REPUBLIC [2]—Continued			
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels--	859	967	1,062
Jet fuel ---do----	478	443	490
Distillate fuel oil ---do----	1,136	1,078	1,195
Residual fuel oil ---do----	1,393	1,337	1,269
Other ---do----	98	96	92
Refinery fuel and losses ---do----	345	330	368
Total ---do----	4,309	4,251	4,476
Quartz, piezoelectric ---kilograms--	2,900	600	2,100
Rare-earth metals:			
Bastnaesite concentrate, gross weight ---metric tons--	97	61	42
Betafite ore, gross weight ---kilograms--	100	--	--
Euxenite ore, gross weight ---do----	6	400	--
Salt, marine ---metric tons--	21,700	27,900	21,000
Stone:			
Calcite (industrial) ---do----	655	1,321	152
Quartz (metallurgical) ---do----	75	92	153
Zirconium concentrate, gross weight ---kilograms--	2,500	2,700	14,000
Other, mineralogical samples, not further described --metric tons--	--	22	700
MALAWI [2]			
Abrasives, natural, corundum ---metric tons--	11	NA	NA
Cement, hydraulic ---thousand metric tons--	70	63	73
Kyanite ---metric tons--	1,371	NA	NA
Lime ---do----	249	e 250	e 250
Sodalite ---do----	2,386	e 2,400	e 2,400
Stone, sand and gravel:			
Limestone ---do----	92,000	e 100,000	114,000
Shale ---do----	90,000	e 100,000	e 100,000
Other stone ---thousand cubic meters--	270	NA	NA
Sand ---do----	170	NA	NA
MALI [2]			
Gold, mine output, metal content [e] ---troy ounces--	30	30	30
Salt [e] ---metric tons--	3,000	3,000	3,000
Stone:			
Limestone ---do----	[5] 2,500	NA	NA
Marble ---do----	[5] 2,500	NA	NA
MAURITANIA [2]			
Copper, mine output, metal content ---do----	r1,950	4,740	15,051
Iron ore and concentrate, gross weight ---thousand metric tons--	9,103	8,457	9,298
Rare-earth metals, monazite concentrate, gross weight ---metric tons--	e 100	e 100	NA
Salt, marine [e] ---do----	1,000	1,000	1,000
MAURITIUS [2]			
Salt, marine ---do----	4,000	5,000	e 5,000
NIGER [2]			
Cement, hydraulic ---thousand metric tons--	r 30	30	35
Gold, mine output, metal content ---troy ounces--	235	119	--
Gypsum [e] ---metric tons--	1,500	r 400	1,500
Salt [e] ---do----	4,000	4,000	4,000
Stone, limestone, not further described [e] ---do----	30,000	30,000	33,000
Tin, mine output, metal content ---long tons--	66	67	73
Tungsten, mine output, metal content ---metric tons--	1	--	--
Uranium concentrate, gross weight ---do----	54	429	867
RWANDA [2]			
Beryllium, beryl concentrate, gross weight ---do----	286	194	e 120
Columbium and tantalum, ore and concentrate, gross weight --do----	30	473	e 500
Tin, mine output, metal content ---long tons--	1,320	1,300	1,300
Tungsten, mine output, metal content ---metric tons--	181	200	260
SENEGAL [2]			
Cement, hydraulic ---thousand metric tons--	241	241	336
Clays, fuller's earth (attapulgite) ---metric tons--	3,050	2,810	3,089
Fertilizer materials, phosphatic:			
Crude:			
Aluminum phosphate ---thousand metric tons--	130	147	166
Calcium phosphate ---do----	998	1,398	1,250
Manufactured:			
Aluminum phosphate, dehydrated ---do----	36	46	52
Other [6] ---do----	7	2	6
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels--	634	669	988
Jet fuel and kerosine ---do----	577	587	776
Distillate fuel oil ---do----	906	834	1,183
Residual fuel oil ---do----	1,478	1,522	1,606

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country, commodity, and unit of measure [1]	1970	1971	1972 [p]
SENEGAL [2]—Continued			
Petroleum refinery products—Continued			
Other ——thousand 42-gallon barrels	106	66	54
Refinery fuel and losses ——do	542	242	247
Total ——do	4,243	3,920	4,854
Salt [e] ——metric tons	117,749	116,000	125,000
Stone:			
Basalt ——cubic meters	15,635	25,100	55,738
Marble (cipoline) ——do	212	350	375
SEYCHELLES ISLANDS [2]			
Phosphate rock, including coral rock phosphate ——metric tons	[r] 6,534	[e] 7,000	[r] 9,217
SOMALI REPUBLIC [2]			
Salt, marine [e] ——do	2,000	2,000	2,000
SOUTHERN RHODESIA [3]			
Abrasives, natural, corundum [e] ——do	1,800	1,800	1,800
Asbestos [e] ——do	80,000	80,000	80,000
Beryllium, beryl concentrate, gross weight [e] ——do	90	90	60
Cement, hydraulic ——thousand metric tons	[r] 475	559	[e] 600
Chromium, chromite, gross weight [e] ——metric tons	360,000	360,000	360,000
Coal, bituminous ——thousand metric tons	3,171	3,093	2,762
Coke, metallurgical [e] ——do	245	245	245
Columbium-tantalum minerals, tantalite, gross weight [e] metric tons	45	40	40
Copper:			
Mine output, metal content [9] ——do	26,527	29,337	38,300
Smelter ——do	[r] 24,399	27,909	41,075
Fertilizer materials, crude, phosphate rock ——do	85,000	105,000	[e] 110,000
Fluorspar [e] ——do	150	150	150
Gold, mine output, metal content ——troy ounces	[e] 500,000	501,551	[e] 502,000
Iron and steel:			
Iron ore [e] ——thousand metric tons	500	500	500
Pig iron and ferroalloys [e] ——do	[r] 250	[r] 250	250
Crude steel [e] ——do	150	[r] 160	160
Lithium minerals, gross weight [e 10] ——metric tons	61,000	61,000	61,000
Magnesite [e] ——do	18,000	20,000	20,000
Nickel:			
Mine output, metal content [e] ——do	11,000	11,600	12,000
Smelter production [e 11] ——do	5,000	7,000	8,000
Pyrite:			
Gross weight [e] ——thousand metric tons	73	73	73
Sulfur content [e] ——do	30	30	30
Silver, mine output, metal content [12] ——thousand troy ounces	71	91	126
Stone, industrial limestone [e] ——thousand metric tons	640	650	700
Tin:			
Mine output, metal content [e] ——long tons	600	600	600
Smelter [e] ——do	600	600	600
Tungsten, mine output, metal content [13] ——metric tons	81	186	151
SPANISH SAHARA [2]			
Fertilizer materials, crude, phosphate rock ——do	--	33,000	150,000
SUDAN [2]			
Cement, hydraulic ——do	156,000	169,000	159,000
Chromium, chromite concentrate, gross weight ——do	47,060	21,100	23,083
Gypsum and anhydrite, crude ——do	1,637	[e] 2,000	[e] 2,000
Iron ore, gross weight (exports) ——do	31,110	4,100	--
Magnesite, crude ——do	100	[e] 100	[e] 100
Manganese ore and concentrate, gross weight ——do	1,160	[e] 1,200	[e] 1,200
Mica, all grades ——do	--	97	NA
Petroleum refinery products:			
Gasoline ——thousand 42-gallon barrels	767	810	863
Jet fuel ——do	491	667	642
Kerosine ——do	158	133	132
Distillate fuel oil ——do	1,746	2,036	2,431
Residual fuel oil ——do	1,593	1,268	1,650
Other ——do	1,178	1,822	2,042
Refinery fuel and losses ——do	281	331	383
Total ——do	6,214	7,067	8,143
Salt ——metric tons	52,366	57,663	60,000
SWAZILAND [2]			
Asbestos, chrysotile ——do	33,057	35,484	28,683
Barite ——do	338	7,525	150
Clays, kaolin ——do	1,620	2,049	2,177
Coal, bituminous ——do	122,946	148,347	126,035
Iron ore, direct shipping, gross weight ——thousand metric tons	[r] 2,552	2,886	2,566
Stone, quarry product ——thousand cubic meters	[14] 33	[14] 25	45
Talc (pyrophyllite) ——metric tons	254	204	108
Tin, mine output, metal content [e] ——long tons	12	12	12

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country, commodity, and unit of measure [1]	1970	1971	1972 [p]
TOGO [2]			
Cement, hydraulic (ground from imported clinker) --metric tons--	--	49,123	116,800
Clay for brick production ----------do----	NA	[e] 3,000	NA
Fertilizer materials, phosphate rock:			
Run-of-mine ----------thousand metric tons--	[e] 3,040	[e] 3,430	NA
Beneficiated product ----------do----	1,508	1,715	1,928
Stone, marble ----------metric tons--	3,801	[e] 3,000	NA

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

[1] In addition to the countries listed individually in this table, Dahomey, Equatorial Guinea, the French Territory of the Afars and Issas, Gambia, and Upper Volta, all covered textually in this chapter, presumably produce modest quantities of crude construction materials such as clays, stone, sand and gravel, and may produce minor amounts of other mineral commodities (most notably gypsum, lime and salt), but no production data are reported, and available information is inadequate to make reliable estimates of output levels.

[2] In addition to the commodities listed, modest quantities of a variety of crude construction materials presumably were produced, but no production data are reported and available information is inadequate to make reliable estimates of output levels.

[3] Limited quantities of tungsten minerals and columbite-tantalite concentrates may also be produced, but no production data are reported and available information is inadequate to make reliable estimates of output levels.

[4] Includes output of the Province of Eritrea.

[5] Data are 1969 output levels; production presumably has continued but is unreported and no reliable basis for estimation exists.

[6] Products marketed under the trade names "baylifos" and "phosphal."

[7] Exports.

[8] In addition to the commodities listed, graphite and mica have been produced in the past and output presumably has continued, but no basis for estimation of output is available; similarly, a variety of crude construction materials presumably continued to be produced, but no basis for estimation of output is available.

[9] Output of Umkondo, Alaska, Lomagundi, Mangula, Gwai River, Inyati and Muriel mines; data are for years ended September 30 of that stated.

[10] Figures presented are 1964 total recorded production rounded; eycryptite, lepidolite, petalite and spodumene were all produced in 1964. No reliable basis exists for estimating either individual output levels for these minerals or total output on a year-to-year basis for 1965-72.

[11] Includes nickel content of nickel oxide and nickel fonte.

[12] Output of Inyati mine only for years ended September 30 of that stated.

[13] Data are for Beardmore mine only for years ended September 30 of that stated.

[14] Figures published in previous edition were in cubic meters, not in thousand cubic meters as erroneously indicated therein.

BURUNDI [7]

The mineral industry of Burundi, which continued to be of minor significance to the national economy, was highlighted in 1972 by the discovery of a large, potentially economic, nickel-copper deposit in the southern part of the country. A 20-kilometer zone of significant nickel-copper mineralization between the towns of Bukirasizi and Rutana was found late in the year by a United Nations Development Programme (UNDP) mineral survey team. Specific information about the deposit is lacking, but several American and European mining companies were reportedly interested in the deposit.

Burundi experienced widespread tribal conflict beginning April 29, 1972, and continuing sporadically throughout the rest of the year. Despite disruptions and chaotic conditions caused by the civil strife, the economy was not severely impaired in 1972. The balance of payments improved and export earning rose $3.4 million to $24.8 million.[8] The value of mineral exports was $277,000, an increase over the 2 previous years but less than the $329,000 in 1969. Mineral exports, mostly tin and rare-earth concentrates, accounted for only slightly more than 1% of total export earnings in 1972. Imports of mineral commodities consisted primarily of iron and steel semimanufactures, refined petroleum products, cement, and salt.

Mineral production was limited to small tonnages of bastnaesite (a rare-earth mineral) and cassiterite (tin) concentrate, lime, small quantities of placer gold, and common construction materials such as stone, sand and gravel, and clays. Bastnaesite

[7] By James H. Jolly, physical scientist, Division of Nonferrous Metals—Mineral Supply.

[8] Where necessary, values have been converted from Burundi Francs (RBF) to U.S. dollars at a rate of RBF87.5=US$1.00.

U.S. Embassy, Bujumbura, Burundi. Economic Trends Report. State Department Airgram A-35, Apr. 20, 1973, p. 3.

was produced at a small underground mine near Karonge in Bujumbura Province by Société Minérale de Karonge (SOMIKA). Owing to weak world prices, civil disruption and declining ore grade, concentrate production was probably less than the 300 tons reported in 1970, the last year for which firm figures were available. Most of the bastnaesite concentrate was exported to France.

Tin was recovered by SOMIKA from alluvial deposits near the Rwanda border. An estimated 154 long tons of concentrate was produced in 1972. Belgium and the United Kingdom purchased most of the tin concentrate exported during the year.

The second phase of the UNDP project to find economic mineral deposits in Burundi began in July amid shortages in personnel and restrictions on travel. Exploration was moderately successful after 3 years of discouraging results. In addition to the nickel-copper find in the south, a promising zone of copper-silver mineralization near Musongati, which lies about 30 kilometers southeast of Gitega, was discovered. Exploratory drilling was planned in 1973.

CAMEROON [9]

Aluminum and cement continued to be the principal mineral products of the Federal Republic of Cameroon. Small quantities of cassiterite (tin ore) and gold may also have been produced, but 1972 output, if any was unreported through yearend 1973.

Compagnie Camerounaise de l'Aluminium Péchiney-Ugine (ALUCAM) produced primary aluminum at its plant at Edea using alumina imported from Guinea. Société Camerounaise de Transformation de l'Aluminium (SOCATRAL) was expected to complete in 1973 installation of a second cold-rolling mill, which will have an annual capacity of 10,000 tons per year. The new mill will be twice the size of the first cold-rolling mill installed in 1968, and will raise overall aluminum rolling capacity to 25,000 tons per year.

Economic and technical studies of the Minim Martap bauxite deposits southwest of Ngaoundere in the Adamawa Range were being conducted by Société d'Études des Bauxites du Cameroun (SEBACAM), an association formed by the Government, Péchiney Ugine Kuhlmann, Kaiser Aluminum and Chemical Corp., and Vereinigte Aluminium Werke. The studies, which were to be completed by 1974, will report on the feasibility of a large-scale bauxite exporting enterprise and the possibility of producing alumina in Cameroon. The geological field work was reported to have been completed. Estimates of reserves in the Minim Martap Area have been on the order of 1 billion tons of medium-grade ore. The deposits are near a section of the Trans-Cameroon Railway scheduled for completion by 1975. The studies will include evaluation of the various possibilities for transporting ore.

French publications reported that the cassiterite deposits at Mays Darlé near the Nigerian border were nearly depleted.

Cement production increased 21% in 1972, and Cimenteries du Cameroon (Cimencam), which operates the two cement plants in Cameroon, was reported to be considering expansion of both plants. A plant at Bonaberi near Douala serves southern Cameroon, and a plant at Figuil serves northern Cameroon and Chad.

[9] By Horace F. Kurtz, industry economist, Division of Nonferrous Metals—Mineral Supply.

Table 2.—Cameroon: Foreign trade in mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS		
METALS		
Aluminum metal, including alloys:		
Scrap	4	38
Unwrought	39,056	28,722
Semimanufactures	2,928	5,751
Copper metal, including alloys:		
Scrap	70	266
Unwrought	1	--
Iron and steel metal:		
Scrap	4,911	3,091
Semimanufactures	880	279
Lead:		
Ore and concentrates	22	22
Metal, including alloys, unwrought and semimanufactures	52	28
Tin ore and concentrate, long tons	41	31
Other ore and concentrate of base metals, n.e.s	--	341
NONMETALS		
Cement	593	2,461
Fertilizer materials:		
Crude, potassic	10	--
Manufactured:		
Nitrogenous	17	174
Potassic	7	8
Other, including mixed	--	11
Lime	20	--
Salt and brine	250	115
Talc, steatite, soapstone, and pyrophyllite	--	10
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	9
Hydrogen, helium and rare gases	2	23
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	--	(2)
Refinery products, do	2	3
IMPORTS		
METALS		
Aluminum:		
Oxide and hydroxide	99,841	92,011
Metal, including alloys:		
Scrap	10	--
Semimanufactures	1,164	497
Arsenic trioxide, pentoxide and acids	6	5
Chromium:		
Chromite	6	20
Oxide and hydroxide	1	--
Copper metal, including alloys, semimanufactures	69	83
Iron and steel metal:		
Scrap	50	--
Pig iron, ferroalloys, and similar materials	237	110
Steel, primary forms	529	73
Semimanufactures:		
Bars, rods, angles, shapes, sections	20,580	14,829
Universals, plates and sheets	9,921	11,301
Hoop and strip	910	872
Rails and accessories	14,034	20,208
Wire	3,427	3,548
Tubes, pipes, and fittings	8,247	4,707
Lead:		
Oxides	25	49
Metal, including alloys, unwrought and semimanufactures	127	18
Magnesium metal, including alloys, unwrought	110	110
Manganese oxides	20	--
Nickel metal, including alloys, semimanufactures	--	2
Platinum and platinum-group metals, troy ounces	64,301	--
Tin metal, including alloys, unwrought and semimanufactures, long tons	4	3
Titanium oxides	69	102
Zinc:		
Oxide	32	33
Metal, including alloys, semimanufactures	10	12
Other:		
Ore and concentrate of base metals, n.e.s	--	8
Oxides, hydroxides and peroxides of metals, n.e.s	1	1
Metals, including alloys, all forms:		
Alkali, alkaline earth and rare-earth metals	1	2
Pyrophoric alloys	2	1
Base metals, including alloys, all forms, n.e.s	40	2

See footnotes at end of table.

Table 2.—Cameroon: Foreign trade in mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	12	26
Grinding and polishing wheels and stones	30	25
Asbestos	3	6
Barite and witherite	135	1,791
Boron materials:		
Crude natural borates	73	43
Oxide and acid	25	70
Cement	135,891	136,814
Chalk	212	277
Clays and clay products (including all refractory brick):		
Crude clay, n.e.s	89	258
Products:		
Refractory (including nonclay bricks)	1,439	1,329
Nonrefractory	1,507	1,466
Cryolite and chiolite	300	--
Diatomite and other infusorial earth	395	524
Fertilizer materials:		
Crude:		
Nitrogenous	--	13
Potassic	1,401	4,391
Manufactured:		
Nitrogenous	32,637	54,835
Phosphatic	6,992	890
Potassic	3,442	4,362
Other, including mixed	1	417
Ammonia	93	336
Graphite, natural	10	10
Gypsum and plasters	6,207	2,004
Lime	1,269	1,625
Magnesite	37	1
Mica, crude, including splittings and waste	4	2
Pigments, mineral:		
Natural, crude	51	67
Iron oxides, processed	28	22
Salt	21,434	20,982
Sodium and potassium compounds, n.e.s	3,867	2,814
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	34	--
Worked	55	1
Dolomite, chiefly refractory grade	503	881
Gravel and crushed rock	61	4
Limestone (except dimension)	1,090	1,416
Sand, excluding metal bearing	--	148
Sulfur:		
Elemental, all forms	15	6
Sulfur dioxide	24	--
Sulfuric acid, oleum	145	106
Talc, steatite, soapstone and pyrophyllite	340	228
Other:		
Crude	131	166
Oxides and hydroxides of magnesium, strontium and barium	--	2
Bromine, iodine and fluorine	--	1
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,497	506
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	23	709
Carbon black	1	2
Coal and briquets	20	71
Coke and semicoke	807	70
Hydrogen, helium and rare gases	11	11
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels--	773	818
Kerosine ---do---	469	536
Residual fuel oil ---do---	711	816
Lubricants ---do---	51	70
Other:		
Liquefied petroleum gas ---do---	25	28
Pitch ---do---	200	131
Bitumen and other residues and bituminous mixtures, n.e.s ---do---	25	47
Other ---do---	10	5
Total ---do---	2,264	2,451
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	326	116

[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Cameroon, rather than from trade returns of trading partner countries as was done in the previous edition (when actual Cameroonian statistics were not available).

[2] Less than ½ unit.

CENTRAL AFRICAN REPUBLIC [10]

Mining activity in the Central African Republic took an upward turn in 1972 with the resumption of commercial diamond mining. An agreement signed in February ended a period of more than 2 years during which commercial diamond production had ceased due to a protracted dispute between the mining companies and the Government. The new agreement set up a combined operation consisting of the Government and a U.S. firm, Diamond Distributors, Inc. Production of diamond, still the country's only recorded mineral product, rose significantly over its depressed level of 1971.

Development of the Bakouma uranium deposits remained at a standstill during the year. The concessionaire, Compagnie des Mines d'Uranium de Bakouma (URBA), had halted work in 1971 due to technical difficulties. A U.S. company, Agricola Metals Corp., was given a contract pertaining to the mine, but no work had begun by yearend.

Studies were in progress on other mineral resources in the country including limestone, iron, and tin. Currently, the only proposed development is a cement plant, for which government funds have been allocated.

PRODUCTION

Diamond production broke out of a 3-year slump and scored a gain of 20%, to 524,102 carats in 1972, from 437,449 carats in 1971. Although statistics are not available on the shares contributed by the mining companies and native diggers, renewal of company operations undoubtedly accounted for a large part of the upswing. Production was valued at $14.7 million in 1972, an increase of 27% from the 1971 value of $11.6 million (however, the increase in value was only 3% in local currency, implying an actual decline in unit value). Gem diamond comprised 66% of the quantity produced and 94% of the value, the remainder consisted of industrial quality stones.

No other mineral production was recorded in the country during 1972. A small amount of gold is believed to have been produced, mostly as a byproduct of diamond mining operations. Statistics are unavailable on the output of building materials, which consisted of brick and ceramic tile from local factories plus the quarrying of sand and gravel, and crushed stone.

Mineral production figures for the Central African Republic are included in table 1.

TRADE

Exports of diamond declined to 455,424 carats in 1971, the latest year for which data is available, 5% less than the 477,284 carats exported in 1970. Accumulated stocks apparently were drawn upon to make up for the slump in production. Diamonds cut by the Comptoir National du Diamond (National Diamond Enterprise) totaled 6,320 carats, the remaining exports consisting of crude stones.[11] Value of exports rose 10% to $13.7 million from $12.4 million in 1970 despite the drop in quantity. An increase in the proportion of gem diamond, cut and uncut, likely accounted for the higher value.

Other mineral exports consisted of negligible amounts of metal scrap, fertilizer materials, and refinery products, all of which were reexported.

Fertilizer materials and refinery products, iron and steel semimanufactures, salt, clay products, and cement comprised the bulk of the country's mineral imports. The balance of mineral trade was highly favorable due to the diamond exports, which accounted for 37% of the value of total trade in 1971 (down from 50% a few years earlier). However, the balance of total trade continued to be unfavorable.

COMMODITY REVIEW

Diamond.—Commercial diamond mining resumed after a more-than-2-year lapse caused by a dispute between the mining companies and the Government. Settlement of the lengthy dispute was accomplished by an agreement signed in February 1972 that established a joint venture composed of the Government and the U.S. company Diamond Distributors, Inc. (DDI). The agreement permitted the resumption of commercial diamond mining, reopening of offices to buy the production of native diggers, and exploration and development of diamond resources.[12]

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[10] By David G. Willard, economist, Division of Nonmetallic Minerals—Mineral Supply.

[11] Mining Journal. Mining Annual Review—1972. June 1972, p. 363.

[12] Work cited in footnote 11.

In an effort to curb diamond smuggling, the Government passed ordinances imposing sentences on smugglers, restricting diamond digging to native Central African citizens, prohibiting foreigners from entering diamond-producing areas without special permission, prohibiting any involvement by government employees in the diamond industry, and compelling all buying offices to permit the requisitioning of stones for the DDI government-owned cutting plant.[13]

Uranium.—A U.S. company, Agricola Metals Corp., signed an agreement in April 1972 with the Government of the Central African Republic concerning the uranium mine at Bakouma. Development of the mine by URBA, a combine of Commissariat a l'Énergie Atomique (CEA), the Péchiney Group, and the Government, was suspended in June 1971 due to technical difficulties. The suspension has been a blow to the economy, which badly needs additional income to offset increasing deficits in trade and the Government budget. The CEA has challenged the Agricola agreement, claiming that URBA's earlier agreement is still in effect. There was no activity at the mine site during the year.[14]

Other Minerals.—Funds were included in the 1973 government budget for the construction of a cement clinker grinding plant.

A study by the United National Development Program of the Fatima limestone deposit, aimed at determining its size and mining feasibility, was completed in 1972. Laboratory studies have already confirmed the material's suitability for cement manufacture. Results of the study were not yet known.

Research projects in progress as part of the country's second 5-year plan included mining feasibility studies of an iron ore deposit at Bogoin and tin deposits in the Yalinga and Nzako regions, along with studies of geological formations elsewhere in the country.[15]

CHAD [16]

The mining industry of Chad is very small. Sun-dried natron (hydrous sodium carbonate) is the most publicized mineral produced. It is generally obtained as slabs weighing about 35 kilograms from approximately 20 of 500 known saliferous basins northwest of Bol, near Lake Chad. Natron has many uses such as for human and animal consumption, preservation of meat and hides, and in the manufacture of soap. Production and trade data are shown in tables 1 and 3.

Other minerals that are mined in Chad include clay for the Chari brickyard at Fort Lamy, sand and gravel for construction, and salt.

Three companies had permits for petroleum exploration in Chad in 1972. They were Continental Oil Co. (CONOCO), Ste. Indépendante de Recherches et d'Exploitation pétrolières (SIREP), and Chad Shell Exploration and Development Corp.

CONOCO's original permit dates back to 1969. It covers exploration for a 5-year period, costing over $5 million, applying to an area of 233,000 square miles in western and southwestern Chad. However, in 1972 CONOCO sold a large portion of its concession to Chad Shell Exploration and Development Corp.

SIREP obtained permission in 1970 to explore 58,700 square miles in the Ounainga-Kebir Region of northeastern Chad for oil. The work was to be done in 5 years at a cost of over $3 million.[17]

A comprehensive report on the social, political, military, industrial, and economic activities of Chad was published.[18]

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[13] U.S. Embassy, Bangui, Central African Republic. State Department Airgram A-49, Mar. 21, 1972, p. 2; Joint Publications Research Service. Translations on Africa. JPRS 58676, Apr. 6, 1973, p. 5.

[14] Joint Publications Research Service. Translations on Africa No. 331. JPRS L/4498, Apr. 27, 1973, pp. 7-8.

[15] Joint Publications Research Service. Translations on Africa. No. 1108. JPRS 55007, Jan. 24, 1972, p. 4.

[16] By Donald E. Eilertsen, physical scientist, Division of Nonmetallic Minerals (retired)—Mineral Supply.

[17] Joint Publication Research Service. Chad. Translations on Africa, No. 1244. JPRS 57791, Dec. 18, 1972, pp. 8-9.

[18] Nelson, H. D. and Others. Area Handbook for Chad. 1972, 261 pp.

Table 3.—Chad: Foreign trade in mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS		
METALS		
Iron and steel:		
Scrap	18	--
Semimanufactures, tubes, pipes, and fittings	--	23
NONMETALS		
Clay products, nonrefractory building bricks	69	--
Nonmetallic minerals, crude, n.e.s	1,458	1,079
MINERAL FUELS AND RELATED MATERIALS		
Petroleum products:		
Motor ---42-gallon barrels	--	26
Lubricants ---do	6	14
Liquefied petroleum gas ---do	209	--
IMPORTS		
METALS		
Aluminum metal, including alloys, semimanufactures	142	151
Copper metal, including alloys, semimanufactures	7	5
Iron and steel:		
Metal:		
Pig iron, ferroalloys, and similar materials	3	4
Semimanufactures	5,617	4,661
Lead metal, including alloys, unwrought and semimanufactures	6	2
Tin metal, including alloys, semimanufactures ---long tons	1	1
Zinc metal, including alloys, semimanufactures	1	1
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	--	3
Grinding and polishing wheels and stones	20	11
Cement	13,751	11,427
Clay products (including all refractory brick):		
Refractory (including nonclay bricks)	--	4
Nonrefractory	257	223
Diatomite and other infusorial earth	124	16
Fertilizer materials:		
Crude:		
Nitrogenous	30	--
Potassic	10	4
Manufactured:		
Nitrogenous	16	799
Phosphatic	7	515
Potassic	875	140
Other, including mixed	40	--
Ammonia	7	--
Lime	206	271
Mica, worked, including agglomerated splittings	--	1
Pigments, mineral, iron oxides, processed	--	1
Salt and brine	3,946	5,195
Sodium and potassium compounds, n.e.s	457	536
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	13	--
Worked	--	2
Gravel and crushed rock	133	--
Sulfur:		
Elemental, other than colloidal	159	81
Sulfuric acid, oleum	28	24
Talc, steatite, soapstone, and pyrophyllite	9	16
Other, building materials of asbestos cement and fiber cement	183	220
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	21
Lignite and lignite briquets	--	15
Hydrogen, helium and rare gases	15	15
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels	198	226
Kerosine ---do	148	150
Distillate fuel oil ---do	136	168
Residual fuel oil ---do	11	14
Liquefied petroleum gas ---do	1	4
Lubricants ---do	14	14
Other ---do	30	22
Total ---do	538	598

[1] Data in this table differ from that published in the last edition of this chapter in that this table is compiled from official trade returns of Chad, rather than from trade returns of trading partner countries as was done in the previous edition (when actual Chadian statistics were not available).

CONGO [19]

Progress was being made in discovery and development of petroleum resources. The offshore Emeraude Field should contribute substantially to Congo's petroleum assets. The Loango offshore discovery gave indication of good potential although it was not considered as important as Emeraude.

Operating oil companies were Société Elf des Pétroles d'Afrique Equatoriale (ELF–SPAFE) and ELF–CONGO, both subsidiaries of Entreprise de Recherches et d'Activities Petrolieres (ERAP); and Azienda Generale Italiani Petroli (AGIP) S.p.A, a subsidiary of Ente Nazionale Idrocarburi (ENI).

Preliminary work on base metal deposits gave promise of future increased production. Technicians from the U.S.S.R. were assisting in appraisal and development of two base metal properties. Reserves at the Djenguilé deposit were estimated at 300,000 tons of ore averaging about 28% lead, 9% zinc, and 4% copper. A mill was to be built at Mfouati to produce concentrates containing 51% lead and 18% copper; the plans called for operations to commence in 1974.

Technicians from the U.S.S.R. were also involved in a study of a base metal deposit in the Yanga-Koubenza Area where minable reserves were reported at 1.2 million tons of ore grading 12% lead, 16% zinc, and 5% copper. Initial production will probably be concentrated on recovery of lead, with other metals to follow as development progress.

With the depletion of its high-grade base metal ore, Société Minière de M' Passa worked on appraisal of available lower grade material. Estimates resulting from this work were 400,000 tons of copper-lead-zinc ore, of which about 140,000 tons was contained in the old dumps.

Estimated quantity of metal-in-concentrates that could be recovered was 16,000 tons of copper concentrate grading 40% metal, and 27,000 tons of lead/zinc concentrates grading 17% lead, and 35% zinc. Production continued on a normal basis.

Compagnie des Potasses du Congo reportedly produced about 430,000 tons [20] of commercial (95% to 96%) potassium chloride in 1971; exports amounted to 423,000 tons and 3,000 tons were marketed within the country. The ore body is discontinuous and complex, which requires considerable underground development resulting in high costs. Minable beds lie at an average depth of 340 meters and are 2 to 3 meters thick. Grade is about 53% KCl, equivalent to 35% K_2O.

The mining site was becoming depleted and it was expected that new development would be started to the southwest. Total reserves may be on the order of 35 million tons of K_2O equivalent. It was thought that output would not exceed 600,000 tons per year without considerable added investment.

The Pointe Indienne oilfield was becoming depleted and it was estimated that it could produce only about 70,000 barrels [21] per year for the next 3 to 5 years. Between 1960 and 1971, 5.4 million barrels were recovered. The highest annual production occurred in 1962 with nearly 890,000 barrels; since then, production has declined steadily to about 104,000 barrels in 1971. Gas was being delivered by means of a 35-kilometer pipeline at a rate of about 525 million cubic feet per year to Compagnie des Potasses du Congo at Holle.

Work continued in the central portion of the Emeraude Field and in early 1972 there were 15 wells producing a total of about 7,000 barrels per day. Work progressed in the northern part of the Emeraude, and it was expected that by 1972, 55 wells would be in production. Field reserves were estimated at between 5.7 and 7.2 billion barrels, 6% to 10% of which was considered recoverable.

The 22° gravity oil was said to be low in sulfur. The field lacks pressure and seawater injection was contemplated. Pipelines of 21 kilometers and 28 kilometers in length connect the main platform to the shore station at Djeno and from Djeno to the Rivière Rouge terminal, respectively. A storage tank holding more than 375,000 barrels was installed at Djeno and a smaller one of 125,000-barrel capacity at the river terminal.

A discovery offshore from Loango reportedly tested over 2,000 barrels per day. Total depth of the well was about 2,600

[19] By Burton E. Ashley, physical scientist, Division of Nonferrous Metals (retired)—Mineral Supply.

[20] World Mining. Congo. August 1972. V. 8, No. 9, p. 90.

[21] Converted at 7.206 barrels per ton of crude oil.

feet; the well was drilled in 85 feet of water.

Siberta Corp. began site work for the oil refinery to be erected near Pointe Noire. It was planned to prefabricate as much of the plant as possible in Belgium. The plant was to operate at slightly more than one-half the planned capacity of about 7 million barrels throughput per year. The contract provided for Siberta to manage the refinery during the initial 7 years of operation after which it would be transferred to the Congo Government; the Government would use revenues from the refinery operations to pay for it. The original construction was to be financed by an international consortium.

DAHOMEY [22]

The mineral industry of Dahomey contributed insignificantly to the economy of the country, as represented by the gross national product (GNP) estimated at $230 million in 1972.

Minerals production consisted mainly of the output for local consumption of stone, sand and gravel, salt, and the manufacture of cement. Exploraton for crude oil in offshore waters, which has been going on since 1965, has led to the discovery of a deposit not considered to be commercial at the present time.

The United Nations Special Fund and Government of Dahomey continued geological and mineral surveys in the northern part of the country. Scheduled to be completed in 1974, the program also has the objective of training local survey personnel. The subterranean water surveys being conducted by the United Nations Special Fund in the Atacora Region were completed in 1972.

At yearend the Government terminated the petroleum concession agreement with Pividoy International Corp. of Los Angeles, Calif. Reportedly, the agreement signed in October 1971 was terminated for nonperformance of the minimum work program.

Société des Ciments du Dahomey (Dahomey Cement Co.) was studying the construction of a cement clinker manufacturing plant to be located in the Pobe Area near Onigbolo and Masse, site of two limestone deposits estimated at 18 million tons each. The plant would have production capacity of 150,000 tons per year initially, which would be expanded later to 300,000 tons per year. Initial cost of the plant was estimated at $9.6 million.[23] Plans for construction of a cement clinker plant at Cotonou by COFEI, a Spanish company, reportedly have been abandoned.[24]

The marble deposits located at Dadjo, 186 miles north of Cotonou, were being studied by a Swedish group. SINCO, an Italian company, reportedly abandoned the project to develop a quarry and supply a marble works at Cotonou with 5,400 tons per year of stone and also provide 6,750 tons per year of marble for export. Reserves in the deposit total 5 million tons of gray and white marble.

A ceramic factory that was scheduled to be constructed under the 1971–72 emergency plan, has not been completed. The plant will have a capacity to produce 630 tons of industrial ceramics, tiles, and sanitary fixtures when built.

After drilling two dry holes in its petroleum concession near the Dahomean-Nigerian border, Union Oil Co. of the United States announced plans to stop exploration operations and return the concession to the Government of Dahomey. Although Union Oil found some crude oil in two structures in Dahomean territorial waters, the company did not consider the deposits to be commercial. In May, Global Energy Co. of Dallas, Tex., assumed all obligations of the Union Oil and Dahomey convention of December 19, 1974. Global planned to drill a confirming well in the two structures in which Union Oil found limited quantities of oil and to start producing crude oil as soon as possible.

Litwin Ltd. of the United Kingdom concluded negotiations with the Dahomean Government to build a $15 million petroleum refinery. The refinery was expected to process about 4 million barrels per year of Nigerian crude oil. Domestic consumption of petroleum products was estimated at about 2 million barrels per year. Surplus output will be sold primarily to neighboring countries.

[22] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[23] Where necessary, values have been converted from African Financial Community Francs (CFAF) to U.S. dollars at a rate of CFAF 230 = US$1.00.

[24] Bulletin de l'Afrique Noire (Paris). Industry, Electric Power, Highway Infrastructure Surveyed. Mar. 14, 1973, pp. 14249–14257.

EQUATORIAL GUINEA AND FERNANDO PO [25]

Mineral commodity production in Equatorial Guinea and Fernando Po was not significant, consisting mainly of small quantities of stone, sand and gravel, and salt for local consumption. Exploration for crude oil in offshore waters, probably the most important mineral activity, continued. Reportedly, Aracca Petroleum Corp. of the United States obtained an offshore petroleum concession in April and was negotiating with the Government for additional offshore concessions.

The Governments of Equatorial Guinea and Gabon agreed to negotiate on hydrocarbon rights in the Gulf of Guinea, under the supervision of the Organization of African States. Equatorial Guinea has claimed that Gabon infringed on its sovereignty on the islands of Muabia and Corisco in the Muni River Delta. Gabon extended its coastal jurisdiction to 62 miles offshore, which precipitated the disagreement.

ETHIOPIA [26]

The mineral industry was not a significant factor in the economy of Ethiopia as represented by the gross national product (GNP) estimated at $1,898 million [27] in 1972 (current prices). Activity in the minerals industry was centered mainly around the development of a copper mine in the Debarwa-Asmara area and the discovery of crude oil and natural gas deposits in the Ogaden Region near Callafo, southwestern Ethiopia.

The Ethiopian and Japanese Governments signed an agreement under which Japanese specialists would conduct geological and mineral surveys in Wollega Province, western Ethiopia. The surveys, which will be completed in 4 years, were scheduled to cost about $1.3 million and cover an area of 3,860 square miles in the districts of Assosa-Kurmuk, Mendi-Tobo and Gordona-Billa. The Canadian International Development Agency reportedly gave the Ethiopian Government $1.4 million for a mineral survey and mapping project in the Omo River Region. Gold, copper, zinc, lead, and platinum deposits have been found in the 30,000-square-mile area.[28] The Ethiopian minister of mines was given a geological map of the Ertoa Ale volcanic area in the Danakil depression. The study and map, reproduced on a scale of 1:100,000, was financed by the French-Italian Scientific Research Center.

The Ethiopian Government was actively seeking foreign investment in the exploration and development of Ethiopia's mineral resources. Ethiopia's investment decree grants liberal benefits to new investment in the mining, industrial, agricultural, and tourism sectors. These include exemption from income taxes for from 3 to 5 years; exemption from duties and taxes on imports of machinery and construction materials, where not available locally; and provision of foreign exchange for remittance of dividends, repatriation of capital, loan repayments, and partial overseas salary deposits. Proposed legislation provides for even more liberal benefits such as accelerated depreciation, and capital allowances.

At yearend Canadian Javelin Ltd., and the Ethiopian Government signed an agreement for the company to explore the Sidamo nickel deposits.[29] Reportedly, a United Nations survey of the deposits gave estimated reserves of 10.5 million tons of nickel ore grading 1.38% nickel.

A British team of technicians was scheduled to conduct a hydrological survey of the Rift Valley Lake Area, southern-southwestern Ethiopia in 1973.

Mineral commodities production in 1972 consisted mainly of refined petroleum products, cement, salt, limestone, clay, gold, and platinum, as shown in table 1.

Nippon Mining Co. of Japan was developing a copper deposit at Debarwa, near Asmara. Shaft sinking was in progress and equipment was being installed. The shaft was scheduled to reach the 300-foot level by September 1973, at which time tunneling to the ore body would begin. Mill construction was planned for early 1974. It

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[25] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[26] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[27] Where necessary, values have been converted from the Ethiopian dollars (Eth$) to U.S. dollars at the rate of Eth$2.28 = US$1.00.

[28] Mining Journal (London). Ethiopia: Mapping Programme. V. 279, No. 7154, Sept. 29, 1972, p. 252.

[29] Wall Street Journal. Canadian Javelin To Explore Nickel Deposits in Ethiopia. V. 181, No. 57, Mar. 23, 1973, p. 19.

has been estimated that the plant will process about 6,000 tons to 7,000 tons of ore per month producing about 2,000 tons per month of 21% to 22% copper concentrate. It was expected that exports of copper concentrate would begin by April 1975 at a rate of 17,000 tons annually. Mineral exploration work was to be continued by the company at Adi-Nefas, Woki, and Enticcio. Nippon Mining Co. and the Government of Ethiopia signed an agreement forming a company named Ethio-Nippon Mining Co. to exploit the copper deposits. Nippon Mining will own 80% of the share equity in the new company and the Ethiopian Government 20%.

At yearend it was reported that natural gas had been discovered in the Ogaden Region on a concession held jointly by Tenneco Ethiopia, Inc., Chevron Oil Co. of Ethiopia, and Texaco Ethiopia, Inc. The discovery well located 400 miles southeast of Addis Ababa flowed gas at test rates of up to 35 million cubic feet per day through a 1-inch choke with surface pressure of 1,500 pounds.[30] The gas was discovered at a depth of 10,800 feet in the center of the 50-million-acre concession area. Tenneco Ethiopia, Inc., owns a 50% interest in the concession area with undivided interest of 25% each held by Chevron Oil Co. of Ethiopia and Texaco Ethiopia, Inc. Tenneco Ethiopia was operator for the group with two seismic crews and one drilling rig operating. Later Tenneco located a 3-foot strata of oil at a depth of 7,000 feet in its fourth well; however, the deposit was not considered to be commercial. Tenneco requested a 2-year extension for the half of its concession (37,828 square miles) it is scheduled to relinquish in September 1974.

The Ministry of Mines signed oil concession agreements with Whitestone-Louisiana Land and Exploration Co. of the United States and the Polar Bear Group, a United States-Canadian consortium composed of Polar Bear International Petroleum Ltd., Voyager Petroleums Ltd., Houston Oils Ltd., and Cardinal Petroleum Co. Voyager will be operator for the group, whose concession areas cover 12,969 square miles in Sidamo and Bale Provinces, a coastal strip fronting on the Red Sea, and two other offshore areas between the Ethiopian-Sudanese border and Massawa. The Whitestone-Louisiana concession area covers 30,983 square miles in Harar Province north of Tenneco's concession area. Ethiopian Oil Corp. (EOC), a United States-Israeli group, has an offshore concession area in the vicinity of Asmara.

Under terms of the agreement with the Government, both Whitestone-Louisiana Land and Exploration and the Polar Bear Group are required to invest a minimum of $2.25 million. Of this amount $250,000 will be for preliminary geological surveys, $500,000 for seismologic work, and $1.5 million for drilling.[31]

At yearend Siebens Oil and Gas Ltd. of Canada was negotiating with the Government for a concession area offshore midway between Massawa and Assab.

THE FRENCH TERRITORY OF THE AFARS AND ISSAS[32]

The French Territory of the Afars and Issas produced small unrecorded quantities of stone, and sand and gravel for local consumption. Mineral industry activity consisted mainly of foreign trade in mineral commodities.

GAMBIA[33]

Gambia's mineral activity consisted mainly of the production for local consumption of unrecorded quantities of stone, sand and gravel, and exploration in offshore territorial waters for crude oil.

There was no additional information available on the kaolin deposit in the Upper River area or on the deposit of ilmenite located near the coast in the Western Division. In 1971 the United Nations Development Program was conducting feasibility studies on these deposits to determine their commercial potential. These studies probably were continued in 1972.

Aracca Petroleum Corp. of the United

[30] U.S. Embassy, Addis Ababa, Ethiopia. State Department Telegram 681, Jan. 24, 1973, p. 1.
[31] U.S. Embassy, Addis Ababa, Ethiopia, State Department Airgram A-89, May 5, 1973, 3 pp., 1 encl.
[32] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.
[33] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

States signed an agreement for exclusive exploration rights on a 2,460-square-mile offshore concession area that formerly belonged to British Petroleum Corp. and Société Elf des Pétroles d'Afrique Equatoriale (Elf-Spafe). At midyear Arâcca Petroleum had started seismic surveys in its offshore concession area.

Foreign trade in mineral commodities consisted mainly of imports of cement and iron and steel semimanufactures.

GUINEA [34]

Bauxite and alumina were the principal mineral products of Guinea in 1972, and alumina exports to overseas aluminum producers continued to be a major source of foreign exchange. Diamonds and gold were also produced during the year. The development of new bauxite mining facilities and investigations which could lead to significant iron ore production and increased diamond output indicated future growth of the mineral industry of Guinea.

Compagnie International pour la Production de l'Alumine (FRIA) mined bauxite and converted it to alumina at its facilities at Kimbo. FRIA was an international consortium comprised of Olin Corp. (48.5%), Péchiney Ugine Kuhlmann (PUK) (26.5%), British Aluminium Co., Ltd. (10%), Swiss Aluminium Ltd. (10%), and Vereinigte Aluminium-Werke A. G. (5%). At yearend, a government proposal for its participation in the ownership of FRIA was under consideration.

Guinea Bauxite Co. (CBG) continued construction of mining and ore preparation facilities and infrastructure for the Boké bauxite project. CBG is owned by the Government of Guinea (49%) and Halco Mining, Inc. (51%), a consortium consisting of Aluminum Co. of America (27%), Alcan Aluminium Ltd. (27%), Martin Marietta Aluminum, Inc. (20%), PUK (10%), Vereinigte (10%), and Montecatini Edison S.p.A. (6%). The first shipment of bauxite was rescheduled for the second half of 1973. Shipments were expected to be made initially at the rate of 4.7 million tons per year and increased to 8 million tons by the third year. The railroad from the mining site at Sangaredi to the port town of Kamsar has been completed. Three drying kilns and facilities for calcining abrasive-grade bauxite are located at Kamsar. At yearend CBG was attempting to raise $60 million in bonds and notes for the Boké project. Reportedly, this would increase the total funds made available for Boké to over $320 million, including $73.5 million in World Bank loans.

The Government, with assistance from the U.S.S.R., was developing a bauxite deposit at Debele in the Kindia region. Reserves were estimated at 44 million tons. The project included construction of a railway link for transporting the bauxite to Conakry, and shipments to the U.S.S.R. were expected to begin by the end of 1974.

Plans for developing the iron deposits in the Nimba Mountain near the southernmost border of Guinea and the deposits at Mount Simandou, about 60 miles farther north, remained incomplete. Unsettled were the composition of a consortium for developing and mining the deposits and an agreement on the route for moving the Nimba Mountain ore to the coast for shipment abroad. Under consideration were plans to ship the ore by rail to Buchanan, Liberia, over an existing railroad, or to Conakry, Guinea, by extending the Conakry-Kankan railroad.

IVORY COAST [35]

The Ivory Coast marked another year of progress in mineral production in 1972, but future prospects were clouded by adverse market conditions and disappointing exploration results. The country's three main mineral commodities, diamond, cement, and petroleum refinery products, scored output gains during the year, creating a significant rise in income from minerals. However, the country's biggest potential mineral development, the Mt. Klahoyo iron ore project, was temporarily stymied by a glut of iron ore on the world market and a resulting disenchantment on the part of potential investors. Hopes for a breakthrough in another mining sector also dimmed when

[34] By Horace F. Kurtz, industry economist, Division of Nonferrous Metals—Mineral Supply.

[35] By David G. Willard, economist, Division of Nonmetallic Minerals—Mineral Supply.

Esso's first two oil wells in the coastal lagoon came up dry.

Government Policies and Programs.—Société pour le Développment Minièr de la Côte d'Ivoire (SODEMI), the state-owned mineral exploration company, continued its countrywide exploration program in 1972, with particular emphasis on molybdenum-copper anomalies at Mameli, Beoumi, Tibeita, and Gueyebli and a columbite-tantalite deposit at Issia. These locations are in southwestern Ivory Coast, an area which has been the subject of special government development efforts. The United Nations Development Program and the Bureau de Recherches Géologiques et Minières (BRGM) were also active in mineral exploration in that area. Other SODEMI activities included investigations of diamond, gravel, clays, shell marl, ornamental stone, and nickel deposits in various sections of the country. None of these studies had so far turned up any resources that might have commercial mining possibilities, with the exception of an iron ore deposit at Monogaga, which may be mined to supply a small local steel mill.[36]

An aerogeophysical survey of most of the country, and a photogeological survey of about half of it, were being planned. They will be financed with the help of a $2.5 million Canadian loan.[37]

Two major projects were officially dedicated during 1972 the Kossou Dam with a powerplant capacity of 175 megawatts, and the port of San Pedro, which will provide ocean access to the hitherto isolated southwestern part of the country. Large scale development schemes are planned in both areas, with special emphasis on the sparsely populated region around San Pedro.[38]

In an effort to further bolster the country's electric power supply, the Government has made an approach to neighboring Ghana for power from that nation's Akossombo Dam. Because of the dam's nearness to the Ivory Coast border, the possibility of obtaining Akossombo power was considered good.[39]

Taxes on industrial and commercial profits were raised from 18% to 20% and 32% to 34%, respectively, effective for all companies whose fiscal years ended after October 31, 1972.[40]

PRODUCTION

Mineral production in the country registered still another sizable increase in 1972. All three of the major mineral products recorded gains for the year. Diamond production totaled 334,000 carats in 1972, 2% higher than the 1971 total of 326,370 carats. Société Anonyme de Recherches et d'Exploitation Minières en Côte d'Ivoire (SAREMCI) accounted for approximately 80% of the total output and Société West African Selection Trust and Harry Winston, Inc. (WASTON), for the remainder. Activities of two previous producers, Société Diamantifere de Côte d'Ivoire (SODIAMCI) and Société Minière des Bandamas (SMB) had ceased in 1970 as the reserves in their concession areas became depleted.

Output of cement rose 17% to 583,000 tons in 1972 from 500,000 tons in 1971. The Government's continuing capital investment program maintained cement requirements at a relatively high level. However, the completion of such major projects as the Kossou Dam and the port of San Pedro during the year may result in lower cement output in 1973.

Petroleum refinery product output increased as the addition of a preflash unit enabled the refinery's previous capacity to be surpassed. Production already approached new capacity in 1972, and further increases will await completion of the expansion program now underway. When the new facilities go onstream in early 1974, capacity of the refinery will be approximately doubled.

Value of the country's recorded mineral production rose 41% to $36.4 million in 1972 from $25.9 million in 1971. The figures are incomplete because production figures for all building materials are missing. They also exaggerate the true rate of increase since they include the changing value of the dollar relative to the West African franc. The real growth rate is probably half as great. The gains in cement and refinery production were responsible for the largest part of the increase.

[36] Joint Publications Research Service. Translations on Africa No. 1242. JPRS 57754, Dec. 12, 1972, pp. 19–20.

[37] Joint Publications Research Service. Translations on Africa No. 1238, JPRS 57592, Nov. 24, 1972, p. 5.

[38] Kaiser Builder. Ivory Coast Power. March 1973. Pages 24–26 of work cited in footnote 13.

[39] Joint Publications Research Service. Translations on Africa No. 1196. JPRS 56694, Aug. 4, 1972, p. 37.

[40] Joint Publications Research Service. Translations on Africa No. 323. JPRS L/4421, Feb. 22, 1971, p. 14.

TRADE

Exports of minerals and related commodities increased very slightly in value in 1971, according to the latest available statistics, when measured in current dollars. However, when the change in relative value of the dollar is taken into account, a decline of approximately 6% actually occurred. Reduced exports of metals, principally caused by the termination of manganese shipments in 1970, accounted for the decline. Gains in exports of diamond, fertilizers, and fertilizer materials offset part of the decline. The fact that total value of exports dropped in the same year that total mineral production value rose sharply indicated increased internal consumption of domestically produced minerals, which otherwise would have had to be imported.

In a similar manner, although mineral imports rose 6% in value in current dollar figures, the true result was a decline of about 3%. The principal reduction was in purchases of metals, particularly iron and steel; increases occurred in imports of cement, fertilizers, and petroleum refinery products.

Balances of total commodity trade and mineral commodity trade are shown in the following tabulation in million dollars:

	1969 r	1970 r	1971
Total commodity trade:			
Exports	482.6	473.4	504.2
Imports	352.2	391.6	441.6
Balance	130.4	81.8	62.6
Mineral commodity trade:			
Exports	12.1	11.2	11.4
Imports	44.5	55.9	59.3
Balance	—32.4	—44.7	—47.9

r Revised.

Tables 4 and 5 contain detailed statistics on exports and imports of minerals and related commodities.

COMMODITY REVIEW

Iron Ore.—Financing problems delayed implementation of the Mt. Klahoyo project during 1972. Oversupply in the world iron market made it difficult to obtain the additional investment capital needed for the project. Pickands Mather & Co. had completed its exploration program previously, and no further work was carried out in the area during the year.[41]

Petroleum.—Esso, operator for the combine that includes Shell and Enterprise de Recherches et d'Activités Petroliéres (ERAP), drilled two unsuccessful wells in the eastern coastal lagoon area during 1972. Drilling was stopped in August for evaluation of the results, but an additional well was planned for 1973.[42]

Construction was under way on the expansion project which will approximately double the capacity of the Société Ivorienne de Raffinage (SIR) refinery at Abidjan by 1974 through addition of a hydroskimming unit.[43]

Other Minerals.—Several industrial projects involving mineral development were being considered during the year. Clay deposits in the vicinity of Abidjan would provide the raw material for three proposed plants making expanded clay, tiles, sanitary fixtures, and dishes.[44]

[41] Page 4 of work cited in footnote 37.
[42] U.S. Embassy, Abidjan, Ivory Coast. State Department Telegram 4777, September 1972, 1 p.
[43] Joint Publication Research Service. Translations on Africa No. 1297. JPRS 58772, Apr. 17, 1973, pp. 4, 5.
[44] Joint Publications Research Service. Translations on Africa No. 302. JPRS L/4256. Aug. 28, 1972, p. 24.

Table 4.—Ivory Coast: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, all forms	539	628
Arsenic, sulfides, natural	--	45
Copper:		
Scrap	1,537	1,150
Metal, including alloys, unwrought and semimanufactures	1	3
Iron and steel:		
Scrap	11,229	4,352
Pig iron, ferroalloys, and similar materials	8	3
Semimanufactures	839	1,921
Lead:		
Ore and concentrate	--	(1)
Oxide	(1)	--
Metal, including alloys, all forms	245	194
Manganese ore and concentrate	74,233	--
Nickel metal, including alloys, all forms	3	3
Tin metal, including alloys, all forms ---long tons--	(1)	14
Zinc:		
Oxide	1	--
Metal, including alloys, all forms	9	12
Other:		
Metal-bearing sands	--	(1)
Ores and concentrates of nonferrous metals, n.e.s	1	--
Oxides, n.e.s	(1)	--
Metalloids, n.e.s	12	14
NONMETALS		
Abrasives, natural, crude, n.e.s. ---kilograms--	--	60
Boron minerals, crude natural	--	(1)
Cement, hydraulic	22,748	26,871
Chalk	2	2
Clays and clay products (including all refractory brick):		
Crude, all types	2	(1)
Products:		
Nonrefractory	42	49
Refractory (including nonclay bricks)	25	2
Diamond:		
Gem, not set or strung ---carats--	5,660	1,175
Industrial ---do---	209,545	274,825
Diatomite	1	(1)
Fertilizer materials:		
Manufactured:		
Nitrogenous	r 68	105
Phosphatic	200	2,277
Potassic	43	1,205
Other, including mixed	7	586
Ammonia	1	4
Gypsum and plasters	20	28
Lime	102	87
Pigments, mineral, natural, crude	3	37
Precious and semiprecious stones, except diamond ---kilograms--	--	350
Salt	236	755
Sodium and potassium compounds, n.e.s	258	214
Stone, sand and gravel:		
Dimension stone, crude and partly worked	3	3
Gravel, crushed rock and dolomite	4	--
Limestone	(1)	--
Sulfur:		
Elemental, all forms	(1)	1
Sulfuric acid	10	42
Talc and steatite	5	1
Other crude nonmetals, n.e.s	3	5
MINERAL FUELS AND RELATED MATERIALS		
Carbon black ---kilograms--	23	1
Coal and briquets	2	--
Coke and semicoke	6	--
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels--	256	181
Kerosine ---do---	134	70
Distillate fuel oil ---do---	179	116
Residual fuel oil ---do---	47	146
Liquefied petroleum gas ---do---	14	6
Bitumen ---do---	1	438
Other ---do---	25	25
Total ---do---	656	982

r Revised.
1 Less than ½ unit.

Table 5.—Ivory Coast: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum:			
Oxide and hydroxide		10	(1)
Metal, including alloys, all forms		4,084	5,927
Antimony metal, including alloys, all forms		1	23
Chromium oxide and hydroxide		10	4
Cobalt metal, including alloys, all forms	kilograms	146	--
Copper:			
Ore and concentrate		(1)	--
Metal, including alloys, all forms		252	321
Gold metal, unworked or partly worked	troy ounces	16,108	21,895
Iron and steel:			
Roasted pyrite		3	(1)
Scrap		91	195
Pig iron, ferroalloys and similar materials		12	26
Steel, primary forms		8,391	8,397
Semimanufactures		92,581	59,884
Lead:			
Oxides		69	106
Metal, including alloys, all forms		100	132
Nickel metal, including alloys, all forms		1	1
Platinum-group metals, including alloys, all forms	troy ounces	64	32
Silver metal, including alloys, all forms	do	10,256	16,333
Thorium and uranium salts	kilograms	7,557	358
Tin metal, including alloys, all forms	long tons	16	9
Titanium:			
Ore and concentrate		40	2
Oxides		232	260
Zinc:			
Oxides		87	84
Metal, including alloys, all forms		386	2,615
Other:			
Ores and concentrates of molybdenum and tin	kilograms	4	--
Ores and concentrates of base metals, n.e.s		64	53
Ash and residue containing nonferrous metals		30	56
Oxides, hydroxides and peroxides of metals, n.e.s		31	80
Waste and sweepings of precious metals		20	(1)
Sands, metal bearing		160	141
Metalloids, n.e.s		6	5
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc		11	25
Grinding and polishing wheels and stones		120	100
Asbestos		2	3
Barite and witherite		236	1,168
Boron:			
Crude natural borates		10	110
Oxide and acid	kilograms	92	732
Cement, hydraulic		371,201	395,828
Chalk		890	1,170
Clays and clay products (including all refractory brick):			
Crude n.e.s.			
Bentonite		98	39
Kaolin		42	54
Refractory		30	5
Other		40	267
Products:			
Nonrefractory		3,518	2,243
Refractory (including nonclay bricks)		732	386
Diamond:			
Gem	carats	50,000	55,000
Industrial	do	125,000	
Diatomite		51	77
Feldspar, fluorspar and nepheline syenite		6	5
Fertilizer materials:			
Crude, phosphatic		r 1,002	150
Manufactured:			
Nitrogenous		r 7,850	7,017
Phosphatic		4,584	3,618
Potassic		24,214	28,549
Other, including mixed		r 49,117	57,601
Ammonia		1,472	4,553
Graphite, natural	kilograms	203	261
Gypsum and plasters		18,797	28,188

See footnotes at end of table.

Table 5.—Ivory Coast: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
NONMETALS—Continued		
Lime	3,667	4,215
Magnesite	4	1
Mica, all forms	(1)	2
Pigments, mineral:		
Natural, crude	70	145
Iron oxides, processed	51	54
Precious and semiprecious stones, except diamond ---kilograms	32	18
Salt	24,950	24,264
Sodium and potassium compounds, n.e.s	4,441	4,602
Stone, sand and gravel:		
Dimension stone:		
Crude	591	186
Worked	803	944
Dolomite, chiefly refractory grade	6,446	5,084
Gravel and crushed rock	r 1,744	1,631
Quartz	65	3
Sulfur:		
Elemental	4,936	2,517
Sulfur dioxide	4	(1)
Sulfuric acid	363	93
Talc and related materials	687	650
Other nonmetals, n.e.s.:		
Crude	1,548	510
Fluorine, iodine and chlorine	58	43
Metalloids, n.e.s	6	5
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	50	105
Coal and briquets	35	25
Coke and semicoke	255	282
Peat and peat briquets	23	53
Petroleum:		
Crude ---thousand 42-gallon barrels	5,905	4,763
Refinery products:		
Gasoline ---do	150	205
Kerosine ---do	34	129
Distillate fuel oil ---do	288	206
Residual fuel oil ---do	3	46
Lubricants ---do	97	89
Liquefied petroleum gas ---do	1	1
Bitumen ---do	50	48
Other ---do	10	16
Crude chemicals from coal, oil and gas distillation	r 1,107	1,643

r Revised.
1 Less than ½ unit.

LESOTHO [45]

Mining activity contributed a slightly greater income to Lesotho's economy in 1972, but the prospects for future mineral development remained uncertain. Output of diamond, the country's only recorded mineral production, was slightly greater than in 1971, but was still far below the levels of earlier years due to the removal of two of the largest diamond pipes from production for company prospecting programs. Results of the programs were not encouraging, and an option to purchase one of the concessions was offered during the year without attracting any buyers. Exploration work continued at the other site and on a countrywide survey by the United Nations.

An agreement for a 10-year petroleum exploration program was concluded during the year.

PRODUCTION AND TRADE

Diamond production in Lesotho recovered slightly from the major declines of the previous 2 years, rising 32% to 9,019 carats in 1972 from 6,815 carats in 1971. Reasons for the upturn were not clear because the two major diamond pipes, Letseng-la-Terai and Kao, continued to be reserved for mining company exploration projects, and the activities of native diggers were limited to

[45] By David G. Willard, economist, Division of Nonmetallic Minerals—Mineral Supply.

several smaller pipes. In any case, the up turn was not truly significant, since the 1972 level represented only 31% of the output achieved 3 years earlier.

Industrial diamond accounted for 91% of the total production, a slight increase from the 85% in 1971; while gem diamond decreased to 9% in 1972 from 15% in 1971.

The 1972 diamond production was valued at $293,000, an increase of only 3% over the 1971 value of $284,000, reflecting the higher percentage of industrial stones. Industrial diamond comprised 38% of the total value in 1972, the same proportion as in 1971, which indicated a sizable decline in their unit value.

Crushed stone, precast concrete, cement bricks, and a small quantity of gem stones other than diamond are also produced in Lesotho, but no statistical data are available on their output or value. Statistics on Lesotho's production are included in table 1.

A sharp increase in imports of minerals and mineral-related commodities, coupled with the drop in diamond production, threw the country's mineral trade far out of balance in 1971, the latest year for which trade statistics are available. Exports of diamond, Lesotho's only mineral export, fell to one-third of their 1970 value as a result of the decline in production occurring when native digging activity was removed from some areas to make way for company exploration projects. Meanwhile, imports of petroleum refinery products and other mineral commodities accelerated sharply due to industrial development programs and increased consumer demand, rising 24% above the 1970 level. The consequent deficits in mineral commodity trade and total commodity trade were the largest in recent years. The following figures show trade results for 1969–71 in million dollars:

	1969	1970	1971
Total commodity trade:			
Exports	$5.7	$5.2	$2.9
Imports	33.5	32.0	37.5
Balance	−27.8	−26.8	−34.6
Mineral commodity trade:			
Exports	1.6	.9	.3
Imports	2.4	2.5	3.1
Balance	−.8	−1.6	−2.8

Source: U.S. Embassy, Maesru, Lesotho. State Department Airgram A–25, Apr. 4, 1973, pp. 17–18.

COMMODITY REVIEW

Diamond.—Prospecting results continued to be disappointing in Lesotho during 1972, but continuing examination of the country's diamond-bearing areas still held out some promise of eventual production.

Rio Tinto Zinc (RTZ) abandoned its concession at the Letseng-la-Terai diamond pipe after completing an exploration program lasting 3½ years and costing nearly $4 million dollars. Reportedly, the relatively low grade of the stones sampled and the difficulty of access to the mountainous region were the factors weighing most heavily against the project. RTZ offered an option on the concession to Newmont Mining Corp. which was investigating the nearby Kao diamond pipe, but the offer was declined. At yearend the Lesotho National Development Corp. (LNDC) and RTZ were attempting to interest other companies in taking up the concession.[46]

At Kao, 30 miles from Letseng-la Terai, Newmont continued its prospecting program begun in late 1971. The operation, originally a joint venture with Lonrho, Ltd., which subsequently sold its share to Newmont, again became a partnership when United States Steel Corp. purchased a 50% interest. A total of approximately $2.25 million had been expended on exploration by yearend but, as at Letseng, the initial results were not promising.[47]

Despite the unsuccessful results of present and past investigations, eventual development of one or both of the Letseng and Kao pipes, along with others, remains a possibility. The information already obtained, which is available to interested concerns and thus eliminates repetition of those exploration costs, and the possible combination of two or more pipes in one operation could provide sufficiently attractive economics to justify production.[48]

Work continued during 1972 on the United Nations Development Program project to investigate Lesotho's diamond resources, including study of the photo-

[46] U.S. Embassy, Maseru, Lesotho. State Department Airgram A–7, Jan. 17, 1973, pp. 1–2.
Engineering and Mining Journal. Exploration Round-up. V. 173, No. 9, September 1972, p. 17.
American Metal Market. Newmont Mining Rejects Africa Property Offer. V. 79, No. 189, Oct. 16, 1972, p. 34.

[47] U.S. Embassy, Maseru, Lesotho. State Department Aigram A–7, Jan. 17, 1973, p. 2.
Newmont Mining Corp. Annual Report 1972. p. 20.

[48] Engineering and Mining Journal. Exploration Round-up. V. 173, No. 9. September 1972, p. 17.

graphic surveys made in the previous year by North American Rockwell Corp.[49]

Petroleum.—An exploration concession previously granted to Ponder Oils, Ltd., was taken over by Westrans Petroleum, Inc., of New York during 1972. The agreement between Westrans and LNDC provided for a 10-year program of surveys and drilling, beginning late in 1972, and covered an area of 4.2 million acres in the western and southern parts of the country. A 51% share in the venture will be divided between the Government and LNDC, the remaining 49% interest will be held by Westrans. However, Westrans will bear all exploration costs.[50]

Other Minerals.—Lesotho has been included in an electronic photo survey conducted by an American Earth Resources Technology Satellite from July 1972 to July 1973. The Satellite employs various photographic techniques to highlight surface features such as geologic formations and mineral outcrops, and will provide mineral survey data with far less time and expense than would be required by other methods.[51]

MALAGASY REPUBLIC [52]

Mining took a downward turn in the Malagasy Republic in 1972. Weakness in the world market caused a cutback in chromite production from the Andriaménа mine, and a slump in domestic construction activity plus a strike curtailed cement output. These two factors were the leading causes of a 4% decline in the value of the country's mineral production during the year.

A revolution in May 1972 unseated the Tsiranana regime and brought to power a new government headed by General Ramantsoa. The new administration declared its support of foreign private investment but stated that all industries must contribute to the country's development needs. Continuing political instability caused a drop in investment and a capital outflow great enough to bring about stringent exchange controls later in the year. During December riots broke out in the country's principal port of Tamatave, and subsequently in other cities, which interfered seriously with mineral exports and other shipping, but stability was soon restored.

Mineral investigation activity proved disappointing during the year. Exploration of the Manantenina bauxite deposits and the Moramanga nickel deposits were completed, and both returned verdicts of "doubtful" owing to low grade of ore or world market conditions. Petroleum exploration also slackened because several companies halted drilling activity to reevaluate their so far unsuccessful efforts. On the positive side, three companies announced plans to drill additional test wells in 1973, and discovery was made of a promising iron seam south of Tananarive.

Government Policies and Programs.—The new Malagasy Government declared its intention to redraft the country's Investment Code and all agreements with foreign investors to make them more conducive to the nation's development. However, no actions had been taken on any of these matters by yearend, and there were no changes in corporate taxes or in the laws controlling remittances of capital and profits. Because of the economic slump and capital outflow that followed the May 1972 revolution, exchange controls were imposed in November 1972 which severely limited transfers of money out of the country, and these controls remained in effect into 1973. The Government continued to welcome foreign private investment, but it had become more selective in its approval of projects.

Legislation covering offshore hardrock mining was being prepared by the Government to fill a legal void. At present, the Petroleum Code is the only law pertaining to any form of offshore mineral activity. A general environmental code may also be under consideration.[53]

Three major hydroelectric projects are currently in the planning stage. Each would make power available for the establishment of smelters to process the country's undeveloped metal deposits. Closest to realization is an installation on the Namorona River between Fianarantsoa and the east

[49] Mining Annual Review. Diamonds. June 1972, p. 124.
[50] U.S. Embassy, Maseru, Lesotho. State Department Telegram 1121, November 1972, 1 p. World Petroleum Report 1973. National Studies, Lesotho. V. 19, p. 64.
[51] U.S. Embassy, Maseru, Lesotho. State Department Telegram 771, July 1972, 3 pp.
[52] By David G. Willard, economist, Division of Nonmetallic Minerals—Mineral Supply.
[53] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A–77, June 30, 1972, pp. 2–3.

coast, for which a $20 million loan was negotiated with the Japanese Government.[54] Largest of the proposed projects is the Rogez Project on the Vohitra River near Moramanga, which is in the vicinity of nickel and chromite deposits.[55] The third, which may have a later timetable, is on the Manery River in southern Madagascar and would supply power to process the Manantenina bauxite deposit.[56]

PRODUCTION

Total recorded mineral production declined an estimated 4% in value to $11.9 million in 1972 from a revised estimate of $12.4 million in 1971. Statistics are unavailable on the production of building materials—stone, and sand and gravel—for domestic consumption, and it is not included in the previously presented totals for either year.

Market problems were behind most of the decline in mineral production in 1972. Lower demand for chromite in 1971, partly due to the economic slump in Japan, which is a major customer, caused Compagnie Minière d'Andriaména (COMINA) to reduce its output 25% in 1972. A little under half of the 1971 output had to be stockpiled. The falloff in local economic activity and investment in the second half of 1972, resulting from uncertainty about the new government's policies, caused a decrease in production of cement and salt. A strike at the Amboania cement plant in October and November 1972 also contributed to the lower cement output and caused a temporary shortage.

Production of most other mineral commodities was also below 1971 levels. Graphite output decreased in 1972, although higher prices caused an actual increase in the total graphite value, and production of phlogopite mica remained at its depressed 1971 level. The outlook for phlogopite remains poor owing to its replacement by reconstituted mica and the demand erosion in electronics usage resulting from solid-state technology and miniaturization. Of the country's major minerals, only petroleum refinery production showed improvement, rising 5% from its 1971 level of 4.3 million barrels to slightly over 4.5 million barrels in 1972.

Mineral production figures for the Malagasy Republic are included in table 1.

TRADE

Despite a rise in mineral production in 1971, the value of mineral commodity exports declined 10% from the 1970 level. (Trade statistics from other countries generally became available long after mineral production figures, and are therefore reported a year later.) Of the major commodities only exports of precious and semiprecious stones and petroleum refinery products showed slight improvement. The other major mineral exports—chromite, graphite, and mica—all decreased from their 1970 levels for various reasons. A recession in the metals industries of Europe and Japan in 1971 probably caused the reduction in chromite and graphite shipments. Long-term market problems, described under Production, were responsible for the sharp drop in exports of phlogopite mica. Expansion work in the Tamatave oil refinery caused a temporary reduction in its output which, along with increased domestic demand, accounted for the decline in exports of refined petroleum products.

A rise in the value of mineral and related product imports moved the balance of mineral commodity trade further into the red in 1971. Imports of refined petroleum products registered the greatest increase; purchases of cement and nonferrous metals were also larger than in 1970. The country's deficit in mineral commodity trade rose 12%, far less, however, than the deficit in total commodity trade, which jumped 259% owing to increased imports of industrial equipment and consumer goods. Values of total commodity trade and mineral commodity trade in 1969 through 1970 were as follows in million dollars:

	1969	1970	1971
Total commodity trade:			
Exports	117.6	145.2	147.3
Imports	186.3	170.9	213.9
Balance	−68.7	−25.7	−66.6
Mineral commodity trade:			
Exports	9.3	13.3	12.0
Imports	NA	29.7	30.4
Balance	NA	−16.4	−18.4

Source: Statistiques du Commerce Extérieur de Madagascar. V. 1 issues for 1969, 1970, and 1971.

Detailed statistics on mineral commodity trade are given in tables 6 and 7.

[54] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A-061, May 18, 1973, p. 1.

[55] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A-107, Aug. 11, 1972, p. 2.

[56] Page 3 of work cited in footnote 55.

Table 6.—Malagasy Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Beryl ore and concentrate	31	14
Chromite	130,341	105,690
Copper metal and alloys:		
Unwrought and scrap	340	212
Semimanufactures	(1)	(1)
Iron and steel:		
Scrap	5,047	--
Semimanufactures	663	497
Lead metal and alloys, all forms	15	5
Manganese ore and concentrate	--	14
Zinc metal and alloys, all forms	20	3
Other ore and concentrate	38	55
NONMETALS		
Abrasives, natural garnet	33	4
Cement, hydraulic	5	116
Clays and products	4	1
Graphite, natural	20,307	17,777
Lime	11	13
Mica, all forms	1,201	942
Precious and semiprecious stones, including quartz crystal, except diamond ---kilograms--	141,495	142,124
Salt and brine	2,798	2,168
Stone, sand and gravel	95	77
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels--	258	308
Kerosine ---do---	144	138
Distillate fuel oil ---do---	231	538
Residual fuel oil ---do---	1,359	2,299
Lubricants ---do---	(1)	(1)
Other ---do---	1	165

[1] Less than ½ unit.

Table 7.—Malagasy Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	264	341
Metal and alloys, all forms	r588	1,285
Arsenic oxide and acid	2	2
Chromium:		
Ore and concentrate	5	--
Oxide and hydroxide	1	1
Cobalt oxide and hydroxide ---kilograms--	22	5
Copper:		
Ore and concentrate	--	(1)
Metal and alloys, all forms	r161	[2]141
Gold metal, unworked and partly worked ---troy ounces--	3,472	9,099
Iron and steel:		
Ore and concentrate	--	5
Scrap	(1)	90
Pig iron, ferroalloys, and similar materials	97	52
Steel, primary forms	--	(1)
Semimanufactures	r59,749	50,041
Lead:		
Oxides	24	14
Metal and alloys, all forms	r369	408
Magnesium metal and alloys, all forms	(1)	(1)
Manganese oxides	2	5
Mercury ---76-pound flasks--	7	6
Nickel and alloys, all forms	r1	(1)
Platinum-group metals and alloys, all forms ---troy ounces--	161	64
Silver metal and alloys, all forms ---do---	5,594	4,662
Tin metal and alloys, all forms ---long tons--	r14	13
Titanium oxides	51	20
Zinc:		
Oxide and hydroxide	44	29
Metal and alloys, all forms	r128	96
Other:		
Oxides and hydroxides	3	4
Metalloids, n.e.s	21	9
Metals and alloys, all forms, n.e.s	r8	12

See footnotes at end of table.

Table 7.—Malagasy Republic: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
NONMETALS		
Abrasives:		
Crude, natural	r 33	29
Dust and powder of precious and semiprecious stones ——kilograms	40	13
Grinding wheels and stones	51	52
Asbestos	13	5
Barite	11	12
Borates, crude natural	9	15
Cement, hydraulic	72,680	93,206
Chalk	548	615
Clays and clay products (including all refractory brick):		
Crude, n.e.s	1,304	684
Products	r 2 15	2
Diamond, all grades ——thousand carats	60	30
Diatomaceous earth	55	103
Feldspar, leucite and nepheline	--	10
Fertilizer materials:		
Crude and manufactured:		
Nitrogenous	r 4,972	6,502
Phosphatic	5,744	2,328
Potassic	4,343	3,798
Other including mixed	15,849	10,963
Ammonia	51	68
Graphite	(1)	(1)
Gypsum and plaster	5,096	4,569
Lime	r 886	1,128
Magnesite	5	37
Mica, crude and worked	15	15
Pigments, mineral including iron oxide	r 220	182
Precious and semiprecious stones ——kilograms	287	160
Quartz crystal ——do	1	27
Salt and brine	978	1,302
Sodium and potassium compounds, caustic soda	r 1,700	2,299
Stone, sand and gravel:		
Dimension stone	r 5	20
Dolomite	37	--
Gravel and crushed rock, n.e.s	119	39
Quartz and quartzite	82	18
Sand, excluding metal bearing	75	55
Sulfur:		
Elemental, all forms	r 22	30
Sulfur dioxide	5	2
Sulfuric acid	r 103	134
Talc, steatite, soapstone and pyrophyllite	30	94
Other:		
Crude nonmetals n.e.s	r 7,249	6,716
Oxides and hydroxides of magnesium, strontium, and barium	(1)	2
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	NA	(1)
Carbon black	12	6
Coal including briquets, all grades	20,994	23,060
Coke and semicoke	54	105
Petroleum:		
Crude and partly refined ——thousand 42-gallon barrels	4,206	3,958
Refinery products:		
Gasoline ——do	r 87	112
Kerosine and jet fuel ——do	r 2	11
Distillate fuel oil ——do	r 15	177
Residual fuel oil ——do	r 8	1
Lubricants ——do	55	52
Other:		
Liquefied petroleum gas ——do	1	1
Mineral jelly and wax ——do	r 35	27
Petroleum coke ——do	8	14
Bitumen, bituminous mixtures, and other residues ——do	r 38	84
Miscellaneous ——do	(1)	(1)
Total ——do	249	479
Mineral tar and other coal–, petroleum–, or gas-derived crude chemicals	r 660	181

r Revised. NA Not available.

1 Less than ½ unit.

2 Partial figure.

COMMODITY REVIEW

Bauxite.—Compagnie de Produits Chimiques et Péchiney (Péchiney) completed its investigation of the bauxite deposits near Manantenina during 1972. Prospects for immediate development of the bauxite deposits remained doubtful. Péchiney indicated that it would not consider developing the deposits unless one or more partners could be found to share the investment. Moreover, it appeared unlikely that the project would be economically feasible until the world aluminum market recovered from its current slump.[57]

The proposed hydroelectric projects on the Namorona and Manery Rivers, previously mentioned under Government Policies and Programs, would make power available for the establishment of aluminum smelters.

Iron.—Discovery of an iron seam near Ambonimahavony, south of Tananarive, in 1971 was reported in the 1971 Minerals Yearbook. Development of the seam was considered a good possibility because of its susceptibility to surface mining and its location near a railroad.

Mica.—Production of phlogopite mica has trended downward for many years, mostly as a result of the marketing difficulties described previously. The closing of one of the largest mica mines on the island, due to the rising cost of mining less accessible ore, now makes a further reduction in output appear likely. This mine was noted for producing mica of a silver quality.[58]

Nickel.—Société le Nickel was expected to issue a report in 1972 on its exploration of a lateritic nickel deposit near Moramanga. Reportedly, the results were not encouraging.[59]

The Rogez hydroelectric project on the Vohitra River in the same area, would provide power for use in a nickel smelter if development of the deposit should prove to be feasibile.

Petroleum.—Exploration activity slackened in 1972 while the oil companies reevaluated the results of their previously unsuccessful drilling. Only one test well was being drilled at yearend. A total of eight other wells have been completed in the last few years, all dusters. However, activity was scheduled to pick up in 1973 because plans to drill four additional wells have been announced.

No petroleum exploration concessions were granted or relinquished in 1972, but Compagnie des Pétroles Total Madagascar (COPETMA) and Azienda General Italiana Petroli (AGIP) each received 5-year extensions of concessions off the west coast of the island. Little change also occurred in the makeup of the oil company combines operating the concessions. Esso resold to AGIP its 50% interest in one of the two permit areas it has been sharing with the company but retained its interest in the other. Mitsubishi Oil Development Corp. purchased from Continental Oil Co. (CONOCO) half of its 50% interest in a concession shared with Société des Pétroles de Madagascar (SPM) but resold it after the first test well proved dry.

SPM/CONOCO announced plans to drill two wells in 1973, and AGIP and Tenneco Corp. were each planning one further well in 1973.[60]

Expansion of the refinery at Tamatave was completed during 1972, raising its capacity from 14,000 to 31,500 barrels per day. However, riots and racial disturbances that struck the city in December resulted in the departure of its engineering staff and a temporary halt in operations.[61]

Construction began on a lubricating oil blending plant in December 1972. The plant, also in Tamatave, will be owned by the five petroleum product distributing companies in the country: Esso, Shell, AGIP, Caltex, and COPETMA. Investment cost is estimated at $800,000. The plant will produce 84,000 barrels annually of various types of automotive and industrial oil, which is expected to satisfy the country's needs and provide a small surplus for export.[62]

Other Minerals.—Exploration of the promising mineral sands deposits along the northeast and southeast coasts of Madagascar was being undertaken by the United States Steel Corp., the Montecatini Edison Co., and

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[57] Page 4 of work cited in footnote 55.
Joint Publications Research Service. Translations on Africa. Can the Ramanantsoa Government Succeed? No. L/4393, Jan. 24, 1973, p. 8.

[58] Mining Annual Review. Mica. June 1972, p. 97.

[59] Engineering and Mining Journal. Exploration Round-up. V. 173, No. 7, July 1972, p. 25.

[60] Page 1 of work cited in footnote 53.
U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A-102, Aug. 8, 1972, 2 pp.

[61] Oil and Gas Journal. Worldwide Construction. V. 70, No. 14. Apr. 3, 1972, p. 85.
Page 6 of work cited in footnote 57.

[62] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A-004, Jan. 5, 1973, 1 p.

others. The deposits are of particular interest as sources of titanium. ilmenite, and zircon.[63]

A venture to exploit deposits of marble at Ambatofinandrahana was formed by members of the Tsiranana Government early in 1972. Work on the project was progressing slowly.[64]

MALAWI [65]

The mineral industry of Malawi was a minor factor in the economy of the country, which was mainly dependent upon the agricultural sector. Approximately 87% of the population of 4.7 million depends upon agriculture for a living.

Minerals industry activity consisted chiefly of quarrying limestone for use in the manufacture of cement and the production of unrecorded quantities of stone, sand, and gravel for use in local construction. Mineral economic studies were conducted on a bauxite deposit near Mount Mulanje, southeastern Malawi, and on a deposit of monazite-strontianite on the Matope Plain near Balaka. Foreign trade in mineral commodities consisted mainly of imports of iron and steel semimanufactures, and fertilizer materials.

Two reports on airborne geophysical surveys conducted in Malawi on behalf of the United Nations Development Programme (UNDP) were released by the Malawi Government.

In 1972 the Malawi Government made available to Zambia rail transportation facilities in Malawi and port facilities at Nacala, Mozambique. Materials consisting mainly of copper, lead, and zinc were shipped across Malawi and Mozambique for export to foreign destinations. Some mineral fuels were shipped to Zambia over the same route.

Reportedly Lonrho (Malawi) Ltd., after an elaborate testing program running over 2 years, concluded that the bauxite deposit on Mount Mulanje was not commercially exploitable at the present time. Reserves in the deposit were estimated at 28.5 million tons of accessible bauxite plus another 1.5 million tons inaccessible. At one time the deposit was thought to contain 100 million tons of bauxite. Other facts in Lonrho's decision not to develop the deposit was that electric power rates, and transportation costs through Mozambique have not been reduced.

Portland Cement Co. (Malawi) Ltd. completed construction on a new kiln in August, which will help to reduce the shortage of cement that has hampered construction in recent years. Total production of cement clinker will be 220,000 tons per year. Cost of the new kiln was $2.8 million.[66] In 1971 imports of portland and hydraulic cement totaled 5,251 tons valued at $167,437.

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[63] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A–75, June 27, 1972, 3 pp.
Mining Annual Review. Malagasy. July 20, 1973, p. 359.

[64] Joint Publications Research Service. Translations on Africa No. 1106. National Assembly Discusses New Budget. JPRS 54988, Jan. 20, 1972, p. 45.

[65] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[66] Where necessary, values have been converted at the rate of 1 Malawi kwacha=US$1.30.

Table 8.—Malawi: Foreign trade in mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS		
METALS		
Aluminum metal and alloys, all forms	23	1
Copper metal and alloys, all forms	94	102
Iron and steel: Pig iron, ferroalloys, crude steel and semimanufactures	2,355	1,098
Lead metal and alloys, all forms	101	44
Nickel metal and alloys, all forms	(2)	--
Zinc metal and alloys, all forms	1	--
NONMETALS		
Cement, hydraulic	5	25
Stone, sand and gravel	151	--
Other nonmetals, n.e.s	607	--
IMPORTS		
METALS		
Aluminum metal and alloys, all forms	148	434
Copper metal and alloys, all forms	19	28
Iron and steel:		
Scrap	44	50
Pig iron, ferroalloys, crude steel and semimanufactures	17,211	21,844
Lead metal and alloys, all forms	19	27
Nickel metal and alloys, all forms	(2)	--
Tin metal and alloys, all forms ---long tons--	4	4
Zinc metal and alloys, all forms	2	1
Other: Precious metals, not further specified ---troy ounces--	1,977	10,894
NONMETALS		
Abrasives, natural, n.e.s	13	7
Cement, hydraulic	3,357	5,251
Clays and clay products:		
Nonrefractory	879	1,019
Refractory	97	149
Fertilizer materials:		
Nitrogenous	27,974	84,637
Phosphatic	2,394	944
Potassic	82	442
Other, including mixed	4,724	5,313
Lime	2,618	1,803
Mica	4	12
Salt and brine	11,523	12,519
Stone, sand and gravel:		
Dimension stone	30	25
Other	4,822	2,565
Sulfur	21	9
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	(2)	17
Coal	45,576	49,320
Petroleum:		
Crude ---thousand 42-gallon barrels--	(2)	(2)
Refinery products:		
Gasoline ---do---	270	293
Kerosine ---do---	52	59
Distillate fuel oil ---do---	362	105
Residual fuel oil ---do---	29	34
Lubricants ---do---	22	25
Other ---do---	124	113

[1] This table has been compiled from official trade statistics of Malawi, unlike the trade table in the previous edition of this chapter which was compiled from trade returns of trading partner countries. As a result, all data for 1970 differs from that in the previous editions.

[2] Less than ½ unit.

MALI [67]

The minerals industry of the Republic of Mali was of minor importance to the economy of the country, which was mainly based upon agriculture. Mali, one of the 25 most underdeveloped countries in the world, had a gross domestic product (GDP) estimated at $292 million [68] in 1972, or a per capita income of about $57.

Activity in the minerals industry was centered mainly around exploration for minerals and crude oil. The United Nations Development Program continued its exploration for ground water resources in western

[67] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[68] Where necessary, values have been converted from Malian francs (MF) to U.S. dollars at the rate of MF500=US$1.00.

Mali, and planned to spend $192,000 in 1973. The project, which has been active for 4 years, has been relatively successful and is applicable to alleviating present Sahelian drought conditions. The National Society for Research and Mineral Exploration (SONAREM) began prospecting manganese deposits near Ansonga in 1971, mainly the hills of Takavasita, and other areas farther north near Agaula and Tondibi.[69] In 1972, SONAREM concentrated its investigation on manganese mineralization in the Ofatikin Hill Area, Gourma region. Drilling was carried out in 1972 on lithium occurences in the Bougouni Region, discovered in 1971 by geochemical prospecting. The deposit of gold at Kalana, which has been studied for mineralization to a depth of 820 feet, was being investigated by sinking shafts and tunneling. In July the Governments of Mali and the Soviet Union signed an agreement whereby the U.S.S.R. will supply technical assistance, equipment, and materials valued at $4 million, for exploitation of the Kalana deposit. Another indication of gold in the Kodiéran stream, Kalana Region, also was being investigated.

The consortium of Friedrich Krupp G.m.b.H. and Saarbergwerke A.G. gave up two permits to explore for radioactive minerals in the area near Kidal and Kayes.

Texaco Mali Inc., an affiliate of Texaco Overseas Petroleum Co., was conducting an aeromagnetic survey of its exploration permit area in the Taoudeni Region of northern Mali. In early 1972, the Government of Mali granted an 18-million-acre exploration permit to Global Energy Co.[70] of Dallas, Tex. At midyear Global signed an agreement with Mali Sun Oil Co. assigning 60% of the concession to Mali Sun. Mali Sun was conducting seismic tests on its concession area at yearend.

Production of mineral commodities in 1972 consisted mainly of the output of limestone, salt, and unrecorded quantities of stone, clays, and sand and gravel for local construction purposes. Cement was manufactured at a plant located at Diamou. The plant reportedly has a production capacity of 50,000 tons of cement per year. Bricks are manufactured by Mali Brick Co. at the Magnanbougou brickyards. Ceramic articles such as tiles, plates, dishes, sinks, and bathroom appliances are manufactured from local raw materials in the ceramics plant at Djikoroni.

Foreign trade in mineral commodities in 1971 consisted mainly of imports of petroleum products valued at $5.2 million, and iron and steel products valued at $4.5 million.

MAURITANIA [71]

The mineral industry of the Islamic Republic of Mauritania in 1972 contributed more than $84.77 million[72] (53%) of the gross national product (GNP) estimated at $160 million. Mauritania's minerals activity consisted mainly of the production and export of iron ore and copper concentrate and of exploration for mineral deposits. Unrecorded quantities of salt, gypsum, sand and gravel, and stone, also were produced for local consumption.

The Government of Mauritania created a new company, Société National Industrielle et Minière (SNIM) to look after the Government's interest and serve on the boards of directors of most mining and manufacturing enterprises. SNIM also planned to mine gypsum at a deposit near Nouakchott for export to Senegal, establish an electric steel mill, a plant to produce industrial salt, an explosives factory, and a copper metallurgical plant.

A cement plant with production capacity of 50,000 tons per year was scheduled to be built at Nouakchott by the People's Republic of China. Mauritania's consumption of cement was estimated at 25,000 tons per year. Raw material for cement manufacture would be oyster shells and locally mined clays and gypsum. A new water supply channel will furnish 792,510 gallons of water per day for cement manufacture. Construction was expected to begin in 1974 and the plant could be operating in 1975.

The United Nations Development Programme (UNDP) published a report of a

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[69] Annales des Mines (Paris). Panorama De L'Industrie Minière du Continent Africian en 1971 (Panorama of the Mining Industry on the African Continent in 1971). November 1972, pp. 82-83.

[70] World Petroleum Report. Mali. V. 19, 1973, p. 66.

[71] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[72] Where necessary, values have been converted from African Financial Community francs (CFAF) to U.S. dollars at the rate of CFAF 250 = US$1.00.

photogeologic study of the east part of the Dorsale Reguibat Region, and of the area to the south.

The Ministry of Plan and Industrial Development of Mauritania was considering an offer by an Austro-Belgium consortium to build a 20,000-barrel-per-day petroleum refinery at Nouadhibou.[73] Construction costs were estimated at $64 million. Crude oil would be imported from Algeria and Libya, and 90% of the refined products would be exported to Europe and the United States.

A team of Bulgarian geologists arrived in Mauritania recently, where they conferred with officials of the Industrial Development Ministry and SNIM.

The Government granted a mineral exploration permit to Compagnie Française des Pétroles of Paris to prospect for uranium in a 38,600-square-mile area.[74]

Production of iron ore and copper ore and concentrates in 1972 was valued at $89.7 million.[75] Iron ore output increased 10% compared with that of 1971 due to improved international market conditions in the second and third quarters. Production of copper ore increased 196% in 1972 compared with that of 1971. However, Société Minière de Mauritania (SOMIMA) operations near Akjoujt have been marked by plant shutdowns, because of equipment failures and strikes. In 1972, the plant was shutdown for 2 months. Production in 1973 was expected to reach 30,000 to 35,000 tons of copper ore. Statistics on production of mineral commodities are shown in table 1.

Foreign trade in mineral commodities consisted mainly of exports of 8,617,000 tons of iron ore valued at $73.9 million compared with exports of 8,601,000 tons valued at $81 million in 1971. Shipments of iron ore in 1972 went mainly as follows: United Kingdom (1.75 million tons), France (1.70 million tons), Italy (1.39 million tons), Belgium-Luxembourg (1.21 million tons), Japan (1.15 million tons), and West Germany (767,000 tons). Copper concentrate exported in 1972 totaled 15,051 tons valued at $10.9 million. All of the concentrates were exported to Spain and France. Imports of mineral commodities into Mauritania consisted mainly of iron and steel semimanufactures, petroleum products, cement, and fertilizer materials. Statistics on foreign trade are shown in tables 9 and 10.

The 1970–73 Mauritanian Development Plan had anticipated production of copper concentrate in 1970 of 22,500 tons and 50,000 tons in 1971. However, because of a strike at SOMIMA's operations in 1971 and a number of technical difficulties with plant and equipment, production in 1971 totaled only 7,660 tons of copper ore and 22,651 tons in 1972. Employment at SOMIMA included 60 supervisors and 440 laborers and clerks, all of whom were Mauritanian citizens. Foreigners totaled 114, 100 of which were supervisors and 14 were staff employees.

The bulk of the ore now exploited by Société des Mines de Fer de Mauritanie (MIFERMA) comes from the Tazadit deposit. Improvement of facilities at Rouessa to allow exploitation of lower grade ore will require an investment of $48 million. MIFERMA will be able to increase production to 11.4 million tons after installations have been completed. However, it has been estimated that known reserves exploited by MIFERMA will be worked out in about 12 years based upon production of 12 million tons per year. Therefore, MIFERMA was conducting technical, economic, and financial studies on the Guelb deposits located east of Zouerate. These seam deposits, which contain significant reserves of low-grade magnetite ore, will require treatment in plants to enrich the iron content of the ore. Studies of the Guelb deposits will be completed by 1975. Employment by MIFERMA in 1972 was estimated at an average of 4,386 workers, of which 3,707 workers were Mauritanian nationals or other Africans. European workers totaled 679 persons, 595 supervisors and 84 staff. The total number of wage earners in Mauritania was estimated at between 17,000 and 18,000 persons.

Two United States petroleum firms, Seneca of Oklahoma City and Oceanic Exploration of Boulder, Colo., were negotiating with the Government of Mauritania for a petroleum exploration concession. At yearend Seneca was granted an 8-million-acre area onshore, in the Nouakchott to Cap Timeris Region. Oceanic was given preliminary approval to prospect in a 4,721-square-mile

[73] U.S. Embassy, Nouakchott, Mauritania. State Department Airgram A-30, June 4, 1973, 3 pp., 1 encl.

[74] World Mining. Mauritania. V. 26, No. 2, February 1973, p. 68.

[75] Europe Outremer (Paris). The Place of Iron and Copper in the Economy. April 1973, pp. 40-81.

area offshore between Cap Timeris and Nouadhibou.[76]

Amoco Mauritania Petroleum Co. and Planet Oil Co. completed its second wildcat well offshore from Cap Timeris in December. The 10,000-foot-plus hole was dry, and no positive findings were reported. Esso (Exxon) Exploration and Production Mauritania notified the Government that it will relinquish its permit area in 1973. The company has drilled three dry holes in its concession area offshore between Nouakchott and the Senegal border.

Texaco Mauritania Inc. conducted seismic surveys and planned to sink a wildcat well at a location 124 miles northeast of Tichitt, Central Mauritania.[77] If the first well shows promise, Texaco may decide to drill several more. However, if results are not promising, rigs and crews will be sent by air to Niger and thereafter to Mali where Texaco also holds extensive concessions. Working in the semidesert Sahel Region is expensive. It has been estimated that the entire Texaco three-country program could cost up to $50 million.

Shell Mauritania Oil Co. was granted an offshore exploration concession area of more than 12,275 square miles.[78] The 5-year agreement calls for a $22 million minimum expenditure and the drilling of at least two wells. The agreement is renewable twice.

[76] U.S. Embassy, Nouakchott, Mauritania. State Department Airgram A-06, Jan. 22, 1973, 2 pp.
[77] U.S. Embassy, Nouakchott, Mauritania. State Department Airgram A-28, Jan. 22, 1973, 2 pp.
[78] World Petroleum Report. Mauritania. V. 19, 1973, p. 66.

Table 9.—Mauritania: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, bauxite and concentrate	118,994	--	
Copper, ore and concentrate	35	5,340	France 2,598; West Germany 357; Spain 357.
Iron and steel:			
Ore and concentrate, except roasted pyrite—thousand tons	9,221	8,601	France 1,768; United Kingdom 1,624; Belgium-Luxembourg 1,254.
Metal, scrap	1,836	2,372	France 2,360.
NONMETALS			
Cement	70	NA	
Clay products, nonrefractory	--	17	All to Mali.
Salt	2,497	2,165	Congo (Brazzaville) 1,802; Zaire 271.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, refinery products:			
Gasoline—42-gallon barrels	349	NA	
Kerosine—do	2,581	NA	
Distillate fuel oil—do	15,785	NA	
Residual fuel oil—do	186	NA	
Lubricants—do	35	NA	

NA Not available.
[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Mauritania, rather than from trade returns of trading partner countries as was done in the previous edition (when actual Mauritanian statistics were not available).

Table 10.—Mauritania: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum metal, including alloys, semimanufactures	47	45
Copper metal, including alloys, semimanufactures	57	25
Iron and steel metal, semimanufactures	6,513	9,172
Lead:		
Oxides	2	1
Metal, including alloys, all forms	6	12
Tin metal, including alloys, all forms ——long tons	12	NA
Zinc metal, including alloys, all forms	31	4
Other base metals, including alloys, all forms, n.e.s	--	8
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	40	26
Cement	32,866	21,714
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	87	241
Products:		
Refractory (including nonclay bricks)	180	15
Nonrefractory	465	251
Fertilizer materials:		
Manufactured:		
Nitrogenous	3,507	3,175
Phosphatic	--	62
Ammonia	9	8
Gypsum and plasters	6	9
Lime	112	123
Pigments, mineral, iron oxides, processed	3	--
Pyrite (gross weight)	--	46
Salt	4,735	4,659
Sodium and potassium compounds, n.e.s	18	18
Stone, sand and gravel:		
Dimension stone, worked	32	--
Gravel and crushed stone	42	18
Sand, excluding metal bearing	434	51
Sulfuric acid, oleum	16	16
Talc and steatite	5	--
Other:		
Nonmetals, n.e.s	6	--
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	460	328
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	19
Coal	12,311	6,851
Petroleum refinery products:		
Gasoline ——thousand 42-gallon barrels	105	94
Kerosine ——do	11	8
Distillate fuel oil ——do	538	415
Residual fuel oil ——do	126	65
Lubricants ——do	31	29
Liquefied petroleum gas ——do	9	10
Bitumen and other residues ——do	20	9
Bituminous mixtures, n.e.s ——do	23	8
Other ——do	(2)	(2)
Total ——do	863	638

NA Not available.

[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Mauritania, rather than from trade returns of trading partner countries as was done in the previous edition (when actual Mauritanian statistics were not available).

[2] Less than ½ unit.

MAURITIUS [79]

The mineral industry of Mauritius made only a minor contribution to the economy of the small island in the Indian Ocean. Agriculture, mainly the raising of sugar cane and the refining of sugar for export was the principal sector of the economy, as represented by the gross national product (GNP) of $170 million in 1972.[80] However, about 6,000 tons of coral are mined each year for the manufacture of lime, which is used by the sugar industry. About 4,000 tons of salt was produced by solar evaporation of sea water for local consumption. Unrecorded quantities of stone, and sand and gravel also were produced for road and building construction.

A plant to produce fertilizer at the rate of 125,000 tons per year was being constructed at Port Louis. It was scheduled to be completed in late 1973. International Chemicals Industries and the Harel Interests have negotiated a joint venture to build and own the factory.

Mauritius has concluded an Investment Guaranty Agreement with the United States. Overseas Private Insurance Corp. (OPIC) political risk insurance was available for U.S. investors on some projects.

Foreign trade in mineral commodities mainly consisted of imports of petroleum products and fertilizer materials.

Texaco Mauritius Inc. concluded its seismic surveys and was preparing to drill a wildcat well offshore, north of St. Brandon in the Cargados Carajos shoals area.

NIGER [81]

The mineral industry of Niger, although small compared with the agricultural and other industrial sectors, assumed increased importance in the overall economy in 1972. Mining was the main employer of industrial labor (1,000 workers) and uranium became the second most important export commodity (after peanuts).

The value of mineral production, for which statistics were not available, apparently increased substantially due to the doubling of uranium output during the year. Uranium production, valued at an estimated $11.5 million, accounted for most of Niger's mineral production value in 1972. Other mineral commodities produced were cement, limestone, clay, gypsum, salt, small tonnages of cassiterite, and minor quantities of gold. Various amounts of crude construction materials (sand and gravel, clay, and stone) for local consumption were also produced. Mineral exports consisted of uranium and tin concentrates. Principal mineral imports were iron and steel semimanufactures and refined petroleum products.

The search for exploitable mineral and petroleum deposits increased as the Government continued to encourage exploration. The United Nations Development Program mineral survey continued, and plans were made to further evaluate mineral occurrences in the Liptako, Kourki, and Aïr Mountain Areas. Large sections of the country, under lease to United States petroleum companies, were being investigated largely by seismic methods for possible exploratory drilling sites. Two uranium deposits, south of the Arlit uranium mine, were being evaluated for possible production. The Essex Iron Co., a subsidiary of United States Steel Corp., concentrated exploration activity on its lease in the Liptako Area of western Niger. Exploratory drilling was carried out in several areas of base metal mineralization.

Bishop Oil and Refining Co. contracted with Hunting Geology and Geophysics, Ltd., for a 5-year exploration program to delineate possible ore deposits, including diamonds, in Bishop's 39,000-square-kilometer concession in the Aïr Mountains.[82]

Société des Mines de l'Air (SOMAIR), a consortium composed of the Government of Niger (GON), the French Commissariat à l'Énergie Atomique (CEA), Compagnie Française des Minerals d'Uranium, Péchiney-Mokta Mining Co. (France), Urangesellschaft A.G. (West Germany), and Agip Nucleare (Italy), increased production of uranium concentrate at the Arlit uranium mine in northwest Niger to 867 tons, compared with 429 tons in 1971. Only 353 tons of uranium concentrate were exported, most-

[79] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.
[80] Where necessary, values have been converted from Mauritius Rupees (Mau Rs) to U.S. dollars at the rate of Mau Rs5.32=US$1.00.
[81] By James H. Jolly, physical scientist, Division of Nonferrous Metals—Mineral Supply.
[82] World Mining. V. 8, No. 2, February 1972, p. 54.

ly to France. Plans to increase the annual capacity of the Arlit mill to 1,500 tons of U_3O_8 were delayed until 1975, owing to the depressed world uranium market, large investment requirements, and relatively high cost of production. Arlit uranium reportedly cost about $2 per pound more than the world price delivered in Europe, owing to the high haulage cost over the 1,300-kilometer truck and rail route from Cotonou, Dahomey.[83]

The Akokan (also referred to as Akouta) uranium deposit, located 20 kilometers south of Arlit, was being evaluated jointly by the GON, CEA, and Overseas Uranium Resources Development Co. (Japan). The deposit occurs at a depth of 100 meters and has estimated reserves of 30,000 tons U_3O_8. An operation similar to that at Arlit was envisioned.

The CEA continued exploration programs on uranium deposits at Imouraren, 50 kilometers south of Arlit, and at Teduidda N'Tessoum, about 200 kilometers southeast of Arlit. Prospecting activity on CEA's lease at Djago in northeastern Niger was planned in 1973.

Société Minière du Niger (SMDN) increased production of tin concentrates to 136 tons, 11 tons higher than in 1971, at the Taroudji and El Meki mines in the southern Aïr Mountains. Tests conducted, using Dry-Flo equipment, brought some improvement in upgrading the tin content in the concentrate. During 1972, 144 tons of tin concentrate, valued at $245,545,[84] was exported to Nigeria and Belgium for processing.

The small gold production resulted from artisanal panning of alluvial deposits in the Sirba River Region. The Geological Service Department of Niger continued to investigate gold occurrences in the Maradi Region, but no production was reported. Niger's one cement plant, at Malbaza, operated at about 80% of capacity during 1972, producing about 35,000 tons of cement, the same as in 1971. Traditional production of salt by solar evaporation was sufficient for domestic needs.

In oil exploration, U.S. oil companies increased activities in their permit areas. In March, the Government approved the acquisition by Niger Sun Oil Co. of 85% of Global Energy Co.'s 75,000-square-kilometer H-Dosso permit in southwestern Niger. Photogeologic studies and an aeromagnetic survey began in April. Seismic surveys were completed on the Agadem permit of Texaco Niger, Inc., and in the western part of Continental Overseas Oil Co.'s Niger S permit. Bishop Oil and Refining contracted with Aeroservices, Inc., for an aeromagnetic survey of its Djada permit.

[83] U.S. Embassy, Niamey, Niger. State Department Airgram A-010, Mar. 13, 1972, p. 2.

[84] Where necessary, values have been converted from Communauté Financiere Africaine Francs (CFAF) to U.S. dollars at the rate of CFAF275=US$1.00.

Table 11.—Niger: Foreign trade in mineral commodities[1]
(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS		
METALS		
Aluminum metal, including alloys, semimanufactures	2	2
Iron and steel:		
Ore and concentrate, except roasted pyrite	2	--
Metal, semimanufactures	6	--
Lead metal, including alloys, semimanufactures	1	--
Tin ore and concentrate, long tons	62	178
Other ore and concentrate of base metals, n.e.s	--	402
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline, 42-gallon barrels	408	2,151
Distillate fuel oil, do	403	--
Lubricants, do	28	--
IMPORTS		
METALS		
Aluminum metal, including alloys, semimanufactures	176	176
Copper metal, including alloys, semimanufactures	3	5
Iron and steel:		
Metal:		
Steel, primary forms	--	3
Semimanufactures	6,120	4,020

See footnotes at end of table.

Table 11.—Niger: Foreign trade in mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
IMPORTS—Continued		
METALS—Continued		
Lead metal, including alloys, unwrought and semimanufactures	3	7
Manganese ore and concentrates	3	--
Mercury ---76-pound flasks--	522	--
Titanium oxides	34	21
Zinc oxide	1	--
Other:		
Metals, including alloys:		
Metalloids	15	2
Base metals, nonferrous, n.e.s	4	--
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	4	3
Barite and witherite	8	7
Cement	53	27
Chalk	20	--
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	6	50
Products:		
Refractory (including nonclay bricks)	111	15
Nonrefractory	374	266
Diamond, industrial ---value, thousands--	--	$25
Diatomite and other infusorial earth	2	2
Fertilizer materials, manufactured:		
Nitrogenous	829	501
Phosphatic	1,266	248
Potassic	20	--
Other, including mixed	100	49
Gypsum and plasters	30	14
Lime	237	290
Pigments, mineral:		
Natural, crude	23	6
Iron oxides, processed	6	10
Salt	13,281	7,753
Soda, caustic	846	884
Stone, sand and gravel:		
Dimension stone, crude and partly worked	3	--
Dolomite, chiefly refractory grade	--	10
Gravel and crushed rock	51	--
Sand, excluding metal bearing	6	3
Sulfur:		
Elemental, other than colloidal	4,001	--
Sulfuric acid, oleum	134	16
Talc, steatite, soapstone and pyrophyllite	17	22
Other nonmetals, n.e.s., building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	62	28
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	22	--
Carbon black	1	--
Coal and briquets of coal	32	--
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels--	128	125
Kerosine ---do---	30	24
Distillate fuel oil ---do---	229	280
Residual fuel oil ---do---	1	1
Lubricants ---do---	9	9
Other:		
Liquefied petroleum gas ---do---	3	3
Bitumen and other residues, and bituminous mixtures, n.e.s ---do---	4	12
Total ---do---	404	454
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	436	--

[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Niger, rather than from trade returns of trading partner countries as was done in the previous edition (when actual Niger statistics were not available).

RWANDA [85]

Cassiterite, Rwanda's chief mineral produced and exported, showed a production increase of 8%, and tungsten production increased 30% compared with that of 1971. Exports of cassiterite accounted for 27% of the total value of exports, compared with 20% in 1971. The total value of mineral exports fell from about $8.2 million in 1971 to about $6.3 million in 1972, mainly because of the drop in tungsten exports. The expansion of mining production was hampered by the lack of new investment in machinery.

Production of methane gas in 1972 was 333,161 cubic meters. Discussions and studies of eventual large scale exploitation of the Lake Kivu methane gas deposits continued.

The People's Republic of China was reported to have an agreement to build a cement plant in the Cyangugu Area.

[85] By V. Anthony Cammarota, Jr., physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 12.—Rwanda: Exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
Beryllium: Beryl concentrates	287	175	Kenya 114;[2] Tanzania 60.[2]
Columbium and tantalum: Columbite-tantalite concentrates	30	30	Kenya 18;[2] United States 7; Tanzania 3.[2]
Tin ore and concentrate—long tons	2,109	2,118	Belgium-Luxembourg 1,860; United Kingdom 146; Uganda 86.[2]
Tungsten ore and concentrate	849	773	Tanzania 295;[2] Kenya 284;[2] Belgium-Luxembourg 105; Uganda 66;[2] United Kingdom 13; Netherlands 10.

[1] Data in this table compiled from official Rwandan statistics rather than from import statistics of trading partner countries as was the case in the 1971 edition of this chapter. Thus, all figures differ from those reported in the previous edition.
[2] Initial shipment destination; ultimate destination unknown.

Table 13.—Rwanda: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum and alloys, metal, all forms [2]	189	160
Copper and alloys, metal, all forms [2]	5	7
Iron and steel, pig iron, ferroalloys, crude steel and iron and steel semimanufactures [2]	6,235	8,766
Lead and alloys, metal, all forms [2]	(3)	1
Nickel and alloys, metal, all forms [2]	(3)	(3)
Tin and alloys, metal, all forms [2]—long tons	(3)	(3)
Zinc and alloys, metal, all forms [2]	5	3
Other:		
Ores, concentrates, cinders, waste and scrap of all metals	1	(3)
Metals and alloys, all forms [2]	--	(3)
NONMETALS		
Cement, hydraulic	14,760	11,715
Salt	7,855	10,195
Other crude nonmetals	52	166
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline:		
Aviation—thousand 42-gallon barrels		2
Other—do		72
Kerosine—do	e 130	27
Distillate fuel oil—do		52
Other—do		10

e Estimate.
[1] Data in this table compiled from official Rwandan statistics rather than from export statistics of trading partner countries as was the case in the 1971 edition of this chapter. Thus, all figures differ from those reported in the previous edition.
[2] May include some quantities of more-highly processed materials than usually reported in Minerals Yearbook.
[3] Less than ½ unit.

SENEGAL [86]

The most significant mineral produced in the Republic of Senegal is phosphate rock and derived fertilizer products. Some cement raw materials, salt, building stone, and attapulgite (fuller's earth) were produced.

A single three-kiln cement plant at Rufisque, owned by Société Ouest Africaine des Ciments, has increased production from its start in 1965 from 206,000 to approximately 250,000 tons per year. Although this plant is relatively small by world standards, 90% of the production is consumed domestically, and the balance is exported to neighboring countries.

Oil prospecting by several international companies has not located commercial quantities. Senegal operates a petroleum refinery at M'Bao near Dakar and supplies most domestic needs from this plant. The refinery has operated since 1963.

Société Prochimat has the capacity to produce about 3,000 tons per year of attapulgite clay. This was approximately the tonnage of clay produced and sold for drilling mud. The deposit is located near Thies.

The Government of Senegal and the U.S.S.R. have agreed to explore for alluvial and primary gold deposits. The cost of the exploration program will be $2.7 million. Reports on the progress of the program have not been made.

Two companies mine phosphates in Senegal. Compagnie Sénégalaise des Phosphates de Taiba mines calcium phosphate, and the Société Sénégalaise des Phosphates de Thiès produces natural aluminum phosphates.

The Taiba Co. deposits, first mined in 1960, are located approximately 70 miles from Dakar, near the city of Tivaouane. The initial production of 600,000 tons of calcium phosphate was increased to 1.1 million tons in 1969 and was 1,398,000 tons in 1971. The phosphate-bearing ore seam is about 21 feet thick under an overburden that ranges from 50 to 80 feet in thickness. Production in 1972 was 1,250,000 tons, a decrease of 11% from 1971 levels, making it necessary to reduce stocks to satisfy sales in 1972.

Sales volume was 1,446,000 tons valued at $12.00 per ton of concentrates averaging 37.5% P_2O_5. All 1972 production tonnage plus 196,000 tons from stocks was exported. Of the tonnage exported, 29.7% was shipped to France, 17.7% to the Netherlands, 17.3% to the United Kingdom, 6.7% to Japan, and lesser quantities were shipped to other European and Asian countries.

International Minerals and Chemical Corp. of Libertyville, Ill., has a 12.5% interest in Phosphates de Taiba. Sales forecasts of from 1.6 to 1.7 million tons in 1973 will make it necessary to expand the plant's capacity of 1.4 million tons per year. Construction is scheduled in 1973 to expand the prewashing and desliming, flotation, and drying units in the beneficiation plant.

The Société Sénégalaise des Phosphates de Thiès, a subsidiary of the Péchiney-St. Gobain Group, operates the Pallo Mine north of Thiès. The deposit is a calcium aluminum phosphate that is blasted after the small amount of overburden is stripped with a bulldozer. The ore is crushed and sized into 4 by 10 millimeters, 10 by 40 millimeters, and 40 by 70 millimeters fractions. Most of the ore is calcined to produce a calcined phosphate fertilizer that assays 34% P_2O_5. The product known as Phospal is calcined at Lam-Lam near Pallo and at Nante, Rouen, and Sete in France. The calcined material is also used in the preparation of Polyfos, an animal feed supplement.

Production of fertilizer materials increased from 194,457 tons in 1971 to 244,454 tons in 1972. The products produced in 1971 and 1972 in tons are compared in the following tabulation:

	1971	1972	Change (percent)
Natural aluminum phosphate rock	146,632	165,646	+ 13
Dryed phosphate rock	45,737	52,338	+ 14
Phospal and Polyfos	1,907	6,238	+227
Baylifos	181	232	+ 28
Total	194,457	224,454	+ 15

The majority of the aluminum phosphate rock, 106,765 tons, was exported to France as was 39,580 metric tons of dried phosphate rock. Phospal and Polyfos were exported to the Ivory Coast. Small quantities were shipped to the Canary Islands and Reunion. The value assigned to the aluminum phosphates was an average of $11.00 per ton.

The future development of the deposits at Thiès will depend on markets for this unique aluminum phosphate mineral. The beds range from 55 to 60 feet in thickness

[86] By W. F. Stowasser, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 14.—Senegal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Copper metal and alloys, all forms		830	585
Iron and steel:			
Scrap		9,341	9,067
Semimanufactures		689	1,044
Lead metal and alloys, all forms		266	4,887
Tin, ore and concentrates	long tons	14	156
Zinc metal and alloys, all forms		(1)	23
Other, n.e.s		10	--
NONMETALS			
Cement, hydraulic		70,837	59,379
Clays, crude		2,654	2,497
Fertilizer materials:			
Crude		r 7	NA
Manufactured:			
Nitrogenous		14	1,524
Phosphatic		48,888	88,577
Mixed		7,617	93,933
Ammonia		3	3
Gypsum		2,004	6
Salt		106,752	75,926
Sand and gravel		12	13
Sodium and potassium compounds, n.e.s		56	135
Stone, dimension, worked		1	1
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	30	155
Kerosine	do	498	621
Distillate fuel oil	do	399	375
Residual fuel oil	do	115	327
Lubricants	do	20	227
Liquefied petroleum gas	do	69	33
Other	do	8	(1)
Total	do	1,139	1,738

r Revised. NA Not available.
1 Less than ½ unit.

Table 15.—Senegal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Aluminum:			
Oxide and hydroxide		--	(1)
Metal and alloys, all forms		r 387	364
Antimony metal and alloys, all forms		3	2
Copper:			
Ore and concentrate		--	(1)
Metal and alloys, all forms		r 112	85
Gold metal, unwrought and semimanufactures	troy ounces	1,791	3,755
Iron and steel:			
Ore and concentrate		--	(1)
Scrap		418	475
Pig iron, ferroalloys, and primary steel forms		r 15	29
Semimanufactures		r 57,571	32,097
Lead:			
Oxide		61	33
Metal and alloys, all forms		r 23	29
Magnesium metal and alloys, all forms		--	(1)
Manganese ore and concentrate		1	1
Nickel metal and alloys, all forms		2	3
Platinum-group metals and alloys, unwrought and semimanufactures		--	22
Silver metal and alloys, unwrought and semimanufactures	thousand troy ounces	35	112
Tin metal and alloys, all forms	long tons	12	8
Titanium oxide		160	104
Tungsten metal and alloys, all forms		--	(1)

See footnotes at end of table.

Table 15.—Senegal: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS—Continued		
Zinc:		
Oxide	43	33
Metal and alloys, all forms	22	37
Other:		
Metalloids, n.e.s	r 2	3
Nonferrous metals and alloys, all forms	r (1)	(1)
NONMETALS		
Abrasives, crude and natural, except diamond	1	4
Asbestos	799	1,016
Barite and witherite	925	516
Borates, crude, natural	r (1)	(1)
Cement, hydraulic	r 1,165	3,083
Chalk	1,245	1,919
Clays and clay products:		
Clays, crude, including kyanite and related materials	6,300	3,374
Products:		
Nonrefractory	729	2,326
Refractory	869	643
Diatomaceous earth	29	33
Fertilizer materials:		
Manufactured:		
Nitrogenous	1,614	1,519
Phosphatic	7	77
Potassic	8,027	4,440
Mixed	9,659	6,090
Ammonia	7,441	6,770
Graphite	(1)	2
Gypsum and plasters	5,344	9,208
Lime	1,230	1,855
Magnesite, crude	49	60
Mica, crude and worked	--	(1)
Pigments, mineral:		
Natural	183	144
Iron oxide, manufactured	98	79
Salt	80	86
Sodium and potassium hydroxide compounds	4,690	4,331
Stone, sand and gravel:		
Dimension stone, crude and worked	r 34	182
Dolomite	40	--
Quartz and quartzite	71	40
Crushed stone and gravel, n.e.s	525	88
Sand, not metal bearing	38	45
Sulfur:		
Elemental	12,932	24,252
Sulfuric acid and sulfur dioxide	35	51
Talc and related materials	155	216
Other:		
Crude ores and concentrates	1	13
Oxides and hydroxides of barium, magnesium and strontium	996	13
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	NA	9
Carbon black	3	3
Coal and coal briquets	r 254	210
Coke	159	234
Peat	6	3
Petroleum:		
Crude ---thousand 42-gallon barrels--	3,774	4,141
Refinery products:		
Gasoline ---do---	26	23
Kerosine ---do---	1	(1)
Distillate fuel oil ---do---	3	3
Residual fuel oil ---do---	NA	(1)
Lubricants ---do---	48	36
Liquefied petroleum gas ---do---	1	(1)
Other ---do---	r 6	6
Total ---do---	r 85	68
Crude chemicals from coal, oil and gas distillation	r 562	512

r Revised. NA Not available.
1 Less than ½ unit.

with overburden not exceeding 10 feet. Reserves at the Pallo concession have been estimated to exceed 50 million tons with a P_2O_5 content that will vary between 28% and 30%.

The total production of calcium phosphate, aluminum phosphate, and processed products was 1,474,454 tons, a decrease of 7.3% from 1971 production levels.

SOMALI REPUBLIC [87]

The mineral industry of the Somali Republic consisted mainly of the quarrying for carving by local craftsmen of small quantities of sepiolite (meerschaum) and the recovery of salt by solar evaporation methods for domestic consumption.

Personnel of the Soviet Union mined high-quality piezoelectric quartz crystals in an area near Berbera. Cassiterite, a tin mineral, was mined with the help of Bulgarian specialists at deposits in the Madjian Area of the Las Khoreh Region. Copper and zinc ores, discovered in the Hargeisa Area, were being studied by the Somali Ministry of Mineral and Water Resources. Reportedly, the ores were relatively rich, and further mineral exploration was planned at sites where the ores were discovered.

The United Nations Mineral and Groundwater Survey organization conducted exploration surveys for uranium deposits. Although uranium in the form of carnotite occurs extensively in southern Somalia, no economically exploitable deposits have been found.

Deposits of marble, granite, and gypsum occur in Somalia; however, they have not been developed.

Data were not available on the quantity of mineral commodities produced in 1972. However, about 2,000 tons of salt and 4,000 tons of sepiolite (meerschaum) were estimated to have been produced, based on output in previous years. Unrecorded quantities of stone, and sand and gravel also were produced. Foreign trade in mineral commodities consisted mainly of imports of petroleum products, iron and steel semimanufactures, cement, and fertliizer materials. Small quantities of iron and steel semimanufactures, nonferrous metal scrap, and cement were exported. Statistics on foreign trade are shown in table 16.

The Somali Cement Co. assisted by North Korean technicians planned to build a plant with a production capacity of 110,000 tons per year, near Berbera.

Hammar Petroleum Co., in cooperation with Burmah Oil Somalia Ltd., Cities Service Corp., and Petrola International Trading and Shipping Corp. completed a test drilling program on its 9.3-million-acre concession area near the Juba River and the Ethiopian border. Results were negative, but Burmah may do additional work at the site. Continental Oil Co. obtained a concession area at yearend extending along the Indian Ocean coast north of Mogadiscio and offshore to the 600-meter depth. Continental planned to begin a marine exploration program, an aeromagnetic survey, and geological exploration of the concession land area in 1973. Elf-Somalia, an affiliate of Entreprise de Recherches et d'Activité Petrolieres (ERAP) of France, conducted a seismic survey in its concession area offshore in the northern part of the country. Elf-Somalia obtained its concession area in 1971.

[87] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 16.—Somali Republic: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS		
METALS		
Iron and steel:		
Ore and concentrate	NA	10
Scrap	NA	3,041
Pig iron and ferroalloys	NA	43
Semimanufactures	NA	8
Nonferrous metals, not further described:		
Ores and concentrates	NA	260
Unwrought, semimanufactures and scrap	125	2
Silver and platinum-group metals	NA	(1)
NONMETALS		
Cement, hydraulic	NA	262
Fertilizer materials, crude, not further described	NA	10
Salt	NA	16
Stone, sand and gravel	NA	1
Other, crude n.e.s	NA	120
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	NA	4
Petroleum refinery products:		
Gasoline ----42-gallon barrels--	NA	850
Kerosine ----do----	NA	93
IMPORTS		
METALS		
Aluminum and alloys, unwrought and semimanufactures	7	32
Copper and alloys, unwrought and semimanufactures	36	45
Iron and steel:		
Ore and concentrate	NA	(1)
Scrap	NA	(1)
Pig iron and ferroalloys	16	(1)
Steel, primary forms	65	1,554
Semimanufactures	5,609	6,454
Lead and alloys, unwrought and semimanufactures	4	64
Nickel and alloys, unwrought and semimanufactures	NA	(1)
Silver and platinum-group metals ----thousand troy ounces--	1,125	43
Tin and alloys, unwrought and semimanufactures ----long tons--	77	7
Zinc and alloys, unwrought and semimanufactures	163	815
Other:		
Nonferrous metal ores, not further described	NA	(1)
Nonferrous metal scrap, not further described	125	(1)
Nonferrous metals, unwrought and semimanufactures, n.e.s	NA	6
NONMETALS		
Cement, hydraulic	17,197	68,682
Clay products:		
Nonrefractory	722	208
Refractory		50
Fertilizer materials:		
Crude	104	1,117
Manufactured	3,360	6,205
Lime	NA	428
Stone, sand and gravel	103	6,058
Other:		
Crude nonmetals, n.e.s	3,563	362
Nonmetallic manufactures, n.e.s	NA	309
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	71,815	61,927
Crude chemicals from distillation of coal, gas or oil	630	39

NA Not available.
[1] Less than ½ unit.

SOUTHERN RHODESIA [88]

Rhodesia's importance as a mineral-producing country continued despite United Nations economic sanctions levied against it. The value of mineral output increased over 6% in 1972 to R$107.4 million[89] and increased by over two-thirds since 1965, when the sanctions were applied. Volume was up 10% over that of 1971, and was up 57% since 1965.

Depressed copper and nickel prices, together with the consequence of the U.S. dollar devaluation, reduced the mining industry profit, especially that of copper and nickel concerns. Though the overall industry volume and value increases were satisfactory in light of the world metal market situation, industry profitability was seriously affected, evidenced by the disparity between volume and value increases.

Exports continued despite economic sanctions, though usually at less than world prices. The 1972 U.S. exception of chromite and other strategic minerals from sanctions was under controversy during the year, but still in effect at yearend.

Although minerals and metals accounted for only about 20% of the total value of Rhodesia's exports in 1965, the mining industry was responsible for at least 30% in 1972.

Registration of new mining companies in 1972 totaled 35 with a nominal capital of R$980,000 compared with 47 new companies with a nominal capital of R$3,436,000 in 1971. Seven mining concerns increased their registered capital by R$3,377,000.

Interest in minerals exploration remained high during the year as new exclusive prospecting orders and extensions balanced revocations, withdrawals, and forfeitures. At yearend, 63 exclusive prospecting orders were in effect, most of which concerned nonferrous metals. Prospects of Rhodesia (Pvt.) Ltd. held eight orders and Prospecting Ventures (Pvt.) Ltd. held six.

Over 58,000 persons were directly employed in the mining industry in 1972, and a far greater number employed in supporting services and allied industries.

Rhodesia supplied 5,742 million kilowatt-hours of electrical energy to the Central African Power Corp. grid (CAPCO) in 1972 and withdrew 4,032 million kilowatt-hours. Energy from CAPCO together with 469 million kilowatt-hours from other sources brought total electrical energy used in Rhodesia to 4,501 million kilowatt-hours. The mining and quarrying industries consumed 19% of the total in 1972 compared with 21% in 1971.

The Minister of Transport and Power announced that the construction of a new $360 million thermal power station at Wankie, with an eventual capacity of 1,320 megawatts, was expected to start within a year. It was reported that the station would be built in stages; the first stage will be 240 megawatts. Completion of the facility by 1975 or 1976 would ensure the country's power needs up to 1985–90.

A new power station was being built in Zambia on the North Bank at Kariba, and should come into full production in 1974, thus releasing the South Bank station capacity of 705 megawatts for the sole use of Rhodesia. Rhodesia currently receives 43% of the capacity of the South Bank station.

COMMODITY REVIEW

Metals.—*Chromium.*—Reportedly Rio Tinto (Rhodesia) Ltd. requested government approval for constructing a chromium smelter at Eiffel Flats near Gatooma. Consideration was being given to operating the smelter on a custom basis, and it would be operational in 1975 if marketing conditions warranted.

Copper.—Copper output at the Coronation Syndicate Ltd. Inyati facilities increased to 6,075 tons compared with 4,607 tons in 1971. Operations during the second half of the firm's fiscal year were at near capacity after overcoming problems encountered earlier in the year. Ore reserves were maintained at 1,108,000 tons of ore grading 2.29% copper with some gold and silver values.

The Messina (Transvaal) Development Company Ltd. (Messina), Rhodesia's largest copper producer, had an estimated output of 31,000 tons of refined copper during its fiscal year, ending September 30.

Messina's Mangula mine output totaled 1,294,000 tons of ore, an increase of 1.2%

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[88] By Larry J. Alverson, industry economist, Division of Ferrous Metals—Mineral Supply.

[89] Where practical, values have been converted from Southern Rhodesian dollars (R$) to U.S. dollars at rate of R$1=US$1.50.

over 1971 and averaged 1.17% copper compared with 1.09% in 1971. Concentrate was produced containing 13,814 tons of copper, an increase of 8.2% from 1971. An additional 502,000 tons of oxide ore was treated by leaching, from which 3,276 tons of copper contained in cement copper was recovered.

The Mangula Co.'s two new mines, Silverside and Norah, were brought into production during the year, though several months behind schedule owing principally to construction delays. Silverside began production in June, but Norah did not begin producing until the end of the year.

Work on preparing the Silverside open pit for ore production was started in October 1971, and by yearend 88,000 tons of ore containing 1.78% copper had been mined. Underground mining will be introduced at a later date. The concentrator was commissioned in June 1972 and reached the milling target rate of 15,000 tons of ore per month by the end of September, processing a total of 42,000 tons of ore averaging 1.48% copper, of which 1.31% was nonsulfide. A total of 361 tons of copper-in-concentrate was produced. The milling target for the financial year ending September 30, 1973, is 180,000 tons containing 1.74% copper, with concentrate produced containing 1,880 tons of copper.

The Norah milling and concentrating plant was commissioned in October 1972, with the latter scheduled to treat 216,000 tons of ore averaging 1.06% copper in the current year and is expected to produce about 2,130 tons of copper-in-concentrate.

Messina's Gwai River mine produced 195,000 tons of ore grading 1.33% copper, and recoverable copper produced was 2,276 tons, only slightly below the target of 2,300 tons. The planned milling rate for the current year (1973) is 160,000 tons, which should produce 1,700 tons of recoverable copper.

From the Shackleton mine, brought into production last year, underground mine production of 483,000 tons of ore averaging 1.91% copper, and 37,000 tons of ore averaging 1.60% copper from the surface stockpile were treated in the concentrator, producing a total of 9,100 tons of copper-in-concentrate. The milling target for fiscal year 1973 is 540,000 tons of ore, which should yield 8,980 tons of copper.

Messina's Alaska mine had its proven reserves increased from 397,000 tons of ore at 1.95% copper to 497,000 tons at 1.78% copper. Mine production totaled 304,000 tons grading 1.23% copper, an increase of 5% over last year. The concentrator throughput increased 4% from 290,000 to 302,000 in 1972, 14,000 tons in excess of the year's target. Copper contained-in-concentrate produced, totaled 2,847 tons, an increase of 12% over last year. The mine is scheduled to produce 2,870 tons of copper-in-concentrate in the next financial year.

The ore reserves and copper content of Messina's Rhodesian mines are as follows:

Mine	Proven ore reserve	
	Tons	Percent copper
Alaska	497,000	1.78
Shackleton	486,000	1.98
Mangula:		
Sulfide ore	13,698,000	1.30
Oxide ore	913,000	.75
Silverside:		
Sulfide ore	400,000	1.77
Oxide ore	454,000	1.77
Norah	1,902,000	1.30
Gwai River	118,000	1.31

Gold.—The high price of gold stimulated prospecting as new claims were staked and interest was shown in old mines. Owners of active mines were looking for ways of extracting ore previously considered uneconomic to exploit. The Rhodesian Minister of Mines at yearend revealed that four new mines were being brought into production while two more were under development. There was a possibility that an additional eight mines may be opened up. The Minister hopes to see Rhodesian gold output doubled in order to take advantage of higher gold prices.

The mines of Coronation Syndicate Ltd. produced 86,294 troy ounces of gold during the year compared with 91,277 troy ounces in 1971. Revenue from gold sales, which averaged R$28 per ounce in 1971, increased to R$36 by the middle of the firm's operating year and subsequently, increased to R$48 per ounce. The Arcturus mine increased the quality of ore milled 14% in producing 25,207 troy ounces of gold and some silver. Development work performed maintained the ore reserves at 92,000 tons. Ore milled at the Mazoe mine decreased 15% as output of gold decreased 25% to 30,865 troy ounces. The decline in ore reserves of the past 3 years was halted, but grade of ore decreased. The ore reserve in June 1972 was 159,000 tons grading 13.8 grams per ton. Mill throughput at the Muriel mine for the year

was maintained at the same level as in the past 5 years at 61,000 tons from which 25,882 troy ounces of gold was recovered. Ore reserves were maintained at 295,000 tons grading 16.2 grams per ton. In addition to recovery of gold at the foregoing mines, 4,340 troy ounces of gold was recovered from copper operations at the firm's Inyati mine.

The value of Rhodesia's gold production increased by 31% to R$16,800,000 during 1972 and represented 5% of total value of domestic exports and 16% of total value of mineral output.

Nickel.—Nickel was being mined by two companies in 1972, the Anglo American group's Rhodesian Nickel Corp. (Rhonickel) and Rio Tinto (Rhodesia). Rhonickel operated the Trojan and Madziwa mines, and Rio Tinto operated the Empress mine and the Perseverance mine which came onstream in 1972.

The bulk of exclusive prospecting orders outstanding, were for nickel. The search for nickel, pursued by several companies, was proceeding as far west as Wankie, as far north and east as the Mozambique border, and south to the Botswana-South African frontier.

Anglo American Corp. reported that material grading 1.31% nickel was intersected while testing in the Trojan nickel mine. No increase in ore reserves had been calculated pending further drilling results. The Trojan mine ore reserve was last given at 7.7 million tons averaging 0.75% nickel.

Johannesburg Consolidated Investment Co. (JCI) made no announcement of firm plans for opening up the Shangani and Damba nickel deposits in Matabeleland. Higher prices would probably bring these deposits into operation.

Tungsten.—The Beardmore mine and concentrator of Messina produced 285 tons of scheelite concentrate containing 190 tons of tungsten trioxide (WO_3). A small slime treatment plant was under construction during the year. The plant was scheduled for startup early in 1973. Reserves of both ore and slimes were expected to be exhausted by September 1973. Surface diamond drilling during the first half of the firm's fiscal year failed to intersect any worthwhile tungsten mineralization and the work was terminated.

Nonmetals.—*Corundum.*—Traditionally, Rhodesia has been one of the world's principal producers of corundum. In 1965 Rhodesian output accounted for about 80% of the non-Communist countries' production. Current production could be as high as 4,000 tons per year. Most of the production has been of the boulder variety (in contrast to the crystalline or gem stone varieties) and comes from the O'Briens claims. A mineral resource report by the Rhodesia Geological Survey discusses corundum uses, specifications and grading, production, and Rhodesian occurences.[90]

Marble.—Millions of tons of high-quality, fine-grained marble was discovered in the Urungwe Tribal Trust Land. Samples were sent to Europe, and experts reported it as among the best types available and equal in quality to Italy's famous Carrara marble.

Phosphate Rock.—The fertilizer industry in Rhodesia has developed strongly over the past several decades and has made a major contribution toward advances in agriculture. The first major development was in 1959 with a factory to manufacture super phosphate fertilizers. In 1965, Dorowa Minerals (Pvt.) Ltd. began operations at the Dorowa mine for mining and concentrating apatite, a phosphorous-bearing mineral. Since Dorowa came onstream, Rhodesia has become nearly self-sufficient in fertilizer raw materials manufacture. An expansion of Dorowa's facilities costing $3 million was underway in 1972 to meet Rhodesia's requirements of phosphate to the end of 1980.

Mineral Fuels.—*Coal.*—A major disaster occurred at the Wankie Colliery Coal Co. Ltd. (Wankie) on June 6, 1972, when 427 men lost their lives. The tragedy was caused by the ignition of methane by some unknown source, which in turn gave rise to severe coaldust explosions. The Report of the Commission of Inquiry into the disaster found several contraventions of safety regulations, any one of which may have contributed to the explosions.

Following the unavoidable decision to seal off Wankie's No. 2 colliery after the June disaster, coal extraction from other sources at Wankie was investigated. It was decided to reopen the No. 1 North Colliery and to develop the area adjacent to No. 3 colliery. This newly planned colliery, a $9.8 million project, was scheduled for completion by the end of 1973. The remaining coal in the No. 2 colliery would eventually be mined from the No. 3 colliery.

[90] Morrison, E. R. Corundum in Rhodesia. Mineral Resources Series, No. 16, Rhodesia Geological Survey, Salisbury, Southern Rhodesia, 1972, 24 pp.

Coal reserves at Wankie are plentiful but lack adequate local outlets, especially since the closure of the Zambian market. Wankie sold 2,762,000 tons of coal in its fiscal year ending August 31, compared with 3,093,000 tons in 1971, a decrease of 10.7%. This decrease was primarily attributable to the June disaster, but also to the Government's refusal to allow an increase in price until yearend. Coke sales 297,000 tons represented an increase of 10.4% over that of 1971.

SPANISH SAHARA [91]

Large-scale production from the phosphate mine of Fosfatos de Bu-Craa S.A. (Fosbucraa) was scheduled for early 1973. The initial production will be used to build stocks at the port of El Aaiun and for trial shipments. It is probable that about 2 million short tons of phosphate rock of grades of 34.3% and 36.6% P_2O_5 will be available for export during 1973. Although the design capacity of the initial phase of the plant is 3.3 million tons per year, preparations are in progress by Fosbucraa to expand the capacity of the mine and plant to 6.6 million tons per year. The U.S. Export-Import Bank has authorized a loan to permit the purchase of a second large dragline from the United States for the second expansion phase, Fosbucraa proposes a third expansion of 3.3 million tons per year to reach a total capacity of about 10 million tons per year. The third expansion has not been scheduled.

The history of phosphate-bearing rocks, the only commercial mineral of this country, dates back to 1947 when low-grade phosphatic sediments were identified in the north of the Spanish Protectorate. Although the deposits were of no economic significance, a reinvestigation was made by Empresa Nacional Minera del Sahara (ENMINSA), a company created by the Spanish Government's Instituto Nacional de Industria (INI) for this purpose in 1962. The studies and data developed indicated that higher grade deposits could be located to the east and southeast of the original site, and in 1964 it was established that more than 1,000 million tons of phosphate rock was available in the Bu-Craa Region. In 1966 the Spanish Government proposed joint ventures with one or more foreign partners. A proposed venture with International Minerals and Chemical Corp., that received much attention, did not develop. ENMINSA proceeded independently with the project and placed orders for the mine, beneficiation plant, and transport system before and during 1970. In August of 1969, ENMINSA was reorganized to form a new company, Fosbucraa, a wholly-owned subsidiary of INI.

The deposit covers an area of more than 77 square miles, and the reserves have been calculated at 1,600 million tons; the grade ranges rom 31% to 33% P_2O_5. The ratio of overburden volume to ore volume will range from 5 to 1 to as much as 10 to 1. The phosphate rock bed thickness ranges from 16 to 20 feet.

Mining started in 1971. Overburden is blasted, ripped, and removed with draglines. Bucket-wheel excavators remove the ore and load 100-ton trucks to transport the ore to a crushing plant. Crushed but unbeneficiated ore is moved from Bu-Craa to the port of El Aaiun, a distance of 62 miles, by a 10-section conveyor belt. The beneficiation plant, power station, and water desalination plant are located at El Aaiun. A 2-mile pier was constructed to accommodate 100,000-ton vessels in three loading berths. The plant at El Aaiun is designed to grind, wash, and dry the concentrates. The grade will be either 75% or 80% bone phosphate of lime (34.3% or 36.6% P_2O_5).

The initial capacity of the plant at El Aaiun is designed to treat 5 million tons per year of crude ore and produce 3.3 million tons per year of concentrate. Although partial production started as early as 1971, full production was not scheduled before 1973. In addition to markets in Spain, Fosbucraa will offer Spanish Sahara phosphate to export markets throughout the world.

There has been considerable activity over the past two decades by many companies in the coastal Mesozoic-Tertiary Basin to discover commercial quantities of oil. Sixty or more exploration wells have been drilled without a commercial discovery. Several of these have been drilled offshore.

The concession status is similar to 1971. Ashland Exploration Co. acquired all the interests of Union Carbide Corp., and Occidental Petroleum Co. withdrew from its con-

[91] By W. F. Stowasser, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

cessions. Amoco withdrew specified applications, and Conoco-Cepsa-Gulf requested an exceptional extension of its permits.

No wells were drilled and only a total of 7.3 party-months of seismic surveys were carried out; 5.3 months by Empresa National de Petróleos de Aragon, S.A. (ENPASA), and 2 party-months by Union Carbide prior to transfer of their interests to Ashland.

SUDAN [92]

The mineral industry of Sudan continued to contribute only minor value to the economy of the country, as represented by the gross domestic product estimated at $1,650 million [93] (current prices) in 1972. Sudan's mineral industry consisted mainly of chromite and gold mining, the recovery of salt by solar evaporation of sea water, the manufacture of cement and the production of refined petroleum products from imported crude oil. In addition, unrecorded quantities of stone, and sand and gravel were produced for local consumption.

The Geological and Mineral Resources Department of Sudan and the United Nations Development Programme (UNDP) continued its minerals exploration activities, particularly in groundwater exploration and hydrological research. The survey of copper deposits near Hofrat-en-Nahas, Darfur Province, was continued by UNDP and the Geological and Mineral Resources Department. The UNDP also furnished specialists to advise on the establishment of an iron foundry in Khartoum. A team of Soviet mineral specialists was studying iron ore deposits in the Red Sea Hills area of northeastern Sudan. Recent geological studies, assisted by UNDP and the Soviet Union, have revealed the existence of surface deposits of high-iron-content ore in Kordofan Province.[94]

The Government of Sudan passed several new articles of legislation designed to attract foreign capital for development of mineral resources. These are the Mines and Quarries Act, 1972, the New Investment Act, 1972, and the Petroleum Resources Act, 1972.

Production of mineral commodities (including petroleum refinery products) were valued at about $11 million in 1972, compared with about $10.3 million (revised) in 1971. Statistics on production of mineral commodities are shown in table 1. Foreign trade in mineral commodities consisted mainly of the import of crude petroleum, iron and steel semimanufactures, and fertilizer materials. Mineral commodity exports consisted chiefly of chromium ore and concentrate, iron ore and petroleum refinery products. Statistics on foreign trade are shown in table 17.

Fluorspar deposits in the vicinity of Jebel Semeih and Jebel Dumbeir, eastern Kordofan Province, were being studied for possible exploitation by the United Trading and Engineering Co., Khartoum. A preliminary investigation of Jebel Dumbeir showed veins of calcite-fluorite occurring in quartzite and marble country rock that was intruded by hornblende syenite and red felspathic rock. Two fluorite pipes were located that reportedly were channels through which fluorine solutions ascended.[95] Jebel Semeih was reported to contain thick quartz fluorspar veins intruding highly weathered granitic country rock. Reportedly, promising fluorspar deposits occur at Jebels Semeih and Dumbeir and the area in between, and a detailed geologic investigation was recommended.

The most important deposits of iron ore in Sudan were reported to be the following: The Red Sea Hills deposits north of Port Soudan in the Red Sea Province (formerly Kassala).[96] Here deposits of Precambrian age that contain hematite and magnetite occur at Sofia (12 million tons containing 60% iron) and at Fachwan (3 million tons of 60% iron). In the Province of Kordofan, the deposit of Abu-Tulu contains reserves of 36 million tons of hematite with an iron content of 61% iron. In the Province of Darfur, the sedimentary deposit at Kutum contains 10 million tons of ore with an iron content of 51%. In the Provinces of Bahr El Gazal and Equatoria, important deposits of limon-

[92] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[93] Where necessary, values have been converted from Sudanese pounds (£S) to U.S. dollars at the rate of £S1=US$2.87.

[94] United Nations Development Programme. Country And Intercountry Programming Sudan. DP/GC/SUD/R. 1, Mar. 30, 1973, p. 47.

[95] Ahemed, A. A. Fluorspar Deposits of J. Semeih and J. Dumbeir, Eastern Kordofan Province, Sudan. United Trading and Engineering Co. Ltd., Khartoum, Sudan, January 1971, p. 7.

[96] Page 94 of work cited in footnote 69.

ite ore cover an area of 30,880 square miles. The ore contains about 37% iron.

A report was published that described the geology in an area along the Nile River, northwest of Kerma, Northern Province.[97] Only minor scattered gold occurrences were noted; however, the area has not been thoroughly prospected for mineral deposits.

The only petroleum concessionaire in the country is Digna Petroleum Co. (Sudan) composed of United States and Kuwaiti owners.[98] Its concession area offshore and along the Red Sea coast has not been drilled. At midyear it was reported that the Saudi Arabian State company, Petromin, and French or Romanian interests planned to build a second petroleum refinery at Port Sudan. The Government of Sudan was negotiating with the United Kingdom, West Germany, and Japan to build a pipeline to transport petroleum products from Port Sudan to Khartoum.

[97] Geological and Mineral Resources Department, Democratic Republic of the Sudan. Geology of The Third Cataract, Halfa District, Northern Province, Sudan. Bull. 22, March 1973, 34 pp.

[98] World Petroleum Report. Sudan. V. 19, 1973, p. 69.

Table 17.—Sudan: Foreign trade in mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS AND REEXPORTS		
METALS		
Copper metal, including alloys, scrap	470	181
Gold, rolled, unworked or semimanufactures, troy ounces	750	--
Iron and steel:		
Ore and concentrate	--	4,100
Metal, scrap	5,042	2,000
Lead metal, including alloys, scrap	255	1,140
Zinc metal, including alloys, scrap	--	35
Other:		
Ores and concentrates of nonferrous metals, n.e.s.[2]	16,554	13,800
Nonferrous metal scrap, n.e.s	10,000	7,542
NONMETALS		
Mica	20	70
Salt	643	619
Sodium carbonate, natural	153,248	145,582
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:[3]		
Gasoline, aviation, thousand 42-gallon barrels	7	6
Jet fuel, do	202	193
Residual fuel oil, do	--	133
Lubricants, do	496	1,136
Total, do	705	1,468
IMPORTS		
METALS		
Aluminum:		
Oxide and hydroxide	41	(4)
Metal, including alloys, unwrought and semimanufactures	830	1,401
Copper metal, including alloys, unwrought and semimanufactures	60	382
Iron and steel metal:		
Scrap	--	242
Pig iron, ferroalloys, and similar materials	324	44
Steel, primary forms	19	4
Semimanufactures:		
Bars, rods, angles, shapes, sections	24,323	23,808
Universals, plates and sheets	20,725	22,110
Hoop and strip	3,685	3,022
Rails and accessories	388	214
Wire	844	1,243
Tubes, pipes, and fittings	12,302	12,890
Castings and forgings, rough	105	393
Lead metal, including alloys, unwrought and semimanufactures	304	611
Platinum-group metals, including alloys, all forms, troy ounces	--	161
Tin metal, including alloys, unwrought and semimanufactures, long tons	104	238
Zinc metal, including alloys, unwrought and semimanufactures	196	398

See footnotes at end of table.

Table 17.—Sudan: Foreign trade in mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
IMPORTS—Continued		
METALS—Continued		
Other:		
Ore and concentrate of nonferrous base metals, n.e.s	2	--
Oxides of cobalt, iron, manganese and titanium, not separated	183	180
Oxides, hydroxides and peroxides of metals, n.e.s	26	14
Base metals, nonferrous, including alloys, n.e.s	2	8
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	64	118
Dust and powder of precious and semiprecious stones	107	68
Grinding and polishing wheels and stones	44	37
Asbestos	1	--
Cement	2,314	3,872
Chalk	687	411
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	1,356	1,517
Products:		
Refractory (including nonclay bricks)	446	874
Nonrefractory	90	1,948
Fertilizer materials:		
Manufactured:		
Nitrogenous	78,277	85,554
Phosphatic	550	350
Potassic	2	3
Other, including mixed	50	99
Ammonia	21	101
Graphite, natural	--	116
Gypsum and plasters	100	303
Iodine	1	14
Lime	553	645
Mica, crude, including splittings and waste	13	5
Pigments, mineral, natural, crude	263,990	266,164
Salt	49	50
Sodium carbonate, natural	146,310	232,033
Sodium and potassium compounds, n.e.s.:		
Caustic soda	5,029	7,661
Caustic potash, sodic and potassic peroxides	153	1,205
Stone, sand and gravel:		
Dimension stone	50	127
Sand, gravel and crushed rock	71	216
Sulfur:		
Elemental and roasted pyrite	85	27
Sulfuric acid	387	453
Other nonmetals, n.e.s.:		
Crude	203	1,372
Slag, dross and similar waste, not metal bearing	--	2
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,672	1,944
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	7,024	94
Carbon black	9	1
Coke and semicoke	--	600
Petroleum refinery products:		
Gasoline:		
Motor ---thousand 42-gallon barrels	768	728
Aviation ---do	136	202
Kerosine ---do	785	695
Jet fuel ---do	2	14
Distillate fuel oil ---do	2,441	2,403
Residual fuel oil ---do	1,561	1,411
Lubricants ---do	155	253
Mineral jelly and wax ---do	2	2
Other:		
Liquefied petroleum gas ---do	25	23
Bitumen and other bitumen mixtures, n.e.s ---do	3	10
Other ---do	(4)	(4)
Total ---do	5,878	5,741
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	428	475

[1] Data in this table differs from that published in the last edition of this chapter in that this table is compiled from official trade returns of Sudan (unless otherwise noted), rather than from trade returns of trading partner countries as was done in the previous edition (when actual Sudanese statistics were not available).

[2] Believed to consist largely, if not entirely, of chromite. Trading partner countries record the receipt from Sudan of 24,808 tons of chromite in 1970 and 25,956 tons of chromite in 1971.

[3] Includes bunkers.

[4] Less than ½ unit.

SWAZILAND [99]

The mineral industry of Swaziland continued to contribute significantly to the economy of the country, as represented by the gross domestic product (GDP) estimated at about $92 million in 1972. Iron ore, asbestos, and coal were the principal mineral commodities mined; however, small quantities of stone, clay, and sand and gravel also were produced mainly for local consumption.

The Government of Swaziland reportedly welcomed foreign investment. The National Industrial Development Corp. of Swaziland (NIDCS) was established for the purpose of attracting foreign investment. NIDCS provides a number of services for companies interested in locating in Swaziland. The United States and Swaziland have a standard investment guaranty agreement and the Overseas Private Investment Corp. (OPIC) provides investment insurance to U.S. investors. A comprehensive investment code is scheduled to be drafted in the future.

A Land Speculation Control Act came into force in December. Two boards were appointed, a Land Control Board, which must approve any land transaction in Swaziland involving noncitizens; and an Appeals Board, which can rule on applications rejected by the Land Control Board.

The United Nations Development Programme (UNDP) provided technical assistance on iron ore beneficiation studies of low grade deposits that occur in the northwest. UNDP also was scheduled to provide technical services to the Swaziland Government in order to revise the 1958 mining law and provide engineering services for the proposed thermal powerplant.

Technical assistance also was provided by the United Kingdom on coal studies required for the thermal power station project. The United Kingdom and UNDP were conducting studies on water resources on the Mbuluzi and Ingwavuma Rivers. The final draft of a report on the development of resources of the Inbuluzi River Basin was given to the Governments of Swaziland and Mozambique.

The Geological Survey and Mines Department of Swaziland conducted geological mapping as a basis for further prospecting and minerals exploration.

Production of mineral commodities in 1972 decreased in value to about $26 million [1] compared with production valued at $29.8 million in 1971. Statistics on production of mineral commodities is shown in table 1. Foreign trade in mineral commodities consisted mainly of the export of iron ore, asbestos, coal, and kaolin. Imports of mineral commodities consisted mainly of petroleum products, iron and steel semimanufactures and fertilizer materials.

The Lowveld Thermal Power Project, which was scheduled for construction beginning in 1979, was moving ahead, with negotiations being conducted between the Government and the International Bank for Reconstruction and Development (IBRD). Located near the site of large coal deposits, the powerplant of 1,500-megawatt to 2,000-megawatt capacity would produce electricity for export to the Republic of South Africa. However, an alternate plan that seems to be gaining favor, is to build a smaller plant in units of 200- to 250- to 300-megawatt capacity. This plan would permit Swaziland to provide for its own internal electricity requirements and also provide small quantities of power for export to the Republic of South Africa. Reportedly, preliminary studies on the coal deposits conducted by Powell-Duffryn Technical Services Ltd. of the United Kingdom showed that the deposits were more than adequate. Reserves of coal on the Swaziland Collieries Concession area at Mpaka were recently estimated at more than 163 million tons of which 33 million tons of high-grade coal have been proved.[2] Powell-Duffryn also has been engaged to advise on the possibilities of exporting coal from Swaziland.

Ownership of the Havelock asbestos mine now belongs to Havelock Asbestos Mine (Swaziland), in which Turner and Newall Ltd. has a 60% interest and the Government of Swaziland has a 40% interest.[3] The Government was scheduled to pay $1.7 million out of dividends over the next 6 years for 20% of the stock and to receive another 20% of the stock in return for mining rights to the deposit. Reportedly, instability of the rock in the ore body at Havelock makes mining difficult, resulting in a decrease in fiber yield and an increase in mining costs.

[99] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[1] Where necessary, values have been converted from South African rand (R) to U.S. dollars at the rate of R1=US$1.42.

[2] Barclays International Review (London). Swaziland. July 1973, p. 40.

[3] Mining Journal (London). Company News, Comments. V. 280, No. 7170, Jan. 19, 1973, pp. 55-56.

TOGO [4]

The mineral industry of Togo continued to expand in 1972. Production of phosphate and cement increased, and a ceramic tile plant utilizing a local kaolin deposit was opened. Construction work continued on the expansion of the phosphate mine, and planning was underway to build a petroleum refinery beginning in 1973. Mineral exploration was carried on in various parts of the country, but the only discovery announced was that of a limestone deposit which could supply the proposed cement plant.

On the less favorable side, financing and feasibility questions kept the cement plant project from moving ahead, and offshore petroleum exploration activity came to a virtual halt owing to the unsuccessful results of previous drilling.

Government Policies and Programs.—A new Government financial institution, the Société Nationale d'Investissements (SNI), was established in December 1971 to manage the Government's shares in all public and private investments in the country. When fully operational, SNI will attempt to harness the excess capital funds of all banks and para-public organizations to prevent their leaving Togo. Also, private companies will be required to purchase SNI "investment shares," which will be reimbursable in accordance with the companies' investment spending. SNI will itself become a source of commercial investment loans.[5]

A new economic community, the Communaute Economique de l'Afrique de l'Ouest (CEAO), comprising several of Togo's neighboring countries, was formed in 1972. Togo declined to join CEAO, however, on the grounds that it was limited to French-speaking African countries and excluded Nigeria, the leading economic power in West Africa. An economic agreement between Togo and Nigeria was signed in May 1972.[6]

Expansion of the port facilities at Lomé is to include an ore and oil port for the handling of bulk mineral cargoes. Opening of the cement crushing plant and the impending petroleum refinery development created the need for additional port capacity. Construction began in 1971 and continued through 1972. When the entire expansion project is completed, at a cost of $45 million, the port's capacity will have increased to 750,000 tons annually from its 1972 annual capacity of 400,000 tons.[7]

PRODUCTION

Togo's mineral output registered further growth in 1972. Production of phosphate rock and cement both reached new highs, but a smaller amount of marble was quarried than in 1971. The opening of a ceramic tile plant during 1972 added a new product to the country's list of minerals.

Completion of the new mine near Kpogame enabled phosphate production to reach a new record high. Expanding fertilizer demand in Europe and Japan continued to provide a market for practically all of the company's capacity.

A construction boom in Lomé, which continued through the early part of 1972, allowed the cement grinding plant and the brick works to produce at capacity during their first full year of operation. However, building activity slackened later in the year after the completion of several major projects, including the airport terminal building, Organisation Commune Africaine, Malagache, et Mauricienne (OCAM) Village, and a luxury hotel, resulting in a reduction of marble output.[8]

The value of Togo's recorded mineral production rose 15% to $22.8 million in 1972 from $19.9 million in 1971. The increased output resulting from the cement plant's first full year of operation was responsible for most of the gain. However, these figures are far from complete because the values of brick clay, kaolin (for ceramic tile), marble, salt, sand and gravel, and stone production are not available. Declining construction activity probably curtailed the output of building materials and reduced the growth in total mineral value.

Statistics on mineral production in Togo are included in table 1.

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[4] By David G. Willard, economist, Division of Nonmetallic Minerals—Mineral Supply.

[5] U.S. Embassy, Lomé, Togo. State Department Airgram A-38, June 30, 1973, p. 7.

[6] Joint Publications Research Service. Economic Growth Despite Smaller Harvests. Translations on Africa No. 1303. JPRS 58888, May 1, 1973, p. 81.

[7] Joint Publications Research Service. Survey of Lomé Port Development. Translations on Africa. JPRS 58706, Apr. 10, 1973, pp. 25-26.

[8] U.S. Embassy, Lomé, Togo. State Department Airgram A-32, May 9, 1973, p. 2.

TRADE

Exports of mineral products from Togo rose substantially in 1971 (trade figures for 1972 are not available) on the strength of increased sales of phosphate rock. Phosphate exports were valued at $17.2 million in 1971, up 28% from $13.4 in 1970. Total mineral exports increased 36%, from $14.7 million in 1970 to 19.9 million in 1971, reversing the decline that occurred between 1969 and 1970.

Other than phosphate rock, the remainder of Togo's mineral exports consisted largely of diamond and cement. A sizable clandestine trade brings diamond overland into Togo, and it is then reexported. The effect of increased vigilance by Ghana's border police showed up in reduced Togolese diamond exports in 1970 and 1971.

Mineral imports continued on an uptrend in 1971, reflecting the country's construction boom and its overall economic growth. Crude and semimanufactured iron and steel, cement clinker (for the grinding plant), petroleum refinery products, salt, and clay products led the list of imported mineral-related commodities. The value of mineral imports totaled $9.9 million in 1971, a 15% gain from $8.6 million in 1970.

Togo's balance of mineral trade is favorable due to the exports of phosphate rock, and it showed further improvement in 1971, rising 39% to $10.0 million from $6.1 million in 1970. These profitable results were in contrast to the country's deficit on total trade, which increased markedly as the result of lower world prices for its agricultural exports. Balances of total commodity trade and mineral commodity trade in the years 1969–71 were as follows in million dollars:

	1969	1970	1971
Total commodity trade:			
Exports	r 44.5	r 54.6	56.4
Imports	r 56.4	r 64.5	70.0
Balance	r —11.9	—9.9	—13.6
Mineral commodity trade:			
Exports	16.1	r 14.7	19.9
Imports	6.9	8.6	9.9
Balance	9.2	r 6.1	10.0

r Revised.

Source: Statistical Office of the European Community. Foreign Trade Yearbook 1939–70 (for Associate Member Countries). V. I, 1971. Luxembourg, 1971, pp. 335–413.

Statistics on Togo's mineral trade are contained in table 18.

Table 18.—Togo: Foreign trade in mineral commodities
(Metric tons unless otherwise specified)

Commodity	1970	1971
EXPORTS		
METALS		
Aluminum metal, including alloys, unwrought and semimanufactures	--	62
Copper metal, including alloys, unwrought and semimanufactures	3	17
Iron and steel:		
Metal:		
Scrap	2,245	16
Semimanufactures	144	4,677
Lead metal, including alloys, unwrought	6	--
Other metals, including alloys, metalloids, n.e.s	--	7
NONMETALS		
Cement	472	41,526
Clay products, nonrefractory	--	9
Diamond, gem, not set or strung ---value, thousands	$996	$741
Fertilizer materials:		
Crude, phosphatic ---thousand tons	1,504	1,814
Manufactured	--	308
Salt	--	1
Sodium and potassium compounds, n.e.s	12	85
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	356	16
Worked	--	1
Gravel and crushed rock	--	6
Sulfuric acid, oleum	--	54
Other:		
Slag and ash, n.e.s	8	29
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	--	255
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Lubricants ---42-gallon barrels	1,085	119
Bituminous mixtures, n.e.s ---do	61	--

See footnotes at end of table.

Table 18.—Togo: Foreign trade in mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
IMPORTS		
METALS		
Aluminum metal, including alloys, semimanufactures	95	66
Copper metal, including alloys, semimanufactures	10	20
Iron and steel:		
Metal:		
Scrap	9	3
Pig iron and similar materials	2	6
Semimanufactures:		
Bars, rods, angles, shapes, sections	6,979	7,193
Universals, plates and sheets	5,762	4,081
Hoop and strip	26	63
Rails and accessories	562	532
Wire	81	189
Tubes, pipes, and fittings	1,431	2,404
Castings and forgings, rough	192	283
Lead:		
Ore and concentrate	10	--
Oxides	1	--
Metal, including alloys, semimanufactures	16	16
Tin metal, including alloys, unwrought ---long tons--	1	1
Other metals, including alloys, metalloids, n.e.s	7	11
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	34	11
Cement	85,640	92,818
Chalk	42	5
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	478	--
Products:		
Refractory (including nonclay bricks)	35	85
Nonrefractory	643	596
Diatomite and other infusorial earth	7	48
Fertilizer materials:		
Manufactured:		
Nitrogenous	342	772
Phosphatic	299	711
Potassic	r 614	14
Other, including mixed	1,219	9
Ammonia	3	6
Gypsum and plasters	171	422
Lime	558	618
Mica, crude, including splittings and waste	27	--
Pigments, mineral, natural, crude	60	50
Salt	9,981	8,306
Sodium and potassium compounds, n.e.s	542	425
Stone, sand and gravel:		
Dimension stone, crude and partly worked	1,115	--
Gravel and crushed rock	993	91
Sand, excluding metal bearing	--	27
Sulfur:		
Elemental, other than colloidal	--	26
Sulfur dioxide	3	4
Sulfuric acid, oleum	22	21
Talc, steatite, soapstone and pyrophyllite	29	56
Other nonmetals, n.e.s.:		
Crude	--	31
Slag and ash, n.e.s	2	27
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	1,111	927
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	25	30
Gas carbon	1	2
Petroleum refinery products:		
Gasoline ---thousand 42-gallon barrels--	140	162
Kerosine ---do---	100	97
Distillate fuel oil ---do---	258	291
Residual fuel oil ---do---	112	185
Lubricants ---do---	12	13
Other:		
Liquefied petroleum gas ---do---	4	4
Bitumen and other residues and bituminous mixtures, n.e.s ---do---	20	22
Other ---do---	(1)	(1)
Total ---do---	r 646	774
Mineral tar and other coal-, petroleum- or gas-derived crude chemicals	559	166

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

Cement.—The project to build a cement plant utilizing Togo's limestone deposits remained stalled on questions of financing and feasibility. In order to make a profit, the plant would have to compete in the markets of several West African countries. A loan application by Société des Ciments de l'Afrique de l'Ouest (CIMAO) was still under study by the International Bank for Reconstruction and Development. Meanwhile, estimates of the investment cost rose to $74.5 million from the earlier figure of $50 million. A newly discovered limestone deposit at Sikakondji near the Dahomey border was selected as the raw material source in preference to the Aveta deposit with its problematic overlying layer of phosphate rock. Reserves at Sikakondji were estimated to be 130 million metric tons.[9]

Marble.—Buoyed by the construction boom in Lomé in the first part of 1972, Société Togolaise de Marbrerie et de Matériaux (SOTOMA) opened a ceramic tile plant in Lomé using local kaolin deposits. Output of the plant was not reported, nor the effect on its operations of the building slump that occurred later in the year. The company's marble production was again limited to meeting local demand as an export market still had not materialized.[10]

Petroleum.—As reported in the 1971 Minerals Yearbook, an exploration concession was granted to Shell Togorex in January 1972 covering an offshore area in the Gulf of Guinea. It was the second petroleum exploration concession granted by Togo. The other is held by the combine of Ashland Oil and Refinery Co. and Frontier Oil Co. for another offshore area.[11] Shell conducted a series of seismic tests in the summer of 1972, which was the only exploration activity on either concession during the year. Two unsuccessful wells drilled previously by Ashland-Frontier tended to discourage further attempts.[12]

Planning continued for the oil refinery to be built in Lomé. With a capacity of 20,000 barrels per day it will be the smallest in West Africa. Investment cost is estimated at approximately $25 million, some 90% of which will be provided by a loan from the National Westminster Bank of England. Construction will begin in 1973, and the refinery is expected to be in operation in 1976. Planet Oil and Mineral Corp. of New York will be the operator; other partners are Humphrey of Glasgow and Weisser A.G. of Hamburg.[13]

Phosphate.—Expansion of the phosphate mine at Hahotoe continued throughout 1972 toward the goal of a 2.4 million tons per year capacity by 1974. Excavation was begun of a new mine at Kpogame (on another part of the same phosphate deposit that is presently being exploited), and construction of bridges for a road and railroad to reach the mine was underway. The Kpogame site was chosen in preference to the previously discussed Aveta site because it is closer to the company's other facilities. An agreement with CIMAO to mine the phosphate at Aveta, which overlies the limestone deposit intended to supply the proposed cement plant, was cancelled because of CIMAO's difficulty in obtaining financing for the plant.[14]

An amendment to the agreement establishing the phosphate mining company, Compagnie Togolaise des Mines du Bénin (CTMB), was signed in 1972 permitting the Government to increase its share in the company by stock purchases over a period of years and to obtain majority ownership by 1987. The Government's holding had been increased to 35% by yearend. Because 1987 is the year of estimated depletion of the phosphate deposit, it is possible that the time table may be accelerated.[15]

Other Minerals.—No other mineral finds of importance were announced in Togo during 1972. The Togolese Service des Mines, assisted by the United Nations Development Program, continued its investigations of a large number of sites containing a variety of mineralization, including pyrite, hematite-rutile, chalcopyrite, nickeliferous laterite, titanium, gold, kaolin, pegmatite, garnet, talc, chromite, dolomite, and iron ore.[16]

[9] Work cited in footnote 8.
[10] Work cited in footnote 8.
[11] U.S. Embassy, Lomé, Togo. State Department Airgram A-39, June 27, 1972, 1 p.
[12] Work cited in footnote 8.
[13] Page 7 of work cited in footnote 43.
[14] U.S. Embassy, Lomé, Togo. State Department Airgram A-40, June 26, 1972, 2 pp.
[15] U.S. Embassy, Lomé, Togo. State Department Airgram A-27, Apr. 16, 1973, p. 2.
[16] Mining Annual Review. Togo. June 1972, p. 362.

UPPER VOLTA [17]

The mineral industry of the Upper Volta contributed little to the economy of the country in 1972. Mining activity consisted mainly of the output of small quantities of stone, clay, and sand and gravel for local consumption. Minerals exploration by the Government of Upper Volta, foreign government agencies and private industry organizations continued. The United Nations Development Programme (UNDP) pursued its studies on the manganese deposits at Tambao. UNDP also published a report on the investigation of mineral and ground water resources in Upper Volta.[18]

Japanese industry groups were examining the possibility of developing a mine at the Tambao deposits, at the request of the Upper Volta Government. The Liptako-Gourma Authority (LGA) planned to study ground water resources to serve the Tambao mine and the proposed railroad extension from Ouagadougou to Tambao, a distance of about 220 miles. A number of other studies on known mineral deposits in Upper Volta were proposed for future consideration by LGA. Studies of the copper deposits of Dienemera and Gongondy by an Upper Voltan Government, Anglo-American Corp., Bureau de Recherches Géologiques et Minières (BRGM), and Péchiney consortium continued. Mineral studies of the titaniferous and vanadiferous magnetite deposits near Oursi, northeastern Upper Volta reportedly were in progress. Société Générale d'Exploitation et de Recherche Minière (SOGEREM), an affiliate of the Péchiney Ugine Kuhlmann group conducted mineral exploration work on the white bauxite deposits near Kaya and Kongaussi. The airborne geophysical prospecting program of an area in the Liptako-Gourma Region, conducted by the Canadian International Development Agency, was scheduled to be continued through 1972.

Foreign trade in mineral commodities in 1971 consisted of the import of petroleum products valued at $4.3 million, iron and steel semimanufactures valued at $1.7 million, cement valued at $1.2 million, and other minerals valued at $758,000. In 1970 the mineral imports listed above were valued at $3.8 million, $1.8 million, $844,765 and $725,632, respectively.[19]

A report that described the copper deposits at Gaoua as porphyry type of Precambrian age was presented.[20]

A plant to manufacture 10 million, 1.5-volt dry cell batteries annually was scheduled for construction at Bobo-Dioulasso in 1973.[21] The battery factory, owned by Piles Wonder, a French firm and Upper Voltan shareholders, will cost about $320,000.[22]

The project to construct a cement plant with a production capacity of from 70,000 tons to 133,000 tons per year was being studied by the Government. Establishment of a viable cement plant depends upon extension of the railroad to Tambao and development of the Tin Hrassan limestone deposits located 18 miles northeast of Tambao. Also it is necessary to develop markets in neighboring countries. The low level of cement consumption in Upper Volta is not sufficient to support the proposed plant.

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[17] By Henry E. Stipp, physical scientist, Division of Ferrous Metals—Mineral Supply.

[18] United Nations (New York). Haute-Volta: Enquête les Ressources Minières et les Ressources en Eaux Souterrained. 1970 (DP/SF/UN/39 Haute-Volta).

[19] U.S. Embassy Ouagadougou, State Department Airgram A-83, Dec. 1, 1972, 2 pp., 5 encl.

[20] Bulletin Du Bureau de Recherches Géologiques et Minières. Cuivre. Section 2, No. 5, 1972, p. 61.

[21] U.S. Embassy, Ouagadougou, State Department Airgram A-1, Jan. 6, 1973, p. 4.

[22] Where necessary, values have been converted from Communauté Financiere African francs (CFA) to U.S. dollars at the rate of CFA250=US$1.00.

The Mineral Industry of Other Near East Areas

By Bernadette Michalski [1]

CONTENTS

This chapter covers the Arab nations along the eastern edge of the Mediterranean Sea, and along the eastern and southern edge of the Arabian Peninsula. For most of these nations, the petroleum industry is a vital element in the economy either through revenues obtained from crude production and/or through transit fees obtained from companies operating pipelines that cross national territories in route to Mediterranean outlets. The largest producer of crude oil in the area is the United Arab Emirates (Abu Dhabi) followed by Qatar, Oman, United Arab Emirates (Dubai), Syrian Arab Republic, and Bahrain. Nations in the area receiving transit revenues are Syrian Arab Republic, Lebanon, and Jordan. Refineries operating on domestic and/or imported crudes are located in each of the nations with the exception of Oman, the United Arab Emirates, and the Yemen Arab Republic. The latter is the only nation in the area not involved in either petroleum production, refining, or pipeline transit.

To avoid having economies based solely on petroleum production, the rulers of many of these nations are planning or have developed several natural gas processing facilities, tanker servicing facilities, an aluminium refinery, and several nonmetallic manufacturing facilities. Previously flared natural gas is utilized as fuel in the production of aluminum and cement and as fuel and feedstock in the production of liquefied natural gas (LNG), natural gas liquids (NGL), and nitrogenous fertilizers. Dubai has begun construction of a drydock for very large crude carriers (VLCC), taking advantage of the heavy tanker traffic on the Persian Gulf and offsetting loss of income when production from its limited petroleum reserves are cutoff. Bahrain will be a site for a second Persian Gulf VLCC drydock. The Bahrain drydock will be owned and operated by the Organization of Arab Petroleum Exporting Countries (OAPEC).

Table 1 lists production of selected mineral commodities in the countries covered by this chapter.

[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Other Near East Areas: Production of mineral commodities

Area, commodity, and unit of measure	1970	1971	1972 p
BAHRAIN [1]			
Aluminum, primary smelter—metric tons	--	10,200	74,500
Gas, natural:			
Gross production—million cubic feet	25,406	25,364	e 25,000
Marketed production—do	12,305	17,902	e 18,000
Petroleum:			
Crude—thousand 42-gallon barrels	27,973	27,346	25,508

See footnotes at end of table.

Table 1.—Other Near East Areas: Production of mineral commodities—Continued

Area, commodity, and unit of measure	1970	1971	1972 p
BAHRAIN [1]—Continued			
Petroleum—Continued			
Refinery products:			
Gasoline—thousand 42-gallon barrels	15,687	8,268	7,335
Jet fuel—do	13,892	15,634	15,033
Kerosine—do	1,076	1,139	950
Distillate fuel oil—do	16,993	19,301	20,400
Residual fuel oil—do	39,347	38,739	33,453
Lubricants—do	1,098	1,129	6,390
Other—do	189	5,745	
Refinery fuel and losses—do	4,443	4,134	3,678
Total—do	92,725	94,089	87,239
JORDAN [1]			
Cement, hydraulic—thousand metric tons	378	419	661
Clays—do	NA	NA	3
Gypsum—do	26	24	30
Fertilizer materials, crude, phosphate rock—do	r 841	650	694
Lime—do	45	2	e 2
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	825	1,226	1,006
Kerosine and jet fuel—do	590	1,025	1,090
Distillate fuel oil—do	762	844	1,071
Residual fuel oil—do	853	781	1,089
Liquefied petroleum gas—do	161	186	201
Asphalt—do	168	210	172
Other—do	--	--	875
Refinery fuel and losses—do	161	381	440
Total—do	3,520	4,653	5,944
Salt—thousand metric tons	25	24	24
Stone:			
Limestone—do	1,000	1,865	2,500
Marble—thousand square meters	r 75	50	75
LEBANON [1]			
Cement, hydraulic—thousand metric tons	1,339	1,499	1,626
Gypsum—do	35	37	e 40
Lime—do	130	125	e 120
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	3,490	3,461	1,000
Jet fuel—do	1,599	1,679	500
Kerosine—do	265	194	
Distillate fuel oil—do	2,673	2,607	700
Residual fuel oil—do	6,636	6,292	2,700
Other—do	469	467	200
Refinery fuel and losses—do	694	757	200
Total—do	15,826	15,457	5,300
Salt e—thousand metric tons	37	38	40
OMAN [1]			
Gas, natural:			
Gross production e—million cubic feet	r 95,000	90,000	90,000
Marketed production e—do	1,500	1,500	1,500
Petroleum, crude—thousand 42-gallon barrels	121,210	107,430	103,131
PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN [1]			
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	r 1,875	1,849	3,400
Jet fuel—do	r 6,851	4,047	3,400
Kerosine—do	r 2,003	1,217	1,050
Distillate fuel oil—do	r 8,374	4,333	3,100
Residual fuel oil—do	r 23,550	13,432	14,500
Other—do	r 2,480	1,576	160
Refinery fuel and losses—do	r 2,503	546	1,149
Total—do	r 47,636	27,000	26,759
Salt—thousand metric tons	r 88	66	e 60
QATAR [1]			
Cement, hydraulic—thousand metric tons	100	72	e 100
Gas, natural:			
Gross production—million cubic feet	127,000	159,418	e 180,000
Marketed production—do	e 39,000	46,480	e 52,000
Petroleum:			
Crude—thousand 42-gallon barrels	132,456	156,882	176,545
Refinery products:			
Gasoline—do	68	64	69
Kerosine—do	34	30	37
Distillate fuel oil—do	56	58	60
Residual fuel oil—do	77	78	72
Refinery fuel and losses—do	19	17	18
Total—do	254	247	256

See footnotes at end of table.

Table 1.—Other Near East Areas: Production of mineral commodities—Continued

Area, commodity, and unit of measure	1970	1971	1972 p
SYRIAN ARAB REPUBLIC [1]			
Asphalt, natural—thousand metric tons	65	NA	NA
Cement, hydraulic—do	r 964	909	1,056
Fertilizer materials, crude, phosphate rock—do	--	7	75
Gas, natural:			
Gross production e—million cubic feet	29,000	36,000	40,000
Marketed production e—do	6,000	7,000	8,000
Gypsum e—thousand metric tons	15	15	15
Petroleum:			
Crude—thousand 42-gallon barrels	29,356	36,462	45,209
Refinery products:			
Gasoline—do	3,264	2,360	e 2,000
Kerosine and jet fuel—do	1,821	2,202	e 1,800
Distillate fuel oil—do	2,723	4,540	e 3,800
Residual fuel oil—do	4,063	4,783	e 4,000
Other—do	1,087	2,548	e 2,100
Refinery fuel and losses—do	1,376	1,090	e 900
Total—do	14,334	17,523	e 14,600
Salt—thousand metric tons	46	24	e 30
Sand, glass e—do	15	NA	NA
UNITED ARAB EMIRATES [1 2]			
Abu Dhabi:			
Gas, natural:			
Gross production—million cubic feet	266,200	365,543	e 412,000
Marketed production—do	26,700	39,749	e 45,000
Petroleum, crude—thousand 42-gallon barrels	252,179	341,007	384,190
Dubai:			
Gas, natural:			
Gross production e—million cubic feet	25,000	36,000	44,000
Marketed production e—do	6,000	10,000	12,000
Petroleum, crude—thousand 42-gallon barrels	31,321	45,648	55,942
YEMEN ARAB REPUBLIC [1]			
Salt e—thousand metric tons	79	87	20

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to the commodities listed, crude construction materials such as common clays, stone, and sand and gravel presumably are produced, but output is not recorded quantitatively and general information is inadequate as a reliable basis for estimation of output levels.

[2] In addition to the emirates listed in the table, there are five others: Ajman, Fujairah, Ras al-Khaimah, Sharjah, and Umm al-Qaiwain; these record no mineral production but presumably produce small quantities of crude construction materials.

BAHRAIN

During 1972, the island emirate of Bahrain experienced its first full year of independence. The economy sustained a balanced budget totaling $59.3 million. Most of the nation's revenue is obtained either directly or indirectly from the petroleum industry. In income tax alone the industry contributed an estimated $23.4 million in revenue. Another $27.3 million was obtained through customs duties, government property rental, and gasoline taxes. Effective April 1, 1972, port dues were levied at the rate of 13.68 cents per ton of gross registered tonnage of tankers loading hydrocarbon substances destined for export from any Bahrain port. Port dues collected in 1972 were estimated at $2.8 million. Since 1966 Bahrain has received a half-share of the income from Saudi Arabia's offshore 95,000-barrel-per-day Abu Safah oilfield operated by the Arabian American Oil Co. (Aramco).

The Council of Ministers of OAPEC selected Muharraq Island, Bahrain, as the site for a $78 million drydock capable of servicing tankers of up to 350,000 deadweight tons. OAPEC will hold 60% equity; Kawasaki (Japan), 20% equity; and Lisnave (Portugal), 20% equity.

Bahrain crude petroleum production for 1972 totaled 25.5 million barrels or an average of 69,895 barrels daily, the lowest output level since 1967. Crude is extracted from the Awali field Cretaceous-Jurassic formation. The field is operated by the Bahrain Petroleum Co. Ltd. (Bapco), which is held on an equal basis by Texaco Inc. and Standard Oil Co. of California.

Well status as of December 31, 1972, was as follows:

Producing oil	211
Producing gas	10
Gas injection	7
Shut-in	16
Abandoned	26
Total	270

Crude from the Awali field as well as 60.3 million barrels of Saudi Arabian crude, arriving via pipeline, is refined at the Bapco refinery at Awali. Refinery throughput averaged 238,359 barrels daily in 1972, a decrease of about 8% as compared with the refinery throughput for 1971. The reduced production and throughput levels were caused by a fire that broke out in late November destroying eight storage tanks and the powerplant, thus reducing the effectiveness of the refinery for the remainder of the year. Refinery cleanup and repair work disrupted construction on the 50,000-barrel-per-day-capacity fuel oil desulfurization plant; however, completion and startup of the unit remains scheduled for late 1973. Under construction by Nippon Oil Co. at a reported estimated cost of $65 million, the plant will make available fuel oil of 0.5% to 1.0% sulfur content for the Japanese market.

Bapco exploration activities in 1972 included a deepwater seismic survey south of the main island and the continuation of a gravimetric survey off Bahrain. Superior Oil Co. (United States) drilled its first wildcat well in its 1,500-square-mile (3,885-square-kilometer) concession area. The Bu Amans No. 1 well located 41 miles (66 kilometers) offshore from Muharraq Island was abandoned in April at a depth of 7,980 feet (2,432 meters). Surveys off Hawar Island were under study, but no drilling in the area was reported by yearend.

Natural gas production from the Khuff formation increased to 145 million cubic feet daily by the end of 1972. Most of this output was consumed by Aluminium Bahrain Ltd. (Alba) as fuel for its aluminum refinery. Natural gas produced from the Arab zones included 7,921 million cubic feet for the Awali refinery and 6,045 million cubic feet for the Government power station at Jufair. A total of 23,419 million cubic feet of Arab and Khuff gas was injected into the Bahrain formation to maintain reservoir pressure.

Near yearend the capacity of the Alba aluminum refinery at Askar was increased from 90,000 to 120,000 tons with the opening of a fourth potline. The refinery constructed by the British Smelter Construction Co. processes alumina shipped from Aluminum Co. of America (Alcoa) operations at Kwinana in Western Australia. The ready availability of natural gas cuts the cost of conversion from alumina to aluminum. Aluminum ingots are absorbed by consortium members in direct proportion to their equity participation in Alba, which is reported as follows:

Government of Bahrain	19%
British Metal Corp	17%
General Cable	17%
Kaiser Aluminum and Chemical Corp	17%
AB Electrokoppar	12%
Breton Investments	9.5%
Western Metal Corp	8.5%

A 3,000-ton-per-year-capacity aluminum powder plant was opened by Bahrain Atomizers International in the fall of 1972.

An aluminum extrusion plant of 3,000-ton-per-year capacity is under construction by the Bahrain Government in partnership with Kaiser Aluminum and Chemical Corp. The plant is scheduled for operation in 1973, supplying Bahrain's demand for extruded aluminum products. Bahrain's production of mineral commodities is reported in table 1.

Table 2.—Bahrain: Trade of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1970	1971	1972
EXPORTS			
Petroleum refinery products:			
Gasoline	16,261	5,490	e 7,159
Naphtha		8,441	
Jet fuel	13,710	15,870	e 14,900
Kerosine	992	1,079	e 920
Distillate fuel oil	20,823	21,697	e 20,000
Residual fuel oil	28,818	28,694	e 28,000
Lubricants	8	[1] 1,117	e 30
Other	567	165	e 6,200
Total	81,179	82,553	e 77,209

See footnotes at end of table.

Table 2.—Bahrain: Trade of crude petroleum and petroleum refinery products—Continued
(Thousand 42-gallon barrels)

Commodity	1970	1971	1972
BUNKER LOADINGS			
Petroleum refinery products:			
Distillate fuel oil	623	727	NA
Residual fuel oil	6,261	6,352	NA
Total	6,884	7,079	NA
IMPORTS			
Crude petroleum	63,518	65,989	60,309
Petroleum refinery products:			
Gasoline and naphtha	1,712	1,317	e 1,500
Kerosine	39	--	--
Lubricants	18	20	e 69
Total	1,769	1,337	e 1,569

e Estimate. NA Not available.
[1] May include reexports.

JORDAN

A trend toward economic improvement was confirmed by a 6.7% increase in the gross national product (GNP) reported at $706.6 million as compared with $662.5 million [2] in 1971. Mining, manufacturing, and construction contribute approximately $100 million to the gross national income. The nation's principal mineral industries are phosphate rock mining and beneficiating, cement manufacturing, metal semimanufactures from crude imported forms, and petroleum refining based on imported crude petroleum. Production of Jordanian mineral commodities is reported on table 1.

Exports of phosphate rock, Jordan's principal mineral commodity, totaled nearly a million tons in 1972, reaching the highest export level in 3 years. Price firming on the international market, the opening of the Syrian border granting Jordanian shipments Mediterranean access, and improved rail and port facilities should result in increased exports in the immediate future. This development will prove a vital factor in the Jordanian economy, which is burdened by increasing trade deficits. In 1972, exports totaled $45 million, while imports climbed to a value of $224 million.

Phosphate reserves are estimated at 270 million tons of ore containing 28% to 36% P_2O_5. Production capacity is rated at 2 million tons annually. Two mines are in production, both of which are operated by the 65% government-owned Jordan Phosphate Mines Co. The El Hassa deposit is worked entirely by open pit methods; capacity is 1,250,000 tons per year. The Ruseifa deposit is worked both by surface and underground methods; capacity is 750,000 tons per year. During the 1973–75 Development Plan, mine capacity will be expanded to 3 million tons annually. Beneficiation plants yielding a product of 32% to 35% P_2O_5 and a moisture content of 2% will have a capacity of 2 million tons annually.

Transport of phosphate to the port of Aqaba will be eased when the Hettiya-Aqaba spur line of the Hijaz railway is completed in 1974. Aqaba port facilities are under expansion. Two new storage units of 60,000 tons each were completed during the year raising total phosphate storage capacity to 160,000 tons. Two berths are in use at the port. The first accommodates vessels up to 15,000 deadweight tons with a maximum draft of 30 feet (9 meters). The berth has a loading capacity of 500 tons an hour. A second berth accommodates bulk carriers of 50,000 deadweight tons with a maximum draft of 40 feet (12 meters). Loading capacity is 1,500 tons per hour. A second conveyer line of equal capacity is under construction. The Development Plan calls for export of 2.5 million tons of phosphate by 1975.

Cement output increased by 57.9% over the production level of the previous year. The increase is attributable to expanded construction activity particularly in Amman and al-Zerqa as well as to trade agreements concluded with Iraq and Syria opening new markets for Jordanian cement.

The production of metal semimanufactures increased more than twofold over that of the previous year with the resumption of mill operations. Production suspended in the last half of 1971 was re-

[2] Where necessary, values have been converted from Jordanian Dinars (JD) to U.S. dollars at the rate of 1JD=US$2.80.

sumed in 1972 when the Syrian border closure was lifted permitting import of crude metal forms for processing.

In July 1972, the Jordanian Government entered into an oil concession and development agreement with the Canadian firm DESCO Investments Ltd. By yearend the agreement was terminated, and new bids for oil exploration concession are under consideration.

The Jordan Petroleum Refining Co. operates a 15,000-barrel-per-day refinery at

Table 3.—Jordan: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum, unwrought	186	181	Lebanon 111; Syrian Arab Republic 69.
Copper matte	606	598	Lebanon 338; Arab Republic of Egypt 176.
Iron and steel:			
Metal scrap	7,109	3,725	Lebanon 3,388; Arab Republic of Egypt 337.
Semimanufactures	253	58	All to Yugoslavia.
Lead, unwrought	317	125	All to United Kingdom.
NONMETALS			
Cement	55,746	90,494	Saudi Arabia 50,564; Syrian Arab Republic 38,731.
Fertilizer materials, crude, phosphatic	656,227	647,278	NA.
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Calcareous	859	1,328	Syrian Arab Republic 991; Saudi Arabia 243.
Granite	7,579	6,391	Syrian Arab Republic 2,575; Iraq 1,633.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	997	462	Lebanon 419; Saudi Arabia 43.
Gas, hydrocarbon, natural	72	1,814	Lebanon 1,761; Saudi Arabia 53.

NA Not available.

Table 4.—Jordan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971 [1]
METALS			
Aluminum and alloys, semimanufactures	723	1,253	Switzerland 685; Lebanon 458.
Copper and alloys, all forms	272	182	India 64; West Germany 64.
Iron and steel:			
Pig iron, ferroalloys, and similar materials	320	--	
Steel, primary forms	23,676	6,842	U.S.S.R. 5,037; France 961; Japan 395.
Semimanufactures	46,496	17,256	Lebanon 4,745; Belgium 2,167; Japan 2,165.
Lead:			
Oxides	863	460	United Kingdom 384; West Germany 59.
Metal including alloys	1,279	1,360	Kuwait 889; Saudi Arabia 348; Qatar 58.
Titanium oxides	NA	91	United Kingdom 56; West Germany 33.
NONMETALS			
Cement	5,701	3,152	Lebanon 1,502; Kuwait 849; Arab Republic of Egypt 733.
Fertilizer materials, crude or manufactured:			
Nitrogenous	1,888	3,409	Canada 900; West Germany 637; Austria 599.
Phosphatic	6,454	3,920	Lebanon 3,350; West Germany 420.
Potassic	4,357	5,011	Italy 2,240; West Germany 1,399; Kuwait 660.
Lime	2,382	2,368	Lebanon 2,335; Syrian Arab Republic 33.
Sodium and potassium compounds, caustic soda	621	611	Romania 350; Italy 142; United Kingdom 60.
Stone, sand and gravel, dimension stone, calcareous (marble)	668	345	Lebanon 307; Italy 32.
Sulfur	685	1,712	Lebanon 890; France 740.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude—thousand 42-gallon barrels	3,521	4,342	All from Saudi Arabia.
Refinery products:			
Gasoline—do	66	--	
Kerosine—do	258	136	Italy 52; Netherlands 42; Greece 28.
Lubricants—do	38	37	Iraq 16; Lebanon 11; Netherlands 3.
Total—do	362	173	

NA Not available.

[1] Jordanian imports transhipped through Lebanon or at least in part reported under the heading "Lebanon-Foreign" in official statistics without recording actual country of origin. These materials are credited to Lebanon in this table together with those materials actually from Lebanon.

al-Zerqa. Imported crude is obtained through the Trans-Arabian Pipeline (TAPline), which supplied 14,600 barrels daily. A contract for increasing the capacity of the catalytic cracker to 3,000 barrels per day, construction of two units for gasoline and liquefied petroleum gas (LPG) treatment, as well as construction of storage tanks was awarded to the British Firm Pritchard Rhodes Ltd.

LEBANON

Mineral output during 1972 was limited to petroleum products derived from imported crude petroleum, several nonmetallic minerals, and metal semimanufactures based on imported crude metal forms. Mineral commodity production is reported in table 1.

The bulk of the nation's petroleum product requirements are supplied by Lebanon's two refineries, the Tripoli 36,000-barrel-per-day refinery operated by the Iraq Petroleum Co. (IPC) and the Sidon 17,500-barrel-per-day refinery operated by Medreco (Mediterranean Refining Co. owned by Mobil Oil Co. and Caltex Petroleum Co.). The Tripoli refinery was supplied with crude from the Iraq fields operated by IPC until midyear when Iraq nationalized IPC's northern Iraq fields and pipeline. The 440,000-barrel-per-day-capacity IPC pipeline has a 20-mile run through Lebanon to the port of Tripoli. Lebanon did not follow the course adopted by Syria of nationalizing the IPC line and facilities in its country. Consequently, Kirkuk crude that had been moving to the Mediterranean via Tripoli was diverted at the Syrian junction to the port of Banias resulting in a serious loss of transit fees for Lebanon. Total IPC transit payments to Lebanon in 1972 were cut by 48% to $4.8 million dollars.[3] To encourage resumption of the Kirkuk crude flow through Lebanon to the port of Tripoli and to provide feedstock for the Tripoli refinery, the Lebanese Government considered several alternatives including buying or renting the IPC pipeline in its territory. By yearend no settlement was achieved. Throughput at the Tripoli refinery declined to an average of 26,000 barrels per day in 1972. The 39° API Murban crude from Abu Dhabi was mixed with IPC's still available 31° API Ain Zalah crude from the Mosul Petroleum Co. concession in northern Iraq when 36° API Kirkuk crude was no longer available.

TAPline traverses the nation from the southern tip of the Syrian border to the port of Sidon, earning approximately $8.9 million in transit and related fees for Lebanon in 1972. This represents a 32% increase in payments as compared with the previous year, partially offsetting revenue loses incurred by closure of the IPC pipeline. TAPline supplies crude petroleum for the Medreco refinery where throughput averaged 14,200 barrels per day in 1972.

The construction and operation of a third refinery for Lebanon continued under discussion. The project will include the participation of Saudi Arabia through the General Petroleum and Mineral Organization (Petromin).

Much of the nation's requirements for rolled steel products and small diameter pipe are supplied by the Amchit rolling mill of Consolidated Steel Lebanon, S.A.L., the Tripoli rolling mill of Lebanon Steel Co., S.A.L., and the two Beirut pipe mills of Société Nationalé des Tubes S.A.L. and Tubes du Levant S.A.L. Combined annual capacity is estimated at 100,000 tons of rolled products and 30,000 tons of small-diameter pipe. Imported scrap and primary forms serve as raw material supply for the mills. Requirements for a variety of steel semimanufactures, particularly flat products, continue to be satisfied through imports.

Lebanon's commercial nonmetal mineral mining activities largely focus on the cement industry and its raw materials. Cement is manufactured at three plants, all located on the Mediterranean coast south of Tripoli at Chekka. Raw materials for the plants include, locally mined gypsum, limestone quarried along the coast at Chekka, and clay that is transported by truck from the Koura region, a distance of 15 kilometers. The largest plant is operated by the Société de Ciments Libanaise where five rotary wet kilns bring total plant capacity to 1.1 million tons annually. Virtually all of the plant output is general

[3] Where necessary, values have been converted from Lebanese pounds (LL) to U.S. dollars at the rate of 1LL=US$2.77.

use and moderate heat cement (Types I and II); however, small quantities of sulfate resisting cement (Type V) is also produced. Other cement manufacturing operations include a 0.5-million-ton-per-year capacity, three rotary wet kiln plant operated by Cimenterie National S.A.L. and a single rotary wet kiln plant of 50,000-ton-per-year capacity operated by Société Libanaise des Ciments Blancs.

Table 5.—Lebanon: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum metal, including alloys, all forms	5,769	6,193	Iraq 1,505; Syrian Arab Republic 1,446; Saudi Arabia 979.
Copper metal, including alloys, all forms	419	357	Belgium 150; Spain 88; West Germany 68.
Gold unworked or partly worked troy ounces	244,924	61,118	Kuwait 26,396; Saudi Arabia 18,872; Switzerland 6,494.
Iron and steel:			
Scrap	62,805	46,205	Arab Republic of Egypt 31,737; Italy 7,993.
Pig iron	30	32	Turkey 28; Iraq 4.
Steel, primary forms and semimanufactures	46,011	97,384	Iraq 49,888; Saudi Arabia 10,682; Kuwait 9,805.
Lead metal, including alloys, all forms	307	199	Syrian Arab Republic 96; Saudi Arabia 59.
Magnesium semimanufactures	--	(1)	NA.
Molybdenum	1	--	
Nickel metal, including alloys, all forms	6	1	Mainly to Arab Republic of Egypt.
Platinum group, including alloys, all forms troy ounces	3,858	514	United Kingdom 225; Kuwait 193.
Silver, including alloys, all forms do	317,874	168,209	Iran 113,203; Switzerland 49,834.
Tin metal, including alloys, all forms long tons	NA	61	Syrian Arab Republic 58.
Zinc metal, including alloys, all forms	24	3	Saudi Arabia 1; Syrian Arab Republic 1.
Other, precious, waste and scrap	19,294	4,819	United Kingdom 4,158; Syrian Arab Republic 650.
Other ores and concentrate of base metals, n.e.s	--	(1)	NA.
NONMETALS			
Abrasives, natural, pumice, emery, natural corundum, etc	34	136	Kuwait 43; Qatar 38; Saudi Arabia 26.
Asbestos	NA	925	Saudi Arabia 713; Libya 211.
Cement	470,642	615,310	Syrian Arab Republic 191,548; Nigeria 158,730; Algeria 139,118.
Chalk	9	9	Jordan 5; Qatar 2; Saudi Arabia 1.
Clays and products:			
Crude	172	70	Kuwait 29; Iraq 20; Saudi Arabia 13.
Products:			
Refractory	269	211	Jordan 72; Saudi Arabia 70; Kuwait 50.
Nonrefractory	1,172	2,028	Kuwait 733; Saudi Arabia 703; Qatar 183.
Diamond, all grades carats	54,500	12,075	Belgium 7,045; Netherlands 2,270.
Diatomite	37	32	All to Saudi Arabia.
Fertilizer materials:			
Crude	510	524	Syrian Arab Republic 351; Saudi Arabia 84; Cyprus 64.
Manufactured:			
Nitrogenous	9,216	15,109	Syrian Arab Republic 14,241; Iraq 672.
Phosphatic	52,013	70,167	Syrian Arab Republic 22,582; Bulgaria 16,460; Italy 12,695.
Potassic	--	(1)	NA.
Other	637	6,495	Turkey 5,000; Cyprus 1,495.
Ammonia	106	108	Syrian Arab Republic 100; Kuwait 4; Saudi Arabia 4.
Gem stones, precious and semiprecious, except diamond thousand carats	2,285	2,535	France 1,100; Saudi Arabia 480; Switzerland 436.
Graphite	1	4	Saudi Arabia 3.
Gypsum and anhydrite	676	2,635	Nigeria 1,400; Libya 970; Syrian Arab Republic 161.
Lime	61,711	57,555	Libya 43,623; Saudi Arabia 7,060; Syrian Arab Republic 3,498.
Pigments, mineral	14	15	Arab Republic of Egypt 10; Saudi Arabia 2.
Pyrite	--	113	All to Syrian Arab Republic.
Salt	59	274	Saudi Arabia 169.
Sodium and potassium compounds, caustic soda and caustic potash	54	1,251	Syrian Arab Republic 655; Iraq 504.
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Calcareous	1,638	1,879	Kuwait 940; Saudi Arabia 343; Iraq 148.

See footnotes at end of table.

Table 5.—Lebanon: Exports and reexports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Dimension stone, crude and partly worked—Continued			
Noncalcareous	467	270	Kuwait 207; Syrian Arab Republic 62.
Dimension stone, worked	3,213	3,370	Kuwait 2,049; Saudi Arabia 564; Qatar 449.
Gravel and crushed rock	1,763	1,282	Jordan 1,004; Kuwait 159.
Sand	557	856	Syrian Arab Republic 598; Saudi Arabia 168.
Sulfur:			
Elemental, all forms	2,667	3,946	Syrian Arab Republic 2,473; Jordan 973; Iraq 500.
Sulfuric acid	1,504	2,625	Syrian Arab Republic 1,685; Libya 753; Cyprus 88.
Talc and steatite	5	6	Libya 3; Saudi Arabia 3.
Nonmetals, n.e.s	76	109	Italy 109.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	10	9	West Germany 5; Jordan 2.
Coal, all grades	235	358	Jordan 121; Syrian Arab Republic 76; Cyprus 50; Kuwait 50.
Coke and semicoke	1,052	1,697	Syrian Arab Republic 1,134; Jordan 201; Iraq 150.
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	252	122	Bunkers 69; Syrian Arab Republic 29; Iraq 17.
Kerosine—do	2,398	2,907	Bunkers 2,752; Syrian Arab Republic 115.
Gas oil—do	4,633	3,151	Bunkers 1,713; Italy 1,184; U.S.S.R. 144.
Lubricants—do	328	40	Jordan 14; Syrian Arab Republic 7; Bunkers 5.
Liquefied petroleum gas—do	18	(1)	NA.
Other petroleum products—do	--	2	Mainly to Cyprus.
Total—do	r 7,629	6,222	

r Revised. NA Not available.
1 Less than ½ unit.

Table 6.—Lebanon: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Oxide and hydroxide	1,503	492	West Germany 286; France 201.
Metals, including alloys, all forms	8,631	8,315	France 6,526; Canada 387; Italy 237.
Copper metal, including alloys, all forms	1,190	2,872	United Kingdom 843; Canada 677; Belgium 548.
Gold unworked or partly worked thousand troy ounces	3,382	2,116	Switzerland 1,431; France 412.
Iron and steel:			
Scrap	34,337	24,318	Kuwait 12,204; Saudi Arabia 3,574; Iraq 3,355.
Pig iron and ferroalloys	1,433	7,071	U.S.S.R. 5,615; United States 997; France 236.
Steel:			
Common grades:			
Primary forms	110,223	131,367	U.S.S.R. 52,520; Bulgaria 50,441; Romania 27,857.
Semimanufactures	119,767	138,495	Czechoslovakia 32,846; West Germany 16,904; Romania 14,185.
Alloys and high carbon, primary forms and semimanufactures	1,121	1,380	Japan 430; Austria 326; Sweden 177.
Lead:			
Oxide	107	133	West Germany 57; United Kingdom 52; France 19.
Metal, including alloys, all forms	1,184	1,208	United Kingdom 285; West Germany 272; Saudi Arabia 197.
Magnesium metal, including alloys, all forms	1	1	Mainly from France.
Mercury—76-pound flasks	14	347	West Germany 339; Spain 4.
Nickel metal, including alloys, all forms	9	42	Bulgaria 25; West Germany 9; United Kingdom 5.
Platinum group, including alloys, all forms troy ounces	7,298	43	France 39.
Silver, including alloys, all forms—do	48,194	551	Switzerland 357; France 94; United Kingdom 88.
Tin, including alloys, all forms—long tons	86	30	United Kingdom 24; Malaysia 3.
Titanium oxide	8,912	1,319	United Kingdom 745; West Germany 419; Belgium 79.

Table 6.—Lebanon: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Zinc:			
Oxide	43	54	France 28; East Germany 20.
Metal, including alloys, all forms	958	1,009	Belgium 790; Canada 99; North Korea 50.
NONMETALS			
Abrasives, natural, pumice, emery, natural corundum, etc	3,038	1,068	Greece 788; Italy 185; West Germany 22; Austria 21.
Asbestos	6,418	3,147	Canada 1,185; unspecified African Countries 1,059; U.S.S.R. 485.
Barite	20	6	Netherlands 5; West Germany 1.
Cement	1,085	841	Denmark 495; France 206; Syrian Arab Republic 135.
Chalk	932	1,137	Belgium 839; United Kingdom 130; France 120.
Clays and products:			
Crude	7,880	8,559	Turkey 4,513; United Kingdom 2,678; Greece 800.
Products:			
Refractory	2,544	4,375	West Germany 2,280; Italy 424; Morocco 399; Canada 366.
Nonrefractory	7,595	8,533	Italy 3,890; West Germany 1,269; France 1,214.
Diamond, all grades—carats	56,465	60,000	Belgium 30,000; India 10,000; United Kingdom 5,000.
Diatomite	218	96	United States 47; Belgium 36.
Feldspar and fluorspar	1,130	1,260	Italy 800; Yugoslavia 400; Finland 15; Netherlands 15.
Fertilizer materials:			
Natural:			
Phosphate rock	143,037	102,427	All from Jordan.
Other	2,924	450	France 226; Spain 180.
Manufactured:			
Nitrogenous	28,452	54,030	West Germany 11,227; Chile 10,000; France 9,437.
Phosphatic	102	331	Romania 200; Belgium 101; Portugal 30.
Potassic	8,237	6,473	Spain 2,800; France 1,869; East Germany 984.
Other	1,676	7,283	West Germany 4,236; Belgium 1,700; Netherlands 849.
Ammonia	16,948	9,021	France 8,940; Netherlands 51.
Gem stones, precious and semiprecious except diamond:			
Natural—thousand carats	7,015	12,810	Brazil 4,760; India 4,495; West Germany 1,765.
Manufactured—do	4,755	10,583	France 5,385; Switzerland 2,730; Italy 1,505.
Powder, waste, etc	130	--	
Graphite	69	8	People's Republic of China 5; West Germany 3.
Gypsum and anhydrite	48,231	70,199	Syrian Arab Republic 69,990; Turkey 105.
Lime	28	34	United Kingdom 25; West Germany 5.
Magnesite	12	42	Netherlands 41.
Mica, all forms	28	26	Norway 17; Romania 5; Hong Kong 3.
Pigments, mineral including processed iron oxides	133	215	West Germany 102; Spain 31; Hungary 30.
Pyrite	1	--	
Salt	1	67	Romania 35; West Germany 30.
Sodium and potassium compounds	5,017	3,859	France 1,246; United Kingdom 1,205; Romania 1,124.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	23,506	29,490	Italy 18,545; Portugal 3,238; Greece 2,204.
Noncalcareous	2,670	3,561	Syrian Arab Republic 3,095; Italy 366.
Worked	177	317	Syrian Arab Republic 236; Italy 42.
Gravel and crushed stone	8,510	8,205	Italy 6,349; Jordan 1,252; France 500.
Limestone	--	7	Italy 4; West Germany 3.
Quartz and quartzite	45	11	Norway 10.
Sand	1,191	2,655	Syrian Arab Republic 2,623; United States 15.
Sulfur:			
Elemental, all forms	61,888	59,649	Poland 27,404; France 21,612.
Sulfuric acid	140	11,683	Poland 8,470; Portugal 3,183.
Talc and steatite	387	814	Czechoslovakia 497; United States 104; Norway 63.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	15	5	United States 5.
Carbon and carbon black	65	109	United States 69; Syrian Arab Republic 27; West Germany 13.
Coal, all grades	300	819	Belgium 415; Spain 380; Greece 24.
Coke and semicoke	5,101	4,500	Poland 2,700; France 1,800.

Table 6.—Lebanon: Imports of selected mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
MINERAL FUELS AND RELATED MATERIALS—Continued			
Peat	29	155	Romania 94; Finland 24; West Germany 20.
Petroleum refinery products:			
Gasoline--thousand 42-gallon barrels	3,170	3,464	Iraq 2,736; Saudi Arabia 702.
Kerosine--do	402	349	Iraq 291; Saudi Arabia 56.
Gas oil and fuel oil--do	5,199	5,867	Iraq 4,110; Saudi Arabia 1,756.
Lubricants--do	125	162	Italy 67; United Kingdom 27; Austria 22.
Liquefied petroleum gas--do	712	850	Italy 365; Iraq 167; France 146.
Mineral jelly and wax--do	6	6	Hungary 1; People's Republic of China 1; Romania 1; U.S.S.R. 1.
Other--do	163	181	Iraq 164; Syrian Arab Republic 4; Italy 3; Netherlands 3.
Total--do	9,777	10,879	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	402	1,084	Netherlands 594; West Germany 315; Italy 90.

OMAN

Petroleum and natural gas are the only minerals produced in Oman in significant quantities. Petroleum Development Oman Ltd. (PDO) is the concessionaire for onshore operations and in 1972 Oman's only crude petroleum and natural gas producer. Royal Dutch/Shell owns 85% equity in PDO, 10% is owned by Compagnie Française des Pétroles (CFP), and the remaining 5% is owned by the Portuguese Participations and Explorations Corp. (Partex). Total production in 1972 is reported in table 1. Production by field is reported as follows in thousand barrels and million cubic feet:

	Crude petroleum	Associated gas	Nonassociated gas
Fahud	44,963.5	18,926	20,918
Yibal	24,680.1	17,155	7,247
Natih	21,799.8	9,423	1,573
Al Huwaisa	11,687.2	2,899	--

Production from the Natih and Fahud fields has declined for the past 3 years as a result of pressure loss. During 1972, PDO tested a water-injection program in the Fahud field and began full operation of a water-injection secondary-recovery operation in the Yibal field.

Inspite of the decline in production, government revenue from oil increased to an estimated level of $138 million as the posted price of 33° API crude at Mina al Fahal tanker terminal rose by 8.5% from $2.31 to $2.50 per barrel on January 31, 1972. The increase in posted prices resulted from an agreement incorporated into the PDO concession paralleling the January 20 Geneva Agreement between the Persian Gulf members of the Organization of Petroleum Exporting Countries (OPEC) and the operating companies.

In addition, increased revenues were obtained as of May 1 by levying port dues of 12 cents per gross registered ton for tankers loading oil at Mina al Fahal. The actual dues were based on the volume of loaded cargo.

To offset the rapid rate of decline in crude oil production from 332,000 barrels daily in 1970 to 282,000 barrels per day in 1972, PDO expanded its exploration program on its onshore concession area. Exploration in 1972, excluding activity in the Dhofar province, resulted in 24.9 party-months of seismic survey, 2 party-months of gravity survey and 13 exploratory wells. Drilling activity totaled 216,091 feet (65,865 meters) in 42.3 string-months. PDO also holds a concession in Dhofar that expires in 1975 unless oil is discovered in the area. Activity in the PDO Dhofar concession included 23.4 party-months of seismic survey and three exploratory wells. Drilling activity totaled 22,040 feet (6,718 meters) in 6.4 string-months.[4]

Exploration activities offshore Oman were conducted by the Wintershall consortium with 59% ownership by Wintershall Aktiengesellschaft, 25% by the Royal

[4] American Association of Petroleum Geologists Bulletin, V. 57, No. 10, October 1973, Tulsa, Okla., p. 2065.

Dutch/Shell group, 10% by Deutsche Schachtbau und Tiefbohrgesellschaft m.b.H. and 7% by Partex. In February, drilling was suspended on the Batinah Marine B–1 well near Damaniyat Island at a depth of 15,194 feet (4,631 meters). This represents the second wildcat well abandoned in offshore Oman by the consortium. The first was abandoned as a dry hole at 13,205 feet. No further drilling activity was reported by the consortium in 1972. Near yearend, PDO announced that heavy oil of 15° to 16° API was discovered at a depth of about 1,500 feet (457 meters) near Ghaba and Qarn Alma and that a lighter crude of 39° API was found at a depth of 8,500 feet (2,591 meters) near Saih Nihayda. Drilling continued throughout the year to determine whether the formations are of commercial value.

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN

During 1972 the mineral industry activity of the People's Democratic Republic of Yemen was focused on refining of imported crude petroleum, salt production and mineral exploration. Refer to table 1 for production figures. The nation's sole refinery is located in Aden and operated by British Petroleum Refinery (Aden) Ltd. The refining capacity is reported at 160,000 barrels per day; however, the refinery's record high throughput was 130,112 barrels per day reported in 1965. The refinery processes crude from Iran, Kuwait, and the Arab Republic of Egypt, and possibly from the United Arab Emirates (Abu Dhabi). Products refined from Egyptian crude are exported back to the Arab Republic of Egypt.

Salt production is centered at Khawr Maksar under direction of the state-owned General Salt Organization. Evaporated salt is produced for local consumption and for export principally to Japan.

Mineral exploration was conducted by the South Yemeni Algerian Petroleum Co. (SYAPCO), which is 51% owned by the South Yemen state petroleum agency and 49% by Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation, des Hydrocarbures (SONATRACH). During 1972 exploration was supported by a $4 million expenditure by Algeria. Activity included a geophysical survey in the Hadhramaut area and two exploratory tests.

Table 7.—People's Democratic Republic of Yemen: Exports and reexports of mineral commodities

Commodity		1970	1971	1972
Petroleum refinery products:				
Gasoline	thousand 42-gallon barrels	1,500	1,765	3,500
Kerosine and jet fuel	do	7,770	5,136	4,320
Distillate fuel oil	do	7,970	4,000	2,510
Residual fuel oil	do	21,960	11,010	12,636
Other including LPG and feedstocks	do	2,250	1,792	155
Total	do	41,450	23,703	23,121
Salt [1]	metric tons	41,734	24,739	15,163

[1] Japanese imports from the People's Democratic Republic of Yemen.

QATAR

During 1972, Qatar celebrated its first full year of independence in vigorous activity designed to strengthen the nation's economy while reducing dependence on petroleum recovery as a primary source of national income. Measures undertaken to diversify the economy included the utilization of previously flared associated gas in the manufacture of fertilizers and in the future production of natural gas liquids (NGL), the expansion of cement manufacturing facilities, and the creation of a national petroleum company with proposed operations in all phases of the petroleum industry. Qatar's production of mineral commodities is reported in table 1.

In April a decree was signed establishing the Qatar National Petroleum Co. (QNPC) to carry out operations in all phases of the petroleum industry. The company is structured as a vehicle for Qatar's participation in existing producing

companies and according to decree will own 25% of both the Qatar Petroleum Co., Ltd. (QPC), and the Shell Oil Co. of Qatar (SOCQ), as well as 50% of the Japanese Qatar Oil Co. on January 1, 1973. The state-owned National Oil Development Co. (NODCO), which handles local distribution and marketing has been absorbed as a subsidiary of the QNPC. The QNPC also assumed control of the state interest in the Qatar Fertilizer Co. (QAFCO).

Other measures exercised in the early months of the year included the cancellation of a concession covering 12,000 square kilometers onshore awarded to the Belgian Oil Corp. in August 1971 and the concession covering 9,000 square kilometers offshore and a small onshore strip awarded to the South East Asia and Gas Co. of Houston, Tex., in 1970. The offshore concession held by the Qatar Oil Co. Ltd. (Japan) was not recinded.

Petroleum revenues were estimated at $220 million, representing about 95% of the Government revenue in 1972, more than half of this amount $133.3 million was paid by QPC. During 1972, QPC averaged 242,673 barrels per day of 41° API crude containing 1.2% sulfur from 57 wells in the Dukhan field. The posted price for Dukhan crude was $2.590 per barrel in 1972. Export shipments from the Umm Said terminal totaled 88.7 million barrels transported in 275 tankers. The shallow waters of the port require tankers to navigate a 37-mile channel, and carrying a maximum load of 80,000 tons. A single buoy mooring system to accommodate large vessels was under construction in 1972.

The Power-Gas Corp. Ltd., a subsidiary of Davy Ashmore Ltd. (United Kingdom), received a contract for QPC's NGL projects. Associated gas from QPC's Dukhan field is to be processed at an 800,000-ton-per-year-capacity NGL plant. The bulk of the plant's output will be exported to Japan. The United Kingdom firm will be responsible for engineering and construction of the complex, which includes gathering systems, liquid extraction plant, liquid product trunk line, fractionation and treating plant, together with storage and marine loading facilities. The overall project cost is estimated at $65 million dollars, and completion of the entire complex is scheduled for 1975.

SOCQ averaged 239,686 barrels per day of 36° API crude containing 1.5% sulfur from a total of 28 wells in three offshore fields. Production by field is reported as follows in thousand barrels and million cubic feet:

	Crude petroleum	Associated gas
Maydan-Mahzan	55,288.8	32,539
Idd El Shargi	15,401.6	43,902
Bul Hanine	17,034.5	12,229

The Bul Hanine field was put into production in mid-1972 at an initial rate of 50,000 barrels per day which increased to more than 100,000 barrels per day by yearend.

The Halul Island terminal operated by SOCQ has a single buoy mooring system and can accommodate tankers of up to 165,000 deadweight tons. During 1972, facilities were expanded by the completion of a 250-ton buoy capable of berthing tankers of up to 500,000 deadweight tons.

The nation's petroleum product consumption requirements are estimated at 3,000 barrels per day. Imports from Iran satisfy most of the product requirements; however, the state-owned NODCO operates a 680-barrel-per-day topping plant at Umm Said. The plant's crude petroleum supply is obtained via pipeline from the Dukhan field.

A contract for construction of a 6,000-barrel-per-day refinery at Umm Said was awarded to Hudson Engineering, a subsidiary of McDermott International. The plant is to be designed to meet local requirements for petroleum products. Construction cost is estimated at $8 million, and completion is scheduled by 1974.

The QPC operates a small gas processing plant at Umm Said. During 1972 production averaged 25 million cubic feet per day for use in local industries such as power generation and water desalination. The plant is capable of increased production.

The manufacture of mineral fertilizer materials was inaugurated with the near yearend startup of the QAFCO 900-ton-per-day ammonia plant at Umm Said. A 1,000-ton-per-day urea unit is scheduled for startup in early 1973. Associated gas from the Dukhan field piped at the rate of 1.2 million cubic meters per day will be used as feedstock. The Qatar Government holds 63% equity in QAFCO, Norsk-Hydro (Norway) acting as manager and marketer holds 20% equity, and Powergas, Ltd., the

plant's main contractor, holds 7% equity.

The Qatar National Cement Co. operates Qatar's sole cement manufacturing facility. The West Coast Umm Bab plant annual capacity is 110,000 tons. The bulk of the plant output is portland cement and limited amounts of sulphate-resistant cement The Tarmac Construction Co. (United Kingdom) was awarded a contract to double the plant's capacity. Domestic requirements for cement are estimated at 70,000 tons annually affording approximately 150,000 tons of cement for the export market when expansion activities are completed by 1974.

Table 8.—Qatar: Exports of crude petroleum and imports of petroleum refinery products
(Thousand 42-gallon barrels)

Commodity	1970	1971	1972
EXPORTS			
Crude petroleum	131,765	156,439	176,302
IMPORTS			
Petroleum refinery products:			
Gasoline	311	325	e 315
Kerosine	20	25	e 120
Distillate fuel oil	200	250	e 350
Lubricants	14	10	e 25
Asphalt	43	38	e 30
Total	588	648	e 840

e Estimate.

SYRIAN ARAB REPUBLIC

The production of crude petroleum at a level of 123,522 barrels per day dominated Syria's mineral output in 1972. In addition to petroleum and natural gas, the nation produces a variety of nonmetallic minerals, and during the year the manufacture of mineral fertilizers was inaugurated in the country. Refer to table 1 for production of mineral commodities.

Petroleum output is derived from the Karachok, the Rumailan, and the Sawaidiyah fields. The fields are operated by the state-owned General Petroleum Co. (GPC). Crude production in 1972 represented about a 24% increase over the previous year's level, and by 1975, GPC estimates that production will double to 240,000 barrels per day. In anticipation of the increased output, the Karachok-Tartus pipeline capacity was expanded to 142,000 barrels per day, and a second oil terminal at Tartus was under construction. The bulk of Syria's crude production is exported with the exception of an estimated 35,000 barrels per day, which is processed at the 54,000-barrel-per-day-capacity of Homs refinery. Domestic low-gravity, high-sulfur crudes are combined with light Iraqi crude delivered by pipeline to yield approximately 40,000 barrels of petroleum products. Revenues for the QPC were reported as follows in million dollars:

Crude petroleum exports	$49.9
Crude petroleum sales to Homs refinery	27.6
Product exports	3.0
Products sales, domestic	46.4

In addition to revenue obtained from petroleum production and processing, transit fees levied on petroleum produced in Saudi Arabia and Iraq and carried via pipeline across Syria earned an estimated $95 million in 1972. Two transit pipelines cross Syrian territory. The TAPline crosses the nation along the southern tip from the Jordanian to Lebanese border, a distance of less than 100 miles. Average daily throughput was estimated as 425,000 barrels in 1972.

The Iraq Petroleum Co. (IPC) pipeline carries crude from the North Iraqi fields across 300 miles of Syrian territory to Mediterranean ports of Banias and Tripoli (Lebanon). On June 1, 1972, Iraq nationalized IPC's northern Iraq fields and pipelines. On the same day IPC's facilities were nationalized in Syria, and the government-owned Syrian Co. for Oil Transport (SCOT) was formed to take over IPC's properties. A dispute over transit fees evolved with Iraq offering 30 cents per barrel and Syria demanding 50 cents per barrel. No settlement was made by year-

end, but the dispute did not completely halt the flow of crude petroleum. The SCOT pipeline was shutdown from the day of nationalization June 1 through July 7 when Iraq recommenced exporting from the Port of Banias. The Tripoli (Lebanon) terminal remained closed to yearend.

The 150,000-ton-per-year-capacity fertilizer plant at Homs came onstream in January with limited production, building up to a production level of 300 tons per day by midyear. The plant was built at a cost of $16.3 million. Plant units include a nitric acid plant built by U.S.S.R. Technoexport under a 1965 contract; a plant for production of an ammonium nitrate-dolomite mixture built by the Czechoslovak Technoexport organization under a 1965 contract; and an ammonia producing unit constructed by SNAM Progetti also under a 1965 contract. Basic construction was completed in 1970, but coordination problems delayed actual production until 1972.

The expansion of facilities for the extraction and processing of rock salt was under consideration during 1972. Present capacity is reported at 36,000 tons, which would be increased to 114,000 tons annually under the current proposal.

Three cement plants each with an annual capacity of 350,000 tons are in operation in Syria. The plants located at Homs, Aleppo, and Damacus are under expansion, and their capacities should double by 1975. Total cost of the expansion project is estimated at $31 million.

UNITED ARAB EMIRATES

The United Arab Emirates formed in 1971 represent a federation of independent sheikhdoms. Included in the federation are Abu Dhabi, Ajman, Dubai, Fujairah, Sharjah, and Umm al-Qaiwan. The sheikhdom Ras al-Khaimah accepted federation membership in 1972 placing the total membership at seven.

The presidency and vice-presidency of the federation are held respectively by the rulers of Abu Dhabi and Dubai, the only oil producing emirates in the federation in 1972. The federation budget has been sustained by revenues emitting from Abu Dhabi's petroleum production. Long-range plans foresee financing by assessing 10% of government revenues from each of the sheikhdoms.

Refer to table 1 for mineral production statistics on the United Arab Emirates.

Abu Dhabi.—Petroleum and natural gas are the only minerals produced in commercial quantities in Abu Dhabi. Revenues obtained from the petroleum industry sustain the economy and offer a financial base for various feasibility studies and development programs that will eventually create a more diversified economy. Petroleum revenues based on tax and royalty obligations were reported at $550 million, an increase of 28% over 1971. Production growth coupled with an 8.49% price rise resulting from the 1972 Geneva currency agreement accounted for the revenue increase. An additional source of revenue was introduced with the decree of January 22, 1972 imposing port dues of 12.7 cents for each gross registered ton on tankers loading at Abu Dhabi. Revenue from this source is estimated at $6 million.

On December 20, 1972, the Government of Abu Dhabi and representatives of companies operating within the territory entered into an agreement affording the Government of Abu Dhabi 25% participation as of January 1973. Participation will be affected by the state-owned Abu Dhabi National Oil Co. (ADNOC) created in 1971.

Petroleum production averaged over a million barrels per day. The entire output was exported with Japan, France, and the United Kingdom as principal destinations; however, an average of 73,000 barrels per day was exported to the United States in 1972.

Petroleum product consumption estimated at 4,000 barrels per day was satisfied by imports via company operations of British Petroleum Co., Ltd. (BP), the Royal Dutch/Shell, and Caltex. Product mix is reported as motor and aviation gasoline, kerosine, and lubricants. Construction of a 15,000-barrel-per-day government refinery at Umm al-Nar Island was under consideration in 1972. Five international firms submitted bids, but no award was announced by yearend.

More than half of the total production of 1972, or 610,738 barrels per day, was derived from the Abu Dhabi Petroleum Co.

(ADPC) operations in the Murban field including the Bab and Bu Hasa domes. Production increased by 6% over 1971. Production from ADPC operations will be nearly doubled by 1974 when the Asab field now under development enters production. Development well drilling activity was more intensive in 1972. During the year, 33 development wells were drilled totaling 278,282 feet as compared with 14 development wells totaling 123,569 feet drilled in 1971. Equity in ADPC is shared by BP/Royal Dutch/Shell and Compagnie Française des Pétroles (CFP), Near East Development (EXXON and Mobil) each by 23¾% with the Portugese Participations and Explorations Corp. (Partex) holding the remaining 5%. Each concessionaire's holding will be reduced by 25% to permit participation by the state-owned ADNOC in January 1973.

Production from Abu Dhabi Marine Areas Ltd. (ADMA) averaged 442,000 barrels per day. Two offshore fields were in production. The Zakum field produced an average of 291,000 barrels per day. The Umm Shaif field averaged 151,000 barrels per day. By application of a pressure maintenance waterflood project, ADMA anticipates raising total production from Zakum and Umm Shaif fields to 800,000 barrels per day by 1974. Participation in ADMA is dominated by BP, 66⅔% equity with the remaining 33⅓% equity held by CFP. BP offered to sell a portion of its holdings in ADMA. The West German firm, Deminex displayed initial interest; however, Overseas Petroleum Corp. (OPC), a consortium of 30 Japanese companies, was also in serious negotiation. By yearend no decision had as yet been reached. Whatever the outcome of BP's negotiations, the corporate structure of ADMA will be altered as of January 1973 to permit 25% participation by the ADNOC.

The Mubarraz field, an offshore concession of Abu Dhabi Oil Co., Ltd., a Japanese consortium was under development during 1972. The field was expected to enter production in the spring of 1973 at an initial rate of 40,000 barrels per day of 31° to 44° API gravity crude containing 0.7% to 1.7% sulfur. According to the 1967 concession agreement, the Abu Dhabi Government has the option of 50% participation in the producing field.

By yearend an agreement was reached on the construction of a $300 million natural gas liquefaction plant on Das Island. Plant construction is scheduled to begin in 1973 with completion anticipated in March 1976. Associated gas from ADMA offshore operations will be used as feedstock to produce 2.2 million tons of liquefied natural gas, and 800,000 tons of liquefied petroleum gas annually. In addition, the plant will also produce 220,000 tons of light distillates and 230,000 tons of sulfur. The Tokyo Electric Power Co. negotiated a 20-year contract beginning in 1976 for the purchase of liquefied natural gas. Participants in the venture include the 36% equity held by Mitsui and Co., Ltd., 26⅔% held by BP, 20% by ADNOC, 13⅓% held by CFP, and 4% held by Bridgestone Liquefied Gas Co., Ltd., of Japan.

Ajman.—The only known mineral commodity produced in the 100-square-mile sheikhdom of Ajman is marble. The Ajman Marble Co. quarries and finishes an average of 50 square meters of marble daily. The output is consumed within the federation of the United Arab Emirates.

Oil concessions for onshore and offshore Ajman are held by Occidental Petroleum Corp. No drilling activity was reported in 1972.

Dubai.—Petroleum and associated natural gas are the only minerals produced in Dubai in significant quantities. Petroleum-based revenues were estimated at $75 million in 1972. Revenues are largely invested in the development of the economy. Projects include the construction of Port Rashid harbor, VLCC drydock facilities, a possible cement plant, and several transportation and social welfare projects.

Petroleum production averaged 152,840 barrels per day for the entire year of 1972; however, production levels reached 220,000 barrels per day by yearend. The entire production is recovered from offshore operations of Dubai Petroleum Co., a wholly owned subsidiary of Continental Oil Co. (Conoco), which is participating as the operating company for a multinational group composed of Dubai Petroleum Co. (subsidiary of Conoco) 30%, Dubai Marine Areas, Ltd. (owned equally by Hispanica de Petroleos S.A.) 50%, Deutsche Texaco A.G. 10%, Sun Oil Co. 5%, and Delfzee Dubai Petroleum (Wintershall A.G.) 5%. The bulk of crude production

or 48.7 million barrels was obtained from the Fateh field. A second field, the Southwest Fateh was placed in production in October producing 7.2 million barrels to yearend. Two additional submarine storage tanks of 500,000-barrel capacity each were installed in 1972 raising total storage capacity to 1.5 million barrels. Tanker loading facilities were under expansion during 1972 with construction of a second monobuoy accommodating tankers of up to 300,000 deadweight tons at a loading rate of 100,000 barrels per hour. The Fateh complex including development wells and production and storage facilities represents an investment of $170 million through 1972.

Expansion and development of harbor facilities at Port Rashid was realized in 1972 following an investment of nearly $60 million. Harbor facilities include 15 cargo berths and ancillary equipment to handle 3 million tons of cargo annually. A sixteenth berth provides for 70,000-deadweight-ton tankers supplying Dubai's needs for petroleum products, all of which are imported. Historically, Dubai has been active in entrepot trading, about half a million tons of goods have been unloaded annually even before port expansion activity. New harbor facilities should insure Dubai's position as commercial center of the lower gulf.

Political activities in 1972 included Dubai's withdrawal of membership from the Organization of Arab Petroleum Exporting Countries (OAPEC), following a decision by OAPEC favoring Bahrain over Dubai as the site for an OAPEC drydock. Near yearend, the Government of Dubai had inaugurated a drydock project far larger in its first phase than the OAPEC project. Two docks capable of berthing tankers of up to 500,000 deadweight tons are planned, and the possible future construction of a berth for a million-deadweight-ton vessel is to be provided for. Proposed ownership of the Dubai Dry Dock Co. places 50% equity with the Dubai Government, 25% equity with John J. McMullen Naval Architects (New York) and 25% equity with Galadari Brothers (Dubai).

Construction of a 500,000-ton-per-year-capacity cement plant was under consideration during the year, but no contract was awarded by yearend. A plant of this size would be the largest in the gulf, affording Dubai with another commodity for the export market.

Fujairah.—The sheikhdom of Fujairah covers an area of 450 square miles. No mineral production nor mineral exploration is reported. The largest single development project in the sheikhdom is a proposed central electric power station that will link east coast Fujairah and Sharjah villages on a single grid. Quidfa was selected as the site of the $2 million power station.

Ras al-Khaimah.—The sheikhdom of Ras al-Khaimah was admitted as the seventh member of the Federation of United Arab Emirates in February 1972. While no mineral production was reported during the year, an exploratory program was conducted in offshore territorial waters and plans were announced for construction of 250,000-ton-per-year-capacity cement plant.

Union Oil Co., (80%) in a partnership with Southern Natural Gas Co., (20%) completed a seismic survey in March in its offshore concession area. By midyear, Union Oil's third wildcat well was abandoned at 17,820 feet after a testing described as noncommercial. By yearend, Union Oil relinquished its concession and terminated all operations in Ras al-Khaimah.

Union Cement Co. announced the proposed construction of a 250,000-ton-per-year-capacity cement plant at Khor Kuwait. The $13.5 million plant is scheduled for operation in 1974.

Sharjah.—Petroleum was discovered in October 1972 when the Murabek A-1 wildcat well off Abu Musa Island test flowed crude from four producing zones at a combined rate of 13,955 barrels daily, averaging 36° API gravity and less than 0.6% sulfur. The field was not in commercial production during the year; however, it is being prepared for production by early 1974.

The Abu Musa discovery well was drilled by Buttes Oil and Gas Co. at 37.5% equity in partnership with Ashland Oil Co. at 25%, Skelly Oil Co. at 25%, and Kerr McGee Corp. at 12.5%. The well is located in an area that has been the center of a boundary dispute revolving about Sharjah's claim to a 12-mile offshore territorial limit. The concession area was also claimed by Iran and by Umm al-Qaiwain. The Iranian claim was resolved by an agreement that splits revenues from the

Abu Musa field between Iran and Sharjah once revenues exceed $7.8 million annually. Revenues below this level are granted to Sharjah. The agreement also confirms concessionary rights of the Butts Oil and Gas Co. group. The concession area is also claimed by Occidental Petroleum Corp. under a November 18, 1969 concession agreement with Umm al-Qaiwain. Legal action has been undertaken to substantiate the claim. A U.S. Circuit Court of Appeals dismissed the suit on grounds of no jurisdiction; however, Occidental Oil Corp. announced it would continue litigation elsewhere.

Umm al-Qaiwain.—No mineral production of commercial significance was reported in Umm al-Qaiwain during 1972. Occidental Petroleum Corp. holds an offshore concession granted in November 1969. The concession as granted by Umm al-Qaiwain extended to the median line with Iran. The neighboring sheikhdom of Sharjah shares possession of Abu Musa Island with Iran. The island's territorial waters cut into Umm al-Qaiwain's offshore zone. Sharjah and Iran claim a 12-mile territorial waters zone around the island, while Umm al-Qaiwain contends that 3 miles is the legal limit. Petroleum has been discovered in the sensitive 9-mile belt claimed by all parties.

YEMEN ARAB REPUBLIC

The mineral industry of Yemen Arab Republic is based on production of several nonmetallic minerals. With the exception of rock salt mined in commercial quantities for export to Japan, the nation's nonmetallic mineral deposits are mined for local consumption. This includes unreported quantities of building stone, limestone, and gypsum. Refer to table 1 for mineral production figures. Indications are that the long-awaited 50,000-ton-per-year capacity Bajil cement plant was in production by yearend. If so, the plant should satisfy the nation's cement consumption requirements as well as supply a second mineral commodity for export in 1973.

Salt is mined commercially in open pit operations at Salif located in the northwest on the Red Sea coast. An overburden of 15 to 20 feet of sand covers the deposit assaying at 98% NaCl. Salt is carried by rail a distance of a quarter mile to the Salif pier where it is loaded on barges for transport to a cargo ship anchored about 3,000 feet offshore. Total production of the Salif mine is shipped to Japan; however, mine, crusher, and rail equipment has fallen into disrepair, limiting output to levels below the export volumes agreed upon between contractors. In August 1972, the Government received a loan from the Kuwait Fund for Arab Economic Development for $3.65 million in addition to a loan of $1.96 million granted by the Kuwait Fund in 1970. The funds represent 90% of the cost for construction of facilities supporting the production, processing, storage, and loading of a million tons of rock salt annually. Project completion is anticipated by 1974.

Domestic petroleum product requirements are imported, with distribution conducted by Yemeni Fuels Co. headquartered at al Hudaydah with branches in al Mukha, Ta'izz, and San'aa. Product storage capacity is 14,000 tons, about 1 month's national supply. Distribution is achieved by a fleet of 40 tank trucks.

Mineral exploration activities were conducted in the early months of the year, but a financial dispute between the Yemeni Government and the Algerian State oil company dissolved the Yemen Oil Minerals Industries Co. (YOMICO) and exploration activity was halted. YOMICO was formed in 1970 with 50% ownership by the Yemeni Government and 50% ownership by Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH). In the first full year of operation, 1971, 8 party-months of land seismic survey were conducted. Shortly before the dissolution of YOMICO, the Yemeni Government reported discovery of commercial petroleum in the Tuhamah region and possible copper deposits, but no additional information has been reported. By midyear, the Government announced its interest in obtaining a new partner, preferably an American firm, in a joint venture exploration concession. The Yemen Arab Republic resumed diplomatic relations with the United States in October 1972 following a 5-year break in relations after the 1967 Arab-Israeli war.

The Mineral Industry of Other Far Eastern and South Asian Areas

By Staff, Bureau of Mines

CONTENTS

AFGHANISTAN [1]

The status of the Afghan minerals industry remained unchanged from that of 1971. The nation's major mineral output continued to be natural gas from the Shibarghan Province gasfield. Production increased slightly over that of 1971. The bulk of production was exported to the U.S.S.R. under a 1967 trade agreement. The price paid for this exported fuel was not known. The remaining small quantity of natural gas was consumed within the country.

During the year an official press release announced that a 100,000-ton-capacity oil refinery will be built in northern Afghanistan, with funds supplied by a Soviet loan, to process oil and gas found in this area by Soviet exploration. In addition, a pipeline from this area and a bridge across the Oxus River are planned to carry gas into the U.S.S.R.

The country's output of coal showed no significant increase over that of the previous year. The major portion of the output was derived from the Karkar, Ishpushta, and Darr-i-Suf mines. The Karkar and Ishpushta mines are considered to have only a short working life remaining. Hence, the Darr-i-Suf mine has been developed to provide for increased future coal production. Reserves at this latter mine have been determined at almost 15,000 million tons. In the future, coal from Darr-i-Suf may be used in conjunction with the iron ore that may be developed at the known Hajigak iron deposits.

The rest of the nation's mineral output consisted of lapis lazuli, marble, salt, and cement.

No progress was reported on the acceptance of the country's proposed mining and petroleum code.

[1] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Other Far Eastern and South Asian Areas: Production of mineral commodities

Area,[1] commodity, and unit of measure	1970	1971	1972 p
AFGHANISTAN [2 3]			
Cement, hydraulic ——thousand metric tons	94	e 90	e 90
Coal:			
Bituminous, mine output ——do	170	e 180	e 180
Briquets (produced from a part of mine output) ——do	30	NA	NA
Gas, natural, marketed production ——million cubic feet	91,217	88,745	e 90,000
Gem stones, lapis lazuli ——kilograms	10,000	e 10,000	NA
Salt, all types ——thousand metric tons	38	e 38	e 38
Stone:			
Marble "traso" ——thousand cubic meters	27	NA	NA
Marble, n.e.s ——do	5	NA	NA
BANGLADESH [2]			
Cement, hydraulic ——thousand metric tons	67	e 30	e 70
Clays, kaolin (china clay) ——metric tons	3,184	e 1,800	e 2,000
Fertilizer materials, manufactured, nitrogenous:			
Gross weight ——do	86,828	e 52,000	e 54,000
Nitrogen content ——do	40,462	e 24,000	e 25,000
Gas, natural, sales [4] ——million cubic feet	20,421	e 20,000	21,900
Iron and steel:			
Crude steel [6] ——thousand metric tons	100	100	NA
Mild steel products [5] ——do	127	NA	NA
Petroleum refinery products:			
Aviation gasoline ——thousand 42-gallon barrels	(6)	24	26
Motor gasoline ——do	(6)	727	362
Jet fuel ——do	(6)	206	73
Kerosine ——do	(6)	1,469	1,267
Distillate fuel oil ——do	(6)	612	763
Residual fuel oil ——do	(6)	2,132	2,291
Other ——do	(6)	295	614
Refinery fuel and losses ——do	(6)	449	458
Total ——do	(6)	5,914	5,854
Salt, marine, evaporated ——thousand metric tons	224	e 130	NA
Stone, limestone, industrial ——do	177	e 80	e 180
BRUNEI [2]			
Gas, natural:			
Gross production ——million cubic feet	126,654	e 120,000	e 170,000
Marketed production ——do	7,965	7,769	e 11,000
Natural gas liquids:			
Condensate ——thousand 42-gallon barrels	16	NA	NA
Natural gasoline ——do	465	NA	NA
Liquefied petroleum gas ——do	207	NA	NA
Petroleum:			
Crude ——do	50,233	47,482	67,008
Refinery products:			
Gasoline ——do	93	e 98	e 112
Distillate fuel oil ——do	218	e 216	e 196
Residual fuel oil ——do	2	e 4	e 6
Other ——do	15	e 14	e 20
Refinery fuel and losses ——do	45	e 48	e 32
Total ——do	373	e 380	e 366
Stone, gravel and cobblestone ——cubic meters	340,657	NA	NA
HONG KONG [2]			
Cement, hydraulic ——thousand metric tons	430	512	480
Clays, kaolin ——metric tons	3,785	2,526	3,162
Feldspar ——do	1,621	1,145	1,149
Iron ore and concentrate, gross weight ——do	170,256	162,739	162,283
Quartz ——do	5,350	5,141	3,631
KHMER REPUBLIC [2]			
Cement, hydraulic ——thousand mertic tons	r 38	59	99
Gem stones:			
Ruby ——carats	NA	1,612	NA
Sapphire ——do	NA	879	NA
Zircon ——do	NA	1,630	32,000
Gold, mine output, metal content e ——troy ounces	4,000	4,000	4,000
Petroleum refinery products:			
Gasoline ——thousand 42-gallon barrels	256	21	--
Jet fuel ——do	183	--	--
Kerosine ——do	146	--	--
Distillate fuel oil ——do	803	82	--
Residual fuel oil ——do	365	43	--
Other ——do	365	14	--
Refinery fuel and losses ——do	137	51	--
Total ——do	2,255	211	--

See footnotes at end of table.

Table 1.—Other Far Eastern and South Asian Areas: Production of mineral commodities—Continued

Area,[1] commodity, and unit of measure	1970	1971	1972 [p]
KHMER REPUBLIC [2]—Continued			
Phosphate rock ---metric tons--	NA	16,011	NA
Salt ---do---	[e] 130,000	130,000	36,300
Sand, silica ---do---	NA	2,200	[e] 2,900
LAOS [2]			
Salt, rock ---do---	1,169	400	7,776
Tin, mine output:			
Gross weight of concentrate ---long tons--	1,358	1,548	1,857
Metal content of concentrate ---do---	679	774	929
MONGOLIA [2]			
Cement, hydraulic ---thousand metric tons---	96	95	[e] 95
Coal:			
Anthracite and bituminous ---do---	84	101	[e] 110
Lignite and brown ---do---	1,915	1,985	2,064
Total ---do---	1,999	2,086	[e] 2,174
Fluorspar, all grades [e] ---metric tons--	80,000	80,000	80,000
Gypsum [e] ---do---	25,000	25,000	25,000
Lime, quicklime and hydrated [e] ---do---	40,000	40,000	40,000
Petroleum:			
Crude [e] ---thousand 42-gallon barrels--	(7)	(7)	--
Refinery products:			
Gasoline ---do---	128	128	[e] 140
Jet fuel and kerosine ---do---	62	62	[e] 70
Distillate fuel oil ---do---	52	52	[e] 60
Residual fuel oil ---do---	173	173	[e] 180
Total [8] ---do---	415	415	450
Salt ---metric tons--	7,000	9,000	[e] 10,000
SINGAPORE [2]			
Cement, hydraulic ---thousand metric tons--	726	613	1,009
Iron and steel:			
Crude steel ---do---	--	124	190
Semimanufactures (rolled only) ---do---	NA	161	194
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels--	11,169	15,809	19,626
Jet fuel ---do---	8,094	14,808	28,251
Kerosine ---do---	1,918	4,848	9,435
Distillate fuel oil ---do---	13,127	19,232	32,434
Residual fuel oil ---do---	33,850	53,566	76,891
Lubricants ---do---	375	2,553	795
Asphalt ---do---	1,203	2,062	7,236
Other ---do---	603		
Refinery fuel and losses ---do---	4,568	7,226	13,290
Total ---do---	74,907	120,104	187,958
Stone, granite ---thousand cubic meters--	1,496	1,664	1,821
Sulfur, byproduct from oil refining ---metric tons--	759	685	5,612
SRI LANKA (FORMERLY CEYLON)			
Cement, hydraulic ---thousand metric tons--	326	386	383
Coke, gashouse ---metric tons--	10,434	7,861	--
Clays:			
Ball ---do---	1,333	226	--
Kaolin ---do---	2,209	3,165	3,946
Other ---do---	130,000	[9] 66,000	70,162
Feldspar, crude and ground ---do---	1,293	258	579
Garnet, not further described ---do---	NA	NA	14
Gem stones, precious and semiprecious, except diamond ---thousand carats--	NA	[10] 126	179
Graphite, all grades ---metric tons--	[10] 9,787	7,186	7,141
Mica, scrap ---do---	[10] 468	[10] 315	194
Petroleum refinery products:			
Gasoline ---thousand 42-gallon barrels--	1,219	966	2,157
Jet fuel and kerosine ---do---	2,069	1,686	2,292
Distillate fuel oil ---do---	3,170	2,474	3,075
Residual fuel oil ---do---	4,652	4,472	4,612
Other ---do---	1,160	803	218
Refinery fuel and losses ---do---	964	1,030	790
Total ---do---	13,234	11,431	13,144
Rare-earth minerals, monazite concentrate, gross weight ---metric tons--	16	6	--
Salt, marine ---do---	64,570	86,144	157,676
Sand and gravel, glass sand ---do---	5,361	2,607	185

See footnotes at end of table.

Table 1.—Other Far Eastern and South Asian Areas: Production of mineral commodities—Continued

Area,[1] commodity, and unit of measure	1970	1971	1972 [p]
SRI LANKA (FORMERLY CEYLON)—Continued			
Stone:			
Dolomite ---------- metric tons	3,408	NA	2,800
Limestone ---------- thousand metric tons	511	551	592
Quartz, massive ---------- metric tons	2,392	1,531	1,657
Titanium:			
Ilmenite concentrate, gross weight ---------- do	84,558	92,892	82,503
Rutile concentrate, gross weight ---------- do	2,395	2,586	2,151
Zirconium concentrate, zircon, gross weight ---------- do	112	139	30
VIETNAM, NORTH[11]			
Cement, hydraulic [e] ---------- thousand metric tons	500	500	500
Coal, anthracite [e] ---------- do	3,000	3,200	2,000
Fertilizer materials, crude, phosphatic, phosphate rock [e] ---------- do	[r] 455	[r] 550	600
Salt [e] ---------- do	150	150	100
VIETNAM, SOUTH			
Cement, hydraulic ---------- do	286	263	235
Clays:			
Kaolin [e] ---------- metric tons	1,000	1,000	1,000
Other ---------- do	[e] 130,000	NA	NA
Salt, marine ---------- do	[e] 120,000	120,000	40,000
Sand and gravel:			
Silica sand ---------- thousand metric tons	NA	10	NA
Other sand and gravel ---------- do	8,002	NA	NA
Stone:[12]			
Granite and porphyry ---------- do	12,338	NA	NA
Limestone ---------- do	286	[e] 270	250

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

[1] In addition to the countries listed individually in this table, Nepal, covered textually in this chapter, presumably produces a variety of crude construction materials such as clays, stone, sand, and gravel, and may produce cement, but production statistics are not available, and general information is inadequate to make reliable estimates of output levels.

[2] In addition to the commodities listed, a variety of crude construction materials such as clays, stone, sand, and gravel presumably were produced, but production statistics are not available and general information is inadequate to make reliable estimates of output levels.

[3] Data are for years beginning March 21 of that stated.

[4] Gross production not reported, but presumably exceeds marketed production by only a small quantity.

[5] As reported in source, types of products not specified.

[6] Figure included with output of Pakistan (see Pakistan chapter) because in 1971 Bangladesh was a part of Pakistan.

[7] Revised to none.

[8] Total of listed figures only, no allowance is made for other products (if any) nor for refinery fuel and losses.

[9] For cement production only.

[10] Exports.

[11] In addition to the commodities listed, chromite, iron ore, lead-zinc ores, and tin ore were mined in the past and the country produced pig iron, crude steel, and smelter zinc from its industrial facilities, but the status of these industries under prevailing war conditions is not sufficiently clear to permit preparation of reliable estimates of output. Similarly, no data on crude construction materials is available and no reliable basis for estimation is available.

[12] Additional varieties of stone presumably are produced, but production statistics are not available, and general information is inadequate to make reliable estimates of output levels.

Table 2.—Afghanistan: Imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1970	1971 [e]	1972 [e]
Gasoline:			
Aviation	70	73	75
Other	710	1,170	1,135
Jet fuel	73	85	90
Kerosine	173	183	254
Distillate fuel oil	630	949	967
Residual fuel oil	183	180	200
Lubricants	29	36	38
Other	37	44	124
Total	1,905	2,720	2,883

[e] Estimate.

BANGLADESH [2]

The emerging nation of Bangladesh remained primarily a nonindustralized nation dependent largely on agriculture as the primary base of its economy. Agriculture accounted for almost three-fifths of the gross national product (GNP). Manufacturing, which includes mining, contributes less than one-twentieth of the GNP. This is hardly an encouraging outlook for the nation's mineral industry. However, with anticipated help from other nations in the form of economic and technical aid, the minerals industry may be further developed in the foreseeable future.

The Government of Bangladesh has published a statistical digest, but it does not show any official data for 1971 and 1972. Data on mineral production shown in table 1 was derived from information published by the former consolidated Government of East and West Pakistan.

Although relatively undeveloped, the nation has known resources of natural gas, coal, limestone, china clay, glass sand, iron ore, gypsum, and barite. Natural gas was produced at the Chhatak, Habiganj, Titas, and Sylhet Fields, but the current production status was unknown. Salt production, by solar evaporation, continued at previously known operations, providing a vital commodity for domestic use and export. The Rajshahi area has known reserves of deep-lying coal which may be brought into production to offset the need to import coal to meet the country's demand.

Bangladesh has available some limited manufacturing facilities that are based on raw or processed minerals. A urea plant with production capacity of 340,000 tons per year has been in operation at Charasal using natural gas as feedstock. A triple superphoshate plant with a capacity of 32,000 tons per year was in operation at Chittagong. The cement industry with a capacity of 2 million tons per year continued to operate using domestic raw material. A steel mill, with a capacity to produce 250,000 ingot tons per year, operated at Chittagong using imported steel scrap and pig iron. In addition, foreign investment has been sought by the Government to finance the search for and development of offshore oil and gas deposits.

BRUNEI [3]

Completion of the gas liquefaction plant's first phase and the departure of the first shipload of liquefied naural gas for Japan in December were the most significant mineral events of 1972 in Brunei. The natural gas project added a new dimension to Brunei's mineral industry, and will be a significant increment to the country's income.

Petroleum output rose sharply, reversing the previous year's decline, but production of building materials slumped after the natural gas project's first phase was completed. Exploration for petroleum continued offshore, but the only two wells drilled were unsuccessful. A crude oil loading terminal was completed during the year, permitting Brunei to export its crude oil directly instead of through Sarawak, and plans were announced to build a new refinery at an indefinite future date.

PRODUCTION AND TRADE

Mineral production in Brunei recorded a substantial gain in 1972 with increases occurring in both of the country's major products, petroleum and natural gas. Petroleum output rose sharply to 67,008,000 barrels, 41% above 1971's level of 47,482,000 barrels, a strong reversal of the output decline that took place in 1971. All three offshore fields—Southwest Ampa, Fairley, and Champion—contributed to the total, with the Champion field going into production for the first time.

The increase in gross natural gas output was also sizable, a 42% gain, from 120,000 million cubic feet in 1971 to 170,000 million cubic feet in 1972. Far more significant was the 41% jump in marketable natural gas production to 11,000 million cubic feet in 1972 from 1971 figure of 7,769 million cubic feet, reflecting the initial liquefaction and export of the previously unusable resource.

Exports of crude petroleum in 1971, the latest year for which trade figures are available, were valued at $110 million, an in-

[2] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[3] Prepared by David G. Willard, economist, Division of Nonmetallic Minerals—Mineral Supply.

crease of 11% over the $99 million value of 1970 exports. Shipments of some 1970 output may be included in the 1971 total, since the figure considerably exceeds the value of 1971 production. Exports of petroleum refinery products were unchanged at about $900,000 each year. Natural gas exports rose one-third to $285,000, but the gain represented no more than a return to the level of 1969. The 1971 figure included no shipments from the new liquefied natural gas (LNG) plant, which was still under construction.

Mineral exports accounted for 97% of the value of Brunei's total exports in 1971, which is only a slightly higher than normal percentage since the country has no significant industry or cash crop. Statistics are not available on imports of mineral commodities, but the balance of mineral trade was obviously extremely favorable. Brunei's balance of total commodity trade registered an unusual deficit in 1971 due to imports of equipment for the LNG plant.

COMMODITY REVIEW

Mineral Fuels.—*Natural Gas.*—In December 1972 the first of five liquefaction trains in Brunei's LNG plant came onstream, and the first shipload of LNG departed for Japan. Completion of the unit was achieved 3 months ahead of schedule.

Agreements reached with additional consumers in Japan in late 1971 required expansion of the originally planned plant to include a fifth liquefaction train and more storage capacity. A seventh LNG tank ship was also ordered. The heat exchangers for the fifth liquefaction train had been manufactured and sent to Brunei by yearend, despite flooding at the Wilkes-Barre, Pa. plant of Air Products and Chemicals, Inc., where it was made. Plans called for installation of three more trains in 1973, with the final one to go onstream in August 1974. All seven LNG tankers are to be in service by 1976. When fully completed the plant will be capable of liquefying 750 million cubic feet per day of natural gas, all of which is committed to Japanese consumers. Present contracts run for 20 years and are valued at a total of $2.6 billion.[4]

Petroleum.—Offshore petroleum exploration continued, but the results were unsuccessful in 1972. Ashland Oil, Inc., operator for a combine which includes Woods Petroleum Corp., and Pennzoil International, drilled two wells in Brunei Bay, both coming up dry.[5] On another concession, Sunray Borneo Oil did no drilling in 1972 but was planning a series of three test wells in 1973. Clark Oil and Refining Co. and Superior Oil Co. are Sunray's partners in that venture. The group relinquished two-thirds of its original concession area in March 1972, retaining 362 square miles out of the former total of 1,133 square miles.[6]

A new terminal at Seria was completed in 1972, which will permit Brunei's crude oil to be exported directly instead of through the refinery facilities at Lutong, Sarawak (Malaysia), as has been necessary in the past.[7] Plans to built an 80,000-barrel-per-day oil refinery at Lumut were announced, but no target dates for construction or completion were given.[8]

HONG KONG [9]

Despite a marginal decline in Hong Kong's export growth, 1972 was a record year in absolute economic expansion. The gross domestic product (GDP) increased by 17% in current prices, to about $4.06 billion,[10] and by 10% in real terms. The consumer price index rose by 6% and wages by 11%. Registered industrial employment reached 617,000 at yearend 1972. Less than 1% were employed in mining or quarrying. Money supply grew by 44%, bank deposits by 31%, and bank loans by 50%. The stock market index rose by 295% and land values soared to record heights. These indicators clearly pointed to overheating of the economy.[11]

[4] American Metal Market. Fifth Air Products Heat Exchanger Shipped to LNG Plant on Borneo. V. 79, No. 185, Oct. 11, 1972, p. 9.
Oil and Gas Journal. First Brunei LNG Shipment moving to Japan. V. 70, No. 51, Dec. 18, 1972, pp. 34–35.
[5] World Petroleum Report, Brunei, 1973. V. 19, 1973, p. 75.
[6] Oil and Gas Journal. International Briefs. V. 71, No. 4, Jan. 22, 1973. p. 66.
[7] Oil and Gas Journal Seria Light Export, Brunei. V. 70, No. 21, May 22, 1972, p. 62.
[8] Work cited in footnote 5.
[9] Prepared by H. B. Wood, mining geologist, Division of Nonmetallic Minerals—Mineral Supply.
[10] Where necessary, values have been converted from Hong Kong dollars (HK$) to U.S. dollars for the first half of the year, at the rate of HK$5.638=US$1.00.
[11] U. S. Consulate, Hong Kong. Trends Report for Hong Kong. State Department Airgram A-120, May 4, 1973.

Rapid industrialization has brought increasing prosperity to Hong Kong's 4 million inhabitants, but with few natural resources, manufacturing and export industries depend almost entirely on imported raw materials. Industry, commerce, and shipping continued to expand in 1972, and fixed capital formation reached nearly $1 billion. Textiles dominated the economy as usual, accounting for half the exports and employing 46% of the labor force.[12] The plastics and electronics industries showed further growth. Mineral production remained unimportant, but metal rolling has become of some consequence. Hong Kong's trade-oriented economy has shown deficits in the last few years, but these have been more than made up by tourism and other invisible earnings.

Hong Kong's economy continued to be fundamentally affected by the supply of electric power and water necessary to support 4 million people in a small land area of 400 square miles (1,045 square kilometers). All the power which runs industry and allows the residents to live and work in Hong Kong's "high-rise concrete jungle" is fueled by oil. Overall power consumption in 1972 increased to 5.4 billion kilowatt-hours, from 4.9 billion in 1971. Breakdown for the power consumed during 1972 was 2.2 billion kilowatt-hours for industry, 2.0 billion for commercial purposes, 1.2 billion for domestic purposes, and 0.2 billion for others. Kowloon and the New Territories, including Lantau and other outlying islands, receive their electricity from the China Light and Power Co. Ltd. The rest of the colony is supplied by the Hong Kong Electric Co. Ltd. and the Cheung Chau Electric Co. Ltd.

The total quantity of gas sold for domestic and industrial use in 1972 was 10.8 million therms compared with 9.8 million therms in 1971, an increase of 10%. It is all imported. Town gas is supplied mostly from the mainland, but liquid petroleum gas (LPG) has become very popular in recent years, and in 1972, 142 million pounds of LPG were imported, mainly from the Philippines and Singapore.

Water for domestic and industrial use continued to be a problem for Hong Kong, and dependence on imported tanker supplies and water from rivers controlled by the People's Republic of China (PRC) remained unchanged. The Government awarded a major contract for construction of the dams for the High Island reservoir scheme. The 60-billion-gallon reservoir will cover 1,700 acres, and is only a part of the intricate system of tunnels and stream drainages to bring in water from the catchment basins. In 1971 a 50,000-gallon-per-day desalting plant was commissioned at Lok On Pai near Castle Peak, and in 1972 a contract was awarded to build another desalting plant capable of producing 40,000 gallons per day. The first of the six units is expected to go into operation in mid-1974.

In July 1972 the Hong Kong dollar was temporarily freed from the pound sterling and tied to the U.S. dollar at an exchange ratio of HK$5.65 to US$1.00 with provisions for a 2.25% fluctuation either way. Financial Secretary Philip Haddon Cave announced that this arrangement will remain in effect as long as sterling continues to float against the U.S. dollar. Due to PRC's antipathy to accept the U.S. dollar in trade, wild fluctuations were anticipated, if a shortage of sterling should arise in the future.

PRODUCTION

In 1972 there were three mining leases, 13 mining licenses, and three prospecting licenses in force. Over 5,000 people were employed in mining and quarrying. In addition, several thousand were employed in metal fabrication. The indigenous mineral industry, which contributes little to the economy, showed a slight decline in output for most mineral commodities. Only clay production showed a modest increase of about 25% over 1971. The 1972 total clay production almost equaled the 1970 production. The 6% drop in cement production was anticipated for 1972, because of a slowdown in construction. There were six major quarries in full production under the new government policy of long-term contracts and five quarries still operating under the old system of crown land permits. Feldspar mine production continued at the same rate, and quartz production decreased 29%.

TRADE[13]

Hong Kong's total trade in 1972 was $7.30 billion. Imports totaled $3.87 billion, up 7.4% over 1971; exports totaled $2.70 billion, up 10.9%; and reexports totaled

[12] Hong Kong Government Press, Hong Kong 1973, Report for the Year 1972. 255 pp.
[13] Work cited in footnote 12.

$750 million. The United States, Japan, and the PRC were Hong Kong's main trading partners in 1972.

Mineral- and metal-oriented products were of some significance in overall imports, representing possibly 16% of the total. Principal items in 1972 and their values were as follows: Nonmetallic mineral manufactures $287.4 million; petroleum products $113.6 million; iron and steel $85.3 million; nonferrous metals $57.9 million; chemical elements and compounds $49.4 million ores and metal scrap $5.7 million; and coal and gas $4.6 million.

Large reexports emphasize the position of entrepot trade in Hong Kong's economy. In exports, ores and metal scrap were the only mineral-related items of consequence and the value totaled $18.2 million in 1972. Most of this consisted of iron ore shipped to Japan from the small Ma On Shan mine. In 1972, 65% of all domestic exports by value went to three markets—the United States, Britain, and the Federal Republic of Germany.

Exports to the United States totaled $1,084 million, and imports were $459.3 million. In contrast, exports to Japan were only $85 million as compared with imports of $892.9 million. Trade with the PRC was predominantly imports which amounted to $682.1 million in 1972. United States-Hong Kong trade showed little in the way of minerals and metals, except for some nonmetallic imports by Hong Kong. Japan furnished Hong Kong primarily with textile yarns, equipment, chemicals, and iron and steel. The PRC has been the principal supplier of food, although textile yarns, crude materials, and chemicals were of some consequence.

Gold import and export trade in 1971 and 1972 became a volume moving item, legal or illegal, with unpredictable trends. Gold was considered to be a sound investment, although price fluctuations have been greater than for precious stones and gems. In 1971 Hong Kong imported 917,847 troy ounces valued at $23,760,000 and reexported 1 million troy ounces valued at $44,067,000. In 1972 Hong Kong imported 511,058 troy ounces valued at $15,639,000 and reexported 579,515 troy ounces valued at $31,107,000. It was reported that at least 500,000 troy ounces of gold bars were illegally smuggled into Hong Kong each year.[14]

COMMODITY REVIEW

Metals.—*Iron Ore.*—Hong Kong's only iron mine, Ma On Shan, continued to produce about 1,000 tons per day of iron ore, the same as in 1971, which was exported exclusively to Japan. The value per metric ton remained almost the same at $6.71. Mining, which started on the surface, has gone completely underground. There is a beneficiation plant at the mine.

Iron and Steel.—Hong Kong's iron and steel industry supported about 1,700 persons in roughly 24 small plants. The total value of the iron and steel manufactures rose to $12 million.

The steel rolling industry had a satisfactory year. Production of reinforcing bars and rods remained steady, despite limited supplies of raw materials, rising labor costs, and keen competition from neighboring country suppliers. With the more intensive building program envisaged by the Government and private sector, this industry should continue to prosper.

Nonmetals.—*Cement.*—Green Island Cement Co., with a plant in Hung Hom, Kowloon, has been the only cement producer in Hong Kong for years. Formerly, it produced both clinker and finished cement. Beginning in early 1971, however, all the kilns were taken out of production, and subsequent output came entirely from processing of imported clinker. Green Island is said to have the capability to produce 790,000 tons of cement annually from imported clinker, although production in recent years has been closer to 50% to 60% of this figure. Imports were reported at 487,000 tons for 1970 and 793,000 tons for 1971; these tonnages seem to be the combined totals for cement clinker and finished cement.

Mineral Fuels.—*Petroleum.*—The Hong Kong Government appointed independent consultants to examine the environmental implications of the Shell Oil Co.'s proposed 200,000-barrel-per-day refinery on Lamma Island. The plant is not expected to come onstream before 1980. Applications from two other companies were still under consideration.

The vulnerability of Hong Kong to an outside supply of oil cannot be minimized; consequently, the oil companies, the elec-

[14] Far Eastern Economic Review. Gold Smuggling Boom. June 18, 1973, p. 44.

Table 3.—Hong Kong: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	420	200	All to Taiwan.
Oxide and hydroxide	6	54	Indonesia 44; Sri Lanka 6.
Metal, including alloys, all forms	10,160	9,137	Taiwan 1,557; Japan 1,308.
Arsenic trioxide, pentoxide and acids	43	39	Mainly to Taiwan.
Chromium oxide and hydroxide	18	18	Do.
Cobalt oxide and hydroxide	6	3	Mainly to Thailand.
Copper metal, including alloys, all forms	10,753	7,319	Japan 5,183; Taiwan 1,878.
Gold metal, unworked or partly worked thousand troy ounces	152	1,000	All to Macau.
Iron and steel:			
Ore and concentrate ---thousand tons	178	180	All to Japan.
Scrap ---do	206	202	Taiwan 66; People's Republic of China 60.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	68	25	Fiji 4; Thailand 3.
Universals, plates and sheets -do	10	11	Mainly to Nigeria.
Other ---do	2	3	Indonesia 1; Brunei 1.
Lead metal, including alloys, all forms	2,017	2,030	Mainly to Taiwan.
Magnesium metal, including alloys, all forms	NA	1	All to Taiwan.
Manganese oxide	97	100	Khmer Republic 50; Taiwan 30.
Mercury ---76-pound flasks	5	3	Malaysia (Malaya) 2; Sri Lanka 1.
Nickel metal, including alloys, all forms	115	27	United Kingdom 10; Netherlands 6.
Silver metal, including alloys thousand troy ounces	366	189	Mainly to United Kingdom.
Tin metal, including alloys, all forms long tons	223	121	Singapore 41; United Kingdom 31.
Titanium oxide	275	751	Indonesia 440; Taiwan 116; Malaysia (Malaya) 107.
Zinc:			
Oxide	34	75	Khmer Republic 37; Indonesia 20; Taiwan 9.
Metal, including alloys, all forms	188	188	Mainly to Khmer Republic.
Other:			
Oxides, hydroxides, and peroxides of metals, n.e.s	8	13	Thailand 6; Singapore 4.
Metals, including alloys, all forms:			
Metalloids	9	3	Mainly to Macau.
Base metals including alloys, all forms, n.e.s	8	46	Singapore 42; Indonesia 4.
NONMETALS			
Abrasives, natural, n.e.s	40	52	Singapore 11; Japan 10; Indonesia 8.
Asbestos	32	2	All to Nigeria.
Barite and witherite	NA	51	Taiwan 30; Singapore 21.
Cement, hydraulic	16,442	3,919	Macau 1,577; Indonesia 1,572.
Chalk	2	3	All to Malaysia (Malaya).
Clays and clay products (including all refractory brick):			
Crude, n.e.s	10,977	13,819	Taiwan 10,922; Japan 1,300.
Products ---value, thousands	$431	$198	Mainly to Indonesia.
Diamond, gem, not set or strung thousand carats	262	282	Japan 68; Israel 66; Belgium-Luxembourg 55.
Feldspar and fluorspar	7,574	379	Thailand 246; Singapore 97.
Fertilizer materials:			
Crude	158	181	Mainly to Malaysia (Sarawak).
Ammonia	4	4	All to Malaysia (Sabah).
Graphite, natural	136	35	Mainly to Indonesia.
Gypsum and plasters	167	102	Indonesia 50; Khmer Republic 30.
Lime	942	1,258	Mainly to Macau.
Mica, all forms	70	24	Japan 14; People's Republic of China 6.
Pigments, mineral, including processed iron oxide	240	115	Taiwan 75; Indonesia 30.
Salt and brine	251	975	Mainly to Philippines.
Sodium and potassium compounds, n.e.s	3,124	2,007	Indonesia 1,736; Khmer Republic 184.
Stone, sand and gravel:			
Dimension stone	695	1,374	Indonesia 775; Thailand 421.
Gravel and crushed rock	12,359	22,332	Brunei 13,093; Indonesia 9,120.
Quartz and quartzite	1,798	1,371	Thailand 924; Singapore 198.

See footnotes at end of table.

Table 3.—Hong Kong: Exports and reexports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Sulfur:			
Elemental, all forms	180	126	Mainly to Macau.
Sulfuric acid	26	6	Mainly to Malaysia (Sabah).
Talc, steatite, soapstone, pyrophyllite	645	1,772	Mainly to Indonesia.
Other nonmetals, n.e.s.:			
Crude	8	381	Mainly to Taiwan.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	176	80	Mainly to Indonesia.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon	24	25	Malaysia (Sabah) 7; Singapore 6; Taiwan 5; Indonesia 5.
Coal and coke, including briquets	35	15	All to Macau.
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	33	35	Do.
Kerosine and jet fuel—do	47	52	Do.
Distillate fuel oil—do	276	281	Do.
Residual fuel oil—do	12	18	Do.
Lubricants—do	122	115	Taiwan 44; Thailand 41; Macau 9.
Mineral jelly and wax—do	52	85	Peru 54; Philippines 17; Taiwan 10.
Other:			
Pitch—do	(1)	(1)	Mainly to Taiwan.
Bitumen and other mixtures—do	1	1	Mainly to Macau.
Bituminous mixtures, n.e.s—do	(1)	(1)	Mainly to Khmer Republic.
Liquefied petroleum gas—do	8	14	All to Macau.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	(1)	(1)	Mainly to Macau.

NA Not available.
[1] Less than ½ unit.
Source: Official trade returns of Hong Kong.

Table 4.—Hong Kong: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	439	447	People's Republic of China 427; Japan 20.
Oxide and hydroxide	294	356	West Germany 203; Japan 90; United States 17.
Metal, including alloys, all forms	23,885	23,864	Australia 6,482; Canada 4,164; Ghana 1,562.
Arsenic:			
Natural sulfides	5	10	All from People's Republic of China.
Trioxides, pentoxides, and acids	86	65	Do.
Chromium oxide and hydroxide	428	114	United Kingdom 89; West Germany 18; Australia 3.
Cobalt oxide and hydroxide	62	31	United Kingdom 20; Belgium-Luxembourg 8.
Copper:			
Copper sulfate	45	76	United Kingdom 68; West Germany 3; Japan 3.
Metal, including alloys, all forms	16,028	17,696	Japan 9,200; Australia 1,616; United Kingdom 1,206.
Gold metal, unworked and partly worked—thousand troy ounces	1,749	1,880	United Kingdom 1,248; Australia 511; Netherlands 120.
Iron and steel:			
Scrap—thousand tons	95	114	United Kingdom 48; United States 22; West Germany 17.
Pig iron, ferroalloys, and similar materials—do	8	19	North Korea 7; People's Republic of China 6; Japan 3.
Steel, primary forms—do	24	55	Australia 39; Japan 7; North Korea 6.
Semimanufactures:			
Bars, rods, angles, shapes, sections—do	218	245	Japan 139; People's Republic of China 56.
Universals, plates and sheets—do	185	152	Japan 81; United Kingdom 24; Australia 15.
Other—do	75	76	Japan 38; People's Republic of China 13; United Kingdom 9.

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Lead metal, including alloys, all forms	1,265	2,365	South Vietnam 1,511; North Korea 203; United Kingdom 98.
Magnesium metal, including alloys, all forms	4	5	Canada 4.
Manganese:			
Ore and concentrate	99	340	Thailand 330; People's Republic of China 10.
Oxides	3,563	3,712	Japan 3,146; Mozambique 311; People's Republic of China 250.
Mercury ——76-pound flasks	455	581	United Kingdom 337; Spain 120; People's Republic of China 101.
Nickel metal, including alloys, all forms	512	559	Japan 170; United Kingdom 109; Netherlands 54.
Platinum-group metals, including alloys, all forms ——thousand troy ounces	74	120	West Germany 42; Netherlands 37; United Kingdom 24.
Rare-earth oxides	3	9	United States 8.
Silver metal, including alloys thousand troy ounces	171	122	Indonesia 52; United States 42; Philippines 13.
Tin metal, including alloys, all forms long tons	305	401	Malaysia 277.
Titanium:			
Ore and concentrate	122	186	Australia 177; United States 9.
Oxides	3,710	3,886	Japan 1,404; Australia 829; United Kingdom 653.
Tungsten metal, including alloys, all forms	2	8	Mainly from United States.
Zinc:			
Oxides	934	1,075	France 505; West Germany 166; Australia 159.
Metals, including alloys, all forms	9,771	9,248	Canada 2,852; Japan 1,467; North Korea 1,199.
Other:			
Ashes and residue containing nonferrous metals	370	2,060	All from United Kingdom.
Oxides, hydroxides and peroxides of metals, n.e.s	10	24	Japan 12; People's Republic of China 5.
Metals, including alloys, all forms:			
Metalloids	80	17	Japan 10; United States 4.
Base metals, including alloys, all forms	61	59	Austria 30; United Kingdom 9.
NONMETALS			
Abrasives:			
Natural, n.e.s	634	929	People's Republic of China 449; Japan 256; United States, 177.
Grinding and polishing wheels and stones	586	549	Japan 181; People's Republic of China 136; United Kingdom 112.
Asbestos	122	114	Canada 91; Japan 11.
Barite and witherite	185	118	People's Republic of China 66; West Germany 42; United Kingdom 10.
Boric oxide and acid	209	172	United States 107; People's Republic of China 60; United Kingdom 5.
Cement, hydraulic ——thousand tons	487	793	People's Republic of China 365; United Kingdom 181; Japan 158.
Chalk	11	--	
Clays and products (including all refractory brick):			
Crude clays, n.e.s	7,037	9,615	United States 6,058; People's Republic of China 1,666; Japan 861.
Products [1]	28,216	38,324	People's Republic of China 18,339; Japan 14,866; Philippines 1,340.
Cryolite and chiolite	31	--	
Diamond, gem, unset ——thousand carats	687	855	Belgium-Luxembourg 260; United Kingdom 215; India 149.
Diatomite and other infusorial earth	265	250	Japan 191; United States 58.
Feldspar and fluorspar	383	904	People's Republic of China 894.
Fertilizer materials:			
Crude	495	547	People's Republic of China 468; Australia 51.
Manufactured:			
Nitrogenous	2,321	2,806	Japan 2,766; Taiwan 30; United Kingdom 10.
Phosphatic	--	70	All from Japan.
Potassic	9	14	All from West Germany.
Other, including mixed	5,755	7,987	West Germany 7,111; France 489.
Ammonia	417	405	Japan 350; United Kingdom 49.

See footnotes at end of table.

Table 4.—Hong Kong: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Graphite, natural	302	270	People's Republic of China 246; United Kingdom 6.
Gypsum and plasters	5,039	25,185	Australia 10,792; Mexico 10,391; Japan 2,350.
Lime	41,832	56,247	People's Republic of China 26,007; North Vietnam 20,458; Japan 4,778.
Magnesite	131	393	Austria 210; People's Republic of China 152.
Mica, all forms	42	43	India 32; United Kingdom 3.
Pigments, mineral including processed iron oxides	635	439	West Germany 261; United Kingdom 74; People's Republic of China 54.
Salt	36,791	39,148	People's Republic of China 32,565; Netherlands 2,651; Taiwan 2,001.
Sodium and potassium compounds, n.e.s	20,254	17,822	People's Republic of China 8,789; Taiwan 3,979; Japan 3,666.
Stone, sand and gravel:			
Dimension stone	5,539	8,108	People's Republic of China 5,418; Italy 2,423; Portugal 30.
Dolomite	51	127	All from People's Republic of China.
Gravel and crushed rock	2,386	3,567	People's Republic of China 3,246; Italy 201.
Limestone (except dimension) thousand tons	263	31	All from Japan.
Quartz and quartzite	1,533	3,436	People's Republic of China 3,419.
Sand, excluding metal bearing	1,976	4,595	People's Republic of China 3,945; Japan 495.
Sulfur:			
Elemental, all forms	2,305	1,650	West Germany 555; Singapore 507; France 450.
Sulfuric acid	563	1,054	Taiwan 934; United Kingdom 57.
Talc and related materials	3,169	5,780	People's Republic of China 5,337; United States 105.
Other nonmetals, n.e.s.:			
Crude	1,660	3,292	People's Republic of China 2,921; Republic of South Africa 175.
Slag, dross, and similar waste, not metal bearing	174,104	493,272	Republic of Korea 263,824; Taiwan 96,341; Japan 86,693.
Oxides and hydroxides of magnesium, strontium, and barium	31	49	West Germany 40; Japan 4.
Bromine, iodine and fluorine	(2)	1	Mainly from United States.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	14,890	17,148	United Kingdom 7,766; Singapore 3,566; Taiwan 2,212.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	78	9	All from United States.
Carbon black and gas carbon	727	914	Japan 607; United States 219.
Coal, coke and peat, including briquets	31,719	38,756	People's Republic of China 23,089; North Vietnam 7,434; Japan 6,004.
Petroleum refinery products:			
Gasoline, including natural thousand 42-gallon barrels	843	1,030	Singapore 525; Bahrain 302; Iran 191.
Kerosine and jet fuel ——do	4,301	5,419	Singapore 2,326; Iran 1,218; Saudi Arabia 1,072.
Distillate fuel oil ——do	4,707	5,446	Singapore 1,902; Saudi Arabia 1,174; Philippines 231.
Residual fuel oil ——do	16,870	16,550	Singapore 7,160; Saudi Arabia 6,553; Kuwait 1,052.
Lubricants ——do	329	313	Japan 141; Netherlands 50; United States 36.
Mineral jelly and wax ——do	89	117	Indonesia 66; Singapore 19; People's Republic of China 14.
Other:			
Pitch ——do	1	1	Mainly from United Kingdom.
Bitumen and other mixtures —do	19	85	Singapore 25; Japan 9.
Bituminous mixtures, n.e.s —do	3	1	Mainly from United Kingdom.
Liquefied petroleum gas ——do	292	541	Singapore 269; South Korea 81; Japan 72.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	479	2,156	United Kingdom 1,190; Japan 791.

[1] Excludes bricks, roofing tiles, and other clay products valued at HK$9,434,058 for 1970 and HK$16,952,356 for 1971.

[2] Less than ½ unit.

tric power companies, and the Petrols and Oils Advisory Committee, a government-sponsored group, have seriously considered establishing a contingency reserve of at least 2 months' supply. Currently, Hong Kong maintains about 2 week's supply of oil.

KHMER REPUBLIC (FORMERLY CAMBODIA) [15]

The small industrial sector and overall general economy of the Khmer Republic further deteriorated owing to the effects of the continuing war in 1972. Mineral production was again limited to precious and semiprecious stones, salt, silica sand, and simple construction materials.

The country's second 5-year plan (1968–72), which was not fully executed, was replaced by a national plan for the support of the defense and reconstruction forces, to be hopefully accomplished within the next 2 years. The new plan, though flexible, ranks projects into three levels of priority, as follows: Those directly related to urgent and essential national needs, such as the rebuilding of important destroyed bridges; those related to national needs, such as the improvement of telecommunication systems and the acquisition of metal bridges; and those retained from peacetime planning, such as industrial development.

The Ministry of Industry and Work recently published a survey of the country's mineral resources indicating what may be described as commercially exploitable deposits of eight mineral commodities—iron ore, phosphate rock, manganese, gem stones, silica, bauxite, gold, and pagodite (an aluminum-iron silicate).[16] The Government is reported to be currently working on a proposal to invite international bids for development of the country's mineral resources.

COMMODITY REVIEW

Nonmetals.—Nonmetallic mineral production in the Khmer Republic in 1972 was reported to be limited to cement, gem stones, silica sand, and salt.[17]

The quantity of cement produced at the National Cement Co. plant near Kampot in 1972 showed a 40,000-ton increase over that reported in 1971.

Gem stone production included sapphire, ruby, zircon, and amethyst. Amethyst production from the Pailin mines was not reported in 1971.

Output of silica sand was 2,900 tons compared with 2,200 tons in 1971, but the quantity of salt produced in 1972 was substantially lower than that reported in 1971.

Mineral Fuels.—The French company ERAP-Cambodge, a subsidiary of Enterprise de Recherches et d' Activities Petrolieres (ERAP), completed drilling of an offshore well in the Gulf of Siam, approximately 161 kilometers northwest of Kompong Som, in August 1972. The well, however, was abandoned at 2,438 meters as a dry hole in October. Additional drilling plans were postponed pending clarification of South Vietnam's claim to ownership of the offshore acreage.

The Government of the Khmer Republic modified an agreement with Essence et Lubrifiant de France (ELF), ELF-ERAP in 1972 that called for relinquishment of all but 20,000 square miles of the company's 95,000-square-mile offshore concessions by October. ELF-ERAP was authorized to retain 40,000 square miles, and the balance was offered to foreign bidding. A 35% interest was obtained by Esso.

The country's only oil refinery at Kompong Som had suspended production of refinery products by mid-1971 because of war damage. Lack of funds to repair the damage was indicated in early 1972, and it is not likely that production was resumed.

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[15] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals—Mineral Supply.

[16] Mining Journal. The Industry in Action. V. 278, No. 7124, Mar. 3, 1972, p. 176.

[17] U.S. Embassy, Phnom Phen, Khmer Republic. Minerals Questionnaire. State Department Telegram 233, May 1973, p. 1.

LAOS [18]

Although exploitation of the tin mine near Thakhek was temporarily disrupted by the continuing war in Laos, tin mining was still the only significant mineral activity in the country in 1972. Despite the war, improvements in transportation and urban utilities, and a significant increase in electric power supply as a result of the completion of the dam at the Nam Ngum hydroelectric project in late 1971, were achieved during the year. However, exploration for mineral resources was paralyzed and the country's industrialization advances continued to be affected by inflation, a wartime budget, and a serious deficit in the trade balance.

The current Laotian 5-year industrial plan (Plan-Cadre de Development, 1969–74), geared primarily to agriculture and construction of dams, includes very few mineral industry projects. Industrial development under the 5-year plan is still at an early stage in Laos and includes the current tin mining operations, two oxygen plants, and a proposed cement factory.

Mineral production reported for Laos in 1972 was confined to tin and salt. Mining and processing of tin continued to show improvement. Production of tin concentrates (gross weight) was 1,857 long tons compared with 1,548 long tons in 1971. Tin metal content of the concentrates was approximately 929 long tons in 1972 compared with 774 long tons the previous year. Most of the tin concentrate was exported to Malaysia for smelting.

The quantity of rock salt produced was reported to be 7,776 tons in 1972.

The principal Laotian mineral imports in 1972 were cement, petroleum products, and iron and steel semimanufacturers.

MONGOLIA [19]

Continued progress apparently was made by Mongolia's small mineral industry in 1972, as various sectors and important facilities reportedly met or overfulfilled their goals. Estimated gains over 1971 amounted to approximately 5% for all mining, 4.5% for the fuels, 23% for the construction materials industries, and 6.8% for electric power generation.

Presently, coal production accounts for an estimated 6% of Mongolia's mineral output by value. During the year, coal output increased about 4.2% over 1971 and apparently surpassed the 1972 target. Most production came from the large Sharyn Gol surface coal mine, which has an annual capacity of about 1.4 million tons. Nalaikha, the country's only other important coal mine, which has failed to achieve targets in recent years, is being modernized by Soviet technicians. In March, continuous mining equipment was installed, which considerably increased productivity, bringing production to 520,000 tons by the middle of December.

An active exploration and geological mapping program carried out during the year outlined coal reserves of approximately 20 billion tons, two-thirds of which are said to be coking quality. Presently 17 coal deposits scattered throughout the country are being exploited primarily by open pit methods.

The important construction materials sector reportedly exceeded its goal with a 6.8% increase over 1971. Specific information was not available on cement; however, plans call for doubling production by 1975.

All of the fluorspar and tungsten concentrate, Mongolia's only mineral export items of consequence, are shipped to the Soviet Union. Based on U.S.S.R. import statistics, Mongolia's fluorspar production apparently remained unchanged from 1971.

Initial work was carried out during the year, with Soviet aid, on the development of the rich copper-molybdenum deposit near Erdenetiyn Oboo. Negotiations were conducted with Japan for aid on the development of a copper mine, with ore reserves estimated at 200 million tons, at Isagan Suburga in the Gobi desert. Plans are to beneficiate the ore into copper concentrate and ultimately convert it into electrical wire.

No official Mongolian trade data are available. However, because at least 85%

[18] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals—Mineral Supply.

[19] Prepared by Donald C. Wininger, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

of the total Mongolian trade is with the U.S.S.R., officially recorded Soviet trade statistics are believed to be highly indicative of total Mongolian mineral commodity trade. Soviet imports of Mongolian fluorspar were given as 76,600 tons in 1970 and 76,200 tons in 1971. Imports of ferrous scrap were given as 12,800 tons in 1971. Small quantities of unspecified ores and concentrates including tungsten are also imported. Iron and steel exports from the U.S.S.R. to Mongolia were 19,460 tons in 1970 and 19,479 in 1971. Small quantities of Soviet nonferrous metals, refractories, coal, and coke also were imported.

Cement imports, from the Soviet Union, totaling 19,000 tons in 1970 and 25,000 tons in 1971, indicate that the recently expanded Darkhan cement plant was still unable to meet domestic requirements. The principal Soviet contribution to Mongolian mineral economy was still petroleum. In fact, the greater part of Mongolia's oil demand has been met by Soviet refined petroleum. The U.S.S.R. also has been supplying enough crude oil to keep the small Dzuun Bayan refinery operating at full capacity. Exports of refined petroleum and crude oil from the U.S.S.R. to Mongolia totaled about 2.06 million barrels in 1970 and 2.11 million barrels in 1971.

NEPAL [20]

According to data available in the 1972 Trade Directory of Nepal, published by the Nepal Industrial Development Corp., the fraction of the gross national product (GNP) generated by Nepal's mineral industry is small. During the fiscal period 1964 to 1965 the percent of the GNP attributable to the mineral industry was 0.02%, and by the end of the fiscal period 1968 to 1969 it had declined to 0.01%. Later information relating to Nepal's GNP is not available, but it is unlikely that any great change has occurred in the percentage of the total GNP represented by the minerals industry.

Previous geologic investigations have shown that useful deposits of metallic and nonmetallic do exist but have not been formally worked in modern times. Some nominal quantities of various minerals may have been extracted for use by indigenous artisans and craftsmen.

According to a 1972 report of the United Nations Development Program on Nepal, there are known deposits of many metals and nonmetals such as copper, lead, bismuth, iron, tin, gold, molybdenum, beryl, magnesite, limestone, mica, marble, slate, graphite, salt, and other minerals. These mineral resources have not been fully explored, and without additional systematic exploration a realistic evaluation is not possible. Nepal's Fourth National Development Plan (1970 to 1975) has significantly increased the funds available for the development of its mineral industry. The Government has placed a high priority on mineral development in an attempt to diversify exports, provide for substitution of some imports, and develop raw materials for mineral-based industries.

SINGAPORE [21]

Singapore achieved a 13% rate of economic growth, with the gross national product (GNP) in 1972 reaching an estimated $2.84 billion.[22] This gain was made despite unstable monetary conditions worldwide and further shutdown of British bases. Gross capital formation gained 23% as compared with 36% in 1971. New investments were large, nonetheless, with manufacturing, including oil and related ventures, and shipping and services, leading the way. Per capita income established the new record of $1,322. Construction was up 36.4%, to $198 million. Liberal government policies on foreign investments and bringing in technical personnel have helped to stimulate the economy.

[20] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[21] Prepared by K. P. Wang, physical scientist, Division of Nonmetallic Minerals—Mineral supply.

[22] Where necessary, 1972 values have been converted from Singapore dollars (S$) to U.S. dollars at the rate of S$2.79=US$1.00 even though the actual rate at yearend was close to S$2.53=US$1.00. In 1971, the exchange rate was S$3=US$1.00.

Manufacturing, which encompasses fields like petroleum refining, metal fabrication, cement, and chemicals, gained ground as the leading component of the GNP. Manufacturing output, measured in terms of value added, increased to $615 million ($2.79 rate of exchange) as compared with $500 million ($3 rate of exchange) in 1971. Approximately 30% of manufacturing in 1972 was petroleum refining, and 40% of the manufactured products were exported.

Singapore's shipbuilding and ship repair industries accounted for about one-sixth of the value added in manufacturing during 1972. In addition to servicing the many ships passing through the world's No. 4 port, Singapore's activities related to oil exploration support vessels and construction of drydocks to handle mammoth supertankers were also important.

Petroleum activities continued to occupy a special role in the economy. Singapore supplied 32 million barrels of fuel oil for bunkering international ships and 1.5 million barrels of jet fuel for servicing airplanes in 1972. Oil imports were about as large as petroleum production in the People's Republic of China, although only a small part of this was locally consumed. Five refineries were in existence, and most of these were undergoing construction or expansion. Plans underway would bring Singapore's daily oil refining capacity to more than 1 million barrels by the mid-1970's. Singapore has one of the world's largest refineries which will be further expanded by roughly 50% by yearend 1974. The Chase Manhattan Bank has estimated that approximately $3 billion annually will be spent on oil exploration, drilling, and production in Southeast Asia during the next few years, and Singapore should share significantly in this expenditure.

PRODUCTION

Singapore's output of refined petroleum products was important, with residual fuel oil leading the way, followed by distillate fuel oil, jet fuel, gasolines, and naphthas. Crude oil processed in 1972 was approximately 150 million barrels, nearly a third higher than in 1971. In addition, possibly 25 million barrels of semiprocessed oil were also refined during 1972. Ingot steel was of some consequence, with production increasing about 53% to 190,000 tons in 1972. The construction boom continued, with cement output topping the 1-million-ton level for the first time and making a gain of about 65% over 1971. Cement imports were nearly as large, with Japan supplying about 380,000 tons and Malaysia and Taiwan also supplying sizable quantities. Singapore produced 2,382,000 cubic yards of granite in 1972, a gain of 9%. The country's mineral production statistics are shown in table 1.

TRADE

Singapore's total foreign trade increased to $5.62 billion in 1972, as compared with $4.68 billion in 1971 when the U.S. dollar was worth more. Exports rose 23% to $2.20 billion, and imports rose 18% to $3.42 billion. The trade deficit was more than offset by income from services such as tourism, banking, insurance, shipping, and capital inflow from abroad to register a net balance-of-payments surplus of $202 million. The above figures do not include trade with Indonesia. Entrepôt trade, the traditional lifeblood of Singapore's economy, rose by 2%, to approximately $1.6 billion.

All told, Singapore imported about 200 million barrels of oil in 1972, of which 70% was crude oil and nearly 15% each was residual fuel oil and semiprocessed petroleum, with a combined value of well over half a billion U.S. dollars. Approximately 47% of the crude came from Kuwait, 20% from Iran, 17% from Saudi Arabia, and 10% from Sarawak. Most of the crude was high in sulfur, but Singapore refineries are designed for this. Singapore exported considerable quantities of refined petroleum also, about 120 million barrels during 1972 including 60 million barrels of residual fuel oil. Singapore's importance as a petroleum distribution center is self-evident.

Although firm figures are not available, the country's 1972 imports of iron and steel products were valued at more than $100 million and its imports of cement at over $20 million.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—Singapore's steel consumption stood at approximately 1 million tons. Steel ingot production (derived from scrap) was reported at 190,000 tons during 1972, and output of reinforcing bars was 182,000 tons. Japan has been by far the leading supplier of steel products to Singapore, furnishing 449,000 tons in 1970, 658,000 tons in 1971, and 603,000 tons in

Table 5.—Singapore: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS			
Aluminum:			
Bauxite and concentrate	100	2	All to Malaysia.
Oxide and hydroxide	1,965	1,244	Do.
Metal, including alloys, all forms	921	1,093	Malaysia 714; Japan 174; Thailand 101.
Chromium oxide and hydroxide	r 8	7	Mainly to Malaysia.
Copper:			
Ore and concentrate	1,118	1,787	All to Japan.
Metal, including alloys, all forms	485	840	Malaysia 701; Japan 101.
Gold bullion—troy ounces	2	--	
Iron and steel:			
Ore and concentrate	61,712	38,711	All to Japan.
Metal:			
Scrap	4,909	565	Taiwan 340; Japan 78; Malaysia 73.
Pig iron, ferroalloys, and similar materials	234	110	Mainly to Malaysia.
Steel, primary forms	1,639	3,614	Malaysia 3,413; Brunei 199.
Semimanufactures:			
Bars, rods, angles, shapes, sections	18,229	25,429	Malaysia 17,306; Brunei 4,606; South Vietnam 1,904.
Universals, plates and sheets	26,384	35,283	Malaysia 30,394; Brunei 1,337; Hong Kong 788.
Hoop and strip	1,042	1,484	Malaysia 1,307; Hong Kong 64; Thailand 17.
Rails and accessories	655	703	Malaysia 443; Philippines 177; Brunei 61.
Wire	4,145	2,443	Malaysia 1,510; Khmer Republic 474; Brunei 203.
Tubes, pipes, and fittings	14,964	40,416	Brunei 27,779; Malaysia 4,369; Nigeria 3,695.
Castings and forgings, rough	136	631	Malaysia 593; Philippines 21; Brunei 16.
Total	65,555	106,389	
Lead:			
Ore and concentrate	3	51	Belgium-Luxembourg 45; India 6.
Oxides	2	15	All to Malaysia.
Metal, including alloys, all forms	r 799	437	Malaysia 370; Japan 30.
Manganese:			
Ore and concentrate	1,021	737	Sri Lanka 419; Malaysia 166; United States 127.
Oxides	113	863	All to Malaysia.
Mercury—76-pound flasks	17	15	Malaysia 10; Brunei 3; Afghanistan 2.
Nickel metal, including alloys, all forms	13	22	Mainly to Malaysia.
Platinum-group metals and silver:			
Ore and concentrate—value	$4,626	--	
Waste and sweepings—kilograms	--	325	All to United Kingdom.
Metals, including alloys:			
Platinum group—troy ounces	195	222	Malaysia 164.
Silver—thousand troy ounces	452	646	United Kingdom 640; Norway 4.
Tantalum ore	9	16	All to United States.
Tin:			
Ore and concentrate—long tons	2,468	2,545	Malaysia 922; Spain 704; Belgium-Luxembourg 400.
Metal, including alloys, all forms—do	285	491	Malaysia 147; Hong Kong 120; Taiwan 98.
Titanium:			
Ore and concentrate:			
Ilmenite	--	14	All to Malaysia.
Other	--	1	Do.
Oxides	310	506	Mainly to Malaysia.
Tungsten ore and concentrate	128	172	Netherlands 73; West Germany 51; United Kingdom 24.
Zinc:			
Oxide and peroxide (except hydroxide)	95	106	Malaysia 101; Khmer Republic 4.
Metal, including alloys, all forms	r 1,299	2,111	Malaysia 1,992; South Vietnam 61; Taiwan 41.
Other:			
Ore and concentrate of base metals, n.e.s. (excluding iron and magnesium)	r 99	238	Belgium-Luxembourg 171; Netherlands 41; Republic of Korea 26.
Ash and residue containing nonferrous metals	1,884	1,389	Malaysia 1,018; Japan 212; West Germany 118.
Oxides, hydroxides and peroxides of metals, n.e.s	46	77	Mainly to Malaysia.
Metals, including alloys, all forms:			
Scrap, nonferrous	10,139	7,603	Japan 3,801; Malaysia 670; West Germany 595.

See footnotes at end of table.

Table 5.—Singapore: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
METALS—Continued			
Other:—Continued			
Metals, including alloys, all forms—Continued			
Metalloids	9	5	Mainly to Malaysia.
Alkali, alkaline earth, and rare-earth metals	1	30	Do.
Base metals, including alloys, all forms, n.e.s	21	1,076	Malaysia 1,013; Netherlands 38.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	11	20	Malaysia 17.
Dust and powder of precious and semiprecious stones—value	--	$675	All to Malaysia.
Grinding and polishing wheels and stones	36	87	Malaysia 77; Brunei 9.
Asbestos	184	14	Malaysia 10; Brunei 4.
Cement	15,868	7,790	Malaysia 2,355; Philippines 1,224; South Vietnam 1,024.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Kaolin	311	492	Malaysia 346; Pakistan 146.
Other	1,710	7,388	Mozambique 3,048; Philippines 1,642; Malaysia 1,102.
Products:			
Refractory (including nonclay bricks)	887	3,089	Malaysia 3,075.
Nonrefractory	1,801	2,920	Malaysia 1,320; Brunei 457; Netherlands 316.
Diamond:			
Gem, not set or strung—value, thousands	$2,180	$1,832	Malaysia $1,522; Belgium-Luxembourg $110; Hong Kong $106.
Industrial—value	$2,386	$385	All to Taiwan.
Feldspar and fluorspar	1,798	2,815	All to Malaysia.
Fertilizer materials:			
Crude:			
Nitrogenous	10	16	Mainly to Malaysia.
Phosphatic	9,051	17,460	Malaysia 17,216; Brunei 182.
Manufactured:			
Nitrogenous	12,627	29,362	Malavsia 17,236; South Vietnam 7,998; Philippines 2,999.
Phosphatic	2,432	13,603	Iran 10,257; Malaysia 3,313.
Potassic	63,961	95,363	Malaysia 92,092; Philippines 1,806; South Vietnam 1,000.
Other, including mixed	21,155	19,635	Malaysia 17,418; South Vietnam 1,700; Brunei 254.
Ammonia	480	161	Malaysia 143; Khmer Republic 9; Brunei 4.
Graphite, natural	7	8	Mainly to Malaysia.
Gypsum and plasters	311	1,018	South Vietnam 580; Malaysia 373; Taiwan 41.
Lime	850	2,081	Malaysia 2,020; Brunei 56.
Magnesite	1,680	722	Malaysia 673; Brunei 49.
Mica, all forms	23	91	Brunei 31; Burma 14; Australia 2.
Pigments, mineral:			
Natural, crude	8	569	Mainly to Malaysia.
Iron oxides, processed	115	137	Malaysia 133.
Precious and semiprecious stones, except diamond—value, thousands	$1,098	$285	Hong Kong $222; Malaysia $22; Japan $19.
Salt	6,596	10,119	Malaysia 9,098; India 656; Brunei 341.
Sodium and potassium compounds, n.e.s	1,848	2,618	Malaysia 2,054; Thailand 202; Khmer Republic 161.
Stone, sand and gravel:			
Dimension stone	131	185	Malaysia 145; Canada 24; Brunei 15.
Dolomite, chiefly refractory grade	7	--	
Gravel and crushed rock	25,176	30,603	Brunei 29,324; Oman 762; Malaysia 486.
Limestone (except dimension)	96	295	Malaysia 291; Brunei 4.
Quartz and quartzite	17	7	All to Malaysia.
Sand, excluding metal bearing	875	2,636	Brunei 1,874; Malaysia 652; Australia 57.
Sulfur:			
Elemental:			
Other than colloidal	5,767	9,858	Mainly to Malaysia.
Colloidal	105	2,077	South Vietnam 900; Sri Lanka 601; Hong Kong 512.
Sulfuric acid	402	1,653	Khmer Republic 705; South Vietnam 644; Sri LanKa 180.

See footnotes at end of table.

Table 5.—Singapore: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal destinations, 1971
NONMETALS—Continued			
Talc, steatite, soapstone, and pyrophyllite	r 1,024	1,472	Mainly to Malaysia.
Other nonmetals, n.e.s.:			
Crude	12,809	14,017	Malaysia 7,988; Philippines 3,412; Republic of Korea 1,118.
Slag, dross and similar waste, not metal bearing	5	1	All to Malaysia.
Oxides and hydroxides of magnesium, strontium, and barium	1	2	Mainly to Malaysia.
Bromine, iodine and fluorine ----value	$237	$1,236	Do.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	16,171	9,071	Malaysia 3,364; South Vietnam 2,371; Hong Kong 1,343.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	56	4	All to Malaysia.
Carbon black and gas carbon:			
Carbon black	327	921	Malaysia 865; Sri Lanka 28; Khmer Republic 27.
Gas carbon	1	1	All to Malaysia.
Coal, all grades, including briquets	5	1,278	Malaysia 1,191; Australia 84; Burma 23.
Coke	761	1,025	Mainly to Malaysia.
Hydrogen, helium and rare gases value, thousands	$14	$58	Brunei $30; Malaysia $27.
Petroleum:			
Crude and partly refined 42-gallon barrels	r 51,496	793,614	Netherlands 629,008; Malaysia 90,625; United Kingdom 73,981.
Refinery products: [1]			
Gasoline:			
Aviation thousand 42-gallon barrels	2,073	2,847	South Vietnam 1,062; Thailand 1,016; Hong Kong 208.
Motor ----do----	11,232	15,159	Japan 7,063; South Vietnam 4,231; Malaysia 1,063.
Kerosine and jet fuel ----do----	r 19,564	24,654	South Vietnam 9,783; Thailand 4,872; United States 2,447.
Distillate fuel oil ----do----	17,470	21,573	South Vietnam 7,478; Malaysia 4,290; Australia 2,233.
Residual fuel oil ----do----	37,525	47,843	Japan 24,272; Australia 8,476; Hong Kong 7,311.
Lubricants ----do----	r 1,033	665	Malaysia 200; South Vietnam 160; Burma 91.
Mineral jelly and wax ----do----	r 140	154	Malaysia 26; South Vietnam 25; Mozambique 17.
Other:			
Nonlubricating oils, n.e.s. do----	17	17	Mainly to Malaysia.
Bitumen and bituminous mixtures, n.e.s ----do----	684	1,318	South Vietnam 549; Australia 452; Malaysia 153.
Other ----do----	323	333	Malaysia 109; South Vietnam 99; Hong Kong 84.
Total ----do----	r 90,061	114,563	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals thousand tons	143	211	Australia 136; New Zealand 26; Japan 14.

r Revised.

[1] In addition to the products listed, liquefied petroleum gas valued at $1,317,000 in 1970 and $2,344,000 in 1971 was also exported.

Table 6.—Singapore: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS			
Aluminum:			
Bauxite and concentrate	716	--	
Oxide and hydroxide	7,965	7,429	Japan 4,569; People's Republic of China 2,810.
Metal, including alloys, all forms	8,347	10,753	Japan 4,728; United States 1,228; United Kingdom 1,006.
Chromium oxide and hydroxide	50	161	Japan 136; Malaysia 6; West Germany 5.
Cobalt oxide and hydroxide	4	7	Hong Kong 5.
Copper:			
Ore and concentrate	1,016	1,271	Mainly from Malaysia.
Metal, including alloys, all forms	4,679	6,175	Japan 2,343; Australia 1,722; United States 490.
Gold bullion ---troy ounces--	49,625	41,250	United Kingdom 25,395; Switzerland 15,950; Hong Kong 4.
Iron and steel:			
Ore and concentrate	37,926	62,133	Malaysia 36,849; Brazil 25,165.
Metal:			
Scrap	33,259	59,249	Australia 24,529; South Vietnam 17,403; United States 7,048.
Pig iron, including cast iron	7,371	20,077	India 15,398; People's Republic of China 2,200; U.S.S.R. 1,500.
Sponge iron, powder and shot	383	188	India 91; United Kingdom 61; Japan 20.
Ferroalloys:			
Ferromanganese	911	964	Japan 750; U.S.S.R. 186; United States 17.
Other	251	793	Japan 402; West Germany 318; Taiwan 28.
Steel, primary forms	35,584	46,416	Japan 27,561; North Korea 12,490; People's Republic of China 2,759.
Semimanufactures:			
Bars, rods, angles, shapes, sections	147,231	227,976	Japan 189,108; United Kingdom 6,241; People's Republic of China 5,664.
Universals, plates and sheets	313,503	298,978	Japan 266,143; United Kingdom 9,420; Australia 8,342.
Hoop and strip	23,430	16,076	Japan 15,596; Belgium-Luxembourg 173; United States 74.
Rails and accessories	11,866	4,046	Malaysia 1,041; United Kingdom 874; Australia 798.
Wire	16,502	28,537	Japan 15,716; People's Republic of China 10,504; Taiwan 1,119.
Tubes, pipes, and fittings	78,227	120,606	Japan 98,299; United States 6,563; India 3,554.
Castings and forgings, rough	797	704	United Kingdom 178; Taiwan 135; Japan 128.
Total	591,556	696,923	
Lead:			
Ore and concentrate	8	10	All from Morocco.
Oxides	457	218	Australia 83; India 55; United Kingdom 43.
Metal	1,563	1,395	Australia 857; Malaysia 200; United Kingdom 166.
Manganese:			
Ore and concentrate	5,596	11,351	Ghana 10,160; Philippines 991; Japan 200.
Oxides	626	978	Japan 934; People's Republic of China 27; Hong Kong 7.
Mercury ---76-pound flasks--	115	12	West Germany 4; Italy 3; Japan 2.
Nickel metal, including alloys, all forms	70	85	Japan 40; United Kingdom 31; Canada 5.
Platinum-group metals and silver:			
Ore and concentrate ---value--	$6,939	--	
Metals, including alloys:			
Platinum group ---troy ounces--	3,677	4,465	United Kingdom 3,319; Australia 406; Switzerland 323.
Silver ---do---	711,643	61,633	Australia 41,716; United Kingdom 7,604; Japan 4,041.
Thorium ore ---value--	$197	$222	All from United Kingdom.

See footnotes at end of table.

Table 6.—Singapore: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
METALS—Continued			
Tin:			
Ore and concentrate ——long tons	1,120	856	Malaysia 823; Burma 26; Laos 7.
Oxides ——do	1	(1)	NA.
Slag and hardhead ——do	197	--	
Metal, including alloys, all forms —do	365	898	Japan 408; Malaysia 302; United Kingdom 65.
Titanium:			
Ore and concentrate:			
Ilmenite	129	10	All from Malaysia.
Other	--	48	All from Australia.
Oxides	2,404	2,014	Japan 857; Australia 365; United Kingdom 267.
Tungsten ore and concentrate	--	76	Thailand 72; Malaysia 4.
Zinc:			
Ore and concentrate	(1)	1	All from United Kingdom.
Oxides and peroxides, except hydroxides	942	566	Australia 286; India 153; United Kingdom 39.
Metal, including alloys, all forms	9,404	9,627	Japan 5,399; Canada 1,713; North Korea 1,099.
Zirconium, zircon	25	99	Australia 96; Malaysia 3.
Other:			
Ore and concentrate of base metals, n.e.s	r 171	226	Malaysia 218; Austria 8.
Ash and residue containing nonferrous metals	157	146	Australia 134; United Kingdom 12.
Oxides, hydroxides and peroxides of metals, n.e.s	116	173	United Kingdom 82; Norway 26; West Germany 23.
Metals, including alloys, all forms:			
Scrap, nonferrous	4,881	4,617	Malaysia 3,791; South Vietnam 635; Brunei 89.
Metalloids	20	18	Japan 8; France 7; West Germany 2.
Alkali, alkaline earth, and rare-earth metals	42	56	West Germany 20; United Kingdom 17; Netherlands 10.
Pyrophoric alloys	122	95	Austria 47; Japan 36; West Germany 10.
Base metals, including alloys, all forms, n.e.s	1,865	1,757	Austria 665; Japan 510; West Germany 336.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	71	68	United States 22; United Kingdom 11; Japan 8.
Dust and powder of precious and semiprecious stones ——value	$574	$2,923	United States $1,826; Japan $912; Australia $185.
Grinding and polishing wheels and stones	1,438	400	Japan 126; People's Republic of China 75; Taiwan 50.
Asbestos	3,150	3,533	Canada 2,646; Switzerland 187; United States 73.
Cement	760,431	888,889	Japan 374,478; Malaysia 166,729; Taiwan 149,398.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Kaolin	3,007	2,710	United Kingdom 944; Malaysia 837; Japan 252.
Other	15,132	28,106	United States 22,865; Malaysia 1,736; United Kingdom 1,381.
Products:			
Refractory (including nonclay bricks)	8,394	7,350	United Kingdom 2,745; Japan 1,264; Netherlands 823.
Nonrefractory	23,678	21,802	Japan 9,706; Malaysia 4,651; People's Republic of China 3,696.
Diamond:			
Gem, not set or strung value, thousands	$1,249	$2,374	India $1,003; Malaysia $534; Israel $291.
Industrial ——value	r $54	$702	United States $539; Australia $72; West Germany $52.
Diatomite and other infusorial earth	138	242	Japan 155; United States 43; Australia 22.
Feldspar	4,025	1,686	India 1,540; Taiwan 80; Hong Kong 46.

See footnotes at end of table.

Table 6.—Singapore: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continuel			
Fertilizer materials:			
Crude:			
Nitrogenous	72	167	All from Chile.
Phosphatic	14,034	19,695	Christmas Island 19,636; United States 22; People's Republic of China 20.
Potassic	9	--	
Nitrogenous	98,214	112,329	United States 94,323; Japan 8,966; West Germany 6,961.
Phosphatic	1,756	5,040	United States 4,003; Belgium-Luxembourg 450; Portugal 270.
Potassic	79,843	117,765	Israel, 61,369; Canada 50,807; United States 5,081.
Other, including mixed	29,372	18,846	West Germany 11,543; Belgium-Luxembourg 3,220; Malaysia 2,614.
Ammonia	912	468	Malaysia 316; Japan 85; Netherlands 36.
Fluorspar	912	468	India 2,295; United Kingdom 880; People's Republic of China 78.
Graphite, natural	204	128	People's Republic of China 60; United States 41; United Kingdom 15.
Gypsum and plasters	29,204	26,473	Australia 12,557; Japan 9,710; Philippines 3,001.
Lime	8,396	5,842	Malaysia 4,372; United Kingdom 1,270; People's Republic of China 200.
Magnesite	215	67	Austria 50; Japan 15; United States 2.
Mica, all forms	r 510	1,321	United States 943; United Kingdom 349; India 16.
Pigments, mineral:			
Natural, crude	369	2,294	United Kingdom 1,416; United States 532; People's Republic of China 203.
Iron oxides, processed	623	646	West Germany 264; People's Republic of China 238; Spain 78.
Precious and semiprecious stones, except diamond:			
Natural—value, thousands	$1,341	$1,486	People's Republic of China $681; Hong Kong $544; India $78.
Manufactured—do	$509	$364	India $133; Thailand $114; France $36.
Salt and brine	42,204	46,844	India 18,628; Thailand 8,419; Pakistan 3,193.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	5,176	9,332	Italy 2,786; United Kingdom 1,611; Yugoslavia 1,141.
Caustic potash, sodic and potassic peroxides	385	429	Belgium-Luxembourg 200; Hong Kong 82; West Germany 66.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	1,378	1,765	People's Republic of China 778; Japan 509; Italy 239.
Worked	2,388	3,579	Taiwan 1,465; Italy 996; People's Republic of China 715.
Dolomite, chiefly refractory grade	3,200	2,641	Malaysia 2,554; Austria 50; Japan 30.
Gravel and crushed rock	95,227	124,187	Malaysia 123,020; Taiwan 325; United Kingdom 259.
Limestone (except dimension)	19,517	23,382	Malaysia 18,623; Japan 4,618; Taiwan 91.
Quartz and quartzite	208	222	Hong Kong 132; United Kingdom 30; United States 29.
Sand, excluding metal bearing	31,472	41,679	Malaysia 38,681; United States 2,341; Belgium-Luxembourg 469.
Sulfur:			
Elemental:			
Other than colloidal	7,657	10,223	Iran 8,819; Canada 1,105; Malaysia 175.
Colloidal	9,652	10,259	Canada 9,753; Malaysia 215; West Germany 117.
Sulfur dioxide	3	5	Mainly from United Kingdom.
Sulfuric acid	60	140	Malaysia 113; West Germany 11; United Kingdom 5.
Talc, steatite, soapstone, and pyrophyllite	6,387	6,767	People's Republic of China 4,924; India 408; South Korea 295.

See footnotes at end of table.

Table 6.—Singapore: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971	Principal sources, 1971
NONMETALS—Continued			
Other nonmetals, n.e.s.:			
Crude	77,227	49,589	Thailand 16,885; United States 16,665; West Germany 7,086.
Slag, dross and similar waste, not metal bearing	138	33	Malaysia 22; India 11.
Oxides and hydroxides of magnesium, strontium, and barium	48	235	Japan 232.
Bromine, iodine and fluorine ---value--	$3,830	$8,424	United States $6,613; United Kingdom $565; West Germany $518.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	12,960	10,542	Malaysia 7,444; United States 751; Australia 695.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	20	2,171	Taiwan 2,000; Japan 160.
Carbon black	3,587	4,537	Japan 3,176; Australia 577; United States 398.
Coal, all grades, including briquets	416	3,275	North Vietnam 1,625; United States 1,519; Australia 82.
Coke	5,357	6,461	Taiwan 4,539; Japan 535; Netherlands 451.
Hydrogen, helium and rare gases value, thousands--	$276	$214	Japan $103; United States $58; France $21.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels--	80,159	113,202	Kuwait 60,269; Saudi Arabia 21,218; Iran 16,207.
Refinery products:			
Gasoline:			
Aviation ---do---	2,216	2,899	Iran 1,438; Netherlands Antilles 506; Saudi Arabia 291.
Motor ---do---	5,315	4,325	Malaysia 1,697; Iran 1,026; Australia 663.
Kerosine ---do---	r 2,312	2,244	Malaysia 1,587; Saudi Arabia 380; Bahrain 122.
Jet fuel ---do---	10,681	9,042	Malaysia 6,069; Iran 1,466; Saudi Arabia 809.
Distillate fuel oil ---do---	11,748	10,139	Saudi Arabia 2,157; Philippines 2,024; Malaysia 1,451.
Residual fuel oil ---do---	35,178	20,587	Bahrain 7,652; Malaysia 4,439; Saudi Arabia 4,173.
Lubricants ---do---	r 1,443	1,275	Japan 612; Netherlands Antilles 390; Netherlands 84.
Mineral jelly and wax ---do---	26	37	Burma 21; People's Republic of China 9; United States 3.
Other:[2]			
Nonlubricating oils, n.e.s.-do---	10	14	United States 6; United Kingdom 4.
Pitch and petroleum coke-do---	12	4	Australia 2; United States 1.
Bitumen and bituminous mixtures, n.e.s ---do---	62	36	Netherlands 17; Malaysia 7; United Kingdom 7.
Other ---do---	r 231	192	Iran 143; Malaysia 16; Philippines 14.
Total ---do---	r 69,234	50,794	

r Revised. NA Not available.
[1] Less than ½ unit.
[2] In addition to the products listed, liquefied petroleum gas valued at $126,000 in 1970 and $44,000 in 1971 was also imported.

1972. About two-thirds of the steel imports from Japan consisted of shapes, plates, and pipes and tubing.

Singapore has two steel producers. The National Iron & Steel Mills, Ltd., with a plant at Jurong, has electric furnaces, merchant bar mills, and a wire rod mill which turns out about 110,000 tons of steel products annually. The second and smaller producer is the Malayan Iron & Steel Mills, Ltd. Two other small firms may eventually enter the steel business, namely the Singapore Steel Supply Centre Ltd. and the Leong Huat Industries Ltd.

Nonmetals.—Cement.—Singapore's cement industry was operating at near full capacity in 1972. Actually, the three existing cement plants are all clinker grinding units, with the clinker supplied by foreign countries. The Asia Cement (Malaysia), Ltd., plant

at Jurong was recently expanded to 480,000 tons per year. Singapore Cement Manufacturing Co. Ltd. has an "Onada" type grinding plant at the Port of Singapore rated at 360,000 tons annually, and plans have been made to acquire more land for expansion. Pan Malaysia Cement Works Ltd. also has a plant in Jurong—annual capacity 300,000 tons. Singapore's imports of cement were approximately 760,000 tons in 1970 and 889,000 tons in 1971.

Mineral Fuels.—Petroleum.—According to new capacity being built and planned at yearend 1972, Singapore's program for expanding oil refining facilities may reach a plateau by about 1975, in contrast to an expected continued growth in consumption, bunkering, and trading of petroleum products. A paper by the Singapore International Chamber of Commerce[23] pointed out that immediate further expansion may not be warranted. A few major reasons were cited: (1) Singapore refineries are not built for the low-sulfur or "sweet" oil from Southeast Asia which the consuming countries may import in increasing quantities for domestic refining; (2) the future market for Singapore's oil exports may also decline on account of termination of the Vietnam war and desire by countries like South Vietnam and Hong Kong to import more crude for local refining; and (3) Japan, which imported 31 million barrels of refined oil products from Singapore in 1972, may likewise decide to import more crude for local refining. The Chamber of Commerce also recommended a "go-slow" policy on petrochemicals for Singapore because of the advantage in building such facilities near consumption centers.

Shell Eastern Petroleum, Ltd., owns the largest oil refining complex in East Asia at Pulau Bukum, an "oil island" of Singapore. As of early 1973, Shell had four refining units with a combined capacity of 350,000 barrels per day. By yearend 1974, another 180,000 barrels per day will have been added. Facilities at Pulau Bukum also include desulfurization, liquefied petroleum gas, asphalt, solvent, and lubricants plants.

Two wholly U.S.-owned refineries under Esso Singapore Pte. Ltd. and Mobil Oil Singapore Pte. Ltd. will require a $200 million investment upon completion of expansion facilities. Esso's refinery on Pulau Ayer was being expanded from 81,000 barrels per day to 231,000 barrels by the Ishikawajima-Harima Heavy Industries of Japan. Mobil's refinery in the Jurong Industrial Estate was being enlarged from 27,000 barrels per day in 1971 to 175,000 barrels by yearend 1973.

The Singapore Petroleum Co., a joint venture formed by Amoco International, Oceanic Petroleum Corp. (subsidiary of U.S. Summit Corp.), and the Development Bank of Singapore, was about to complete a $70 million, 65,000-barrel-per-day refinery at Pulau Merlimau, just south of the Jurong Estate and adjacent to Esso's refinery. The British Petroleum Co. has Singapore's fifth and smallest refinery (25,000 barrels) on the "mainland" at Tanjong Pagar; this plant has no land space to expand.

SRI LANKA (FORMERLY CEYLON)[24]

The island nation of Sri Lanka has a small minerals industry that provides raw and processed mineral materials for both domestic use and export. The major components of the minerals industry are nationalized and are controlled by government-sponsored corporations that are responsible for the management of their segment of the minerals industry.

Natural graphite production, for which Sri Lanka is well known, achieved the same level of production as that of 1971. About 40% of the natural graphite produced was exported to the United States. The industry was managed by the State Graphite Corp., which was established in July 1971 for the purpose of mining, separating, refining, and preparing graphite and other minerals for sale and export. In addition, the corporation studied the feasibility of establishing domestic manufacturing industries using domestic graphite.

The production of titanium concentrate from Sri Lanka's coastal beach sands has gained increased importance in the nation's mineral economy. Although available in all the island beach sands, economic concentrations of ilmenite, rutile, zircon,

[23] Far Eastern Economic Review (Hong Kong). Petrochemicals Out. June 10, 1972, pp. 32–33.

[24] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

and monazite occur only at Pulmoddai, at Terrukkovil near Batticaloa, at Kaikawela and Polkotuwa near Beruwela, and at Kudremalai Point near Manna. Pulmoddai is the largest deposit and is located on the east coast 3 miles north of Trincomalee.

The Mineral Sands Corp. was formed in December 1957 to exploit the Pulmoddai deposit. A plant was located close to the deposit for the recovery of ilmenite by magnetic separation. The plant tailings were transported by sea to the plant at China Bay for the recovery of rutile by high-tension separator units and zircon by wet tables. There are at present no facilities for the recovery of monazite and sillimanite. The corporation planned to integrate its operation at Pulmoddai by expanding operations and moving equipment from China Bay to Pulmoddai. The production of titanium concentrates in 1972 declined from that of the previous year.

Sri Lanka's cement production remained almost unchanged from that of 1971. The industry operated under the management of the State Cement Corp. established in 1957 and was responsible for the operations of the Kankesan cement mill, the Galle terminal grinding and packing plant, and the Puttalam cement mill. Raw materials for the plants were obtained from indigenous limestone and clay deposits. Gypsum required for these operations was imported. During the fiscal period 1971–72, 385,000 tons of cement was produced at the facilities of the State Cement Corp.

Salt was produced by solar evaporation in the northern, western, and southern regions of the island. As a result of favorable weather conditions, production increased over 80%. This island supplied its own industrial and nonindustrial requirements for this vital commodity. Salt production was under the direction of the National Salt Corp., which owned 7 of the 14 salterns on the island.

The country's petroleum activities remained dependent on imported crude oil, of which 40% was obtained from Iraq and the Arab Republic of Egypt under bilateral trading agreements. Crude petroleum refining was managed by the state-sponsored Ceylon Petroleum Corp., which had control of all production facilities including marine bunkering and aviation refueling.

The country also produced feldspar, gem stones, mica, monazite, and stone. In addition, fabricated steel products were from domestic scrap iron and imported pig iron.

Table 7.—Sri Lanka: Exports and reexports of mineral commodities[1]

Commodity	1970	1971	Principal destinations, 1971
METALS			
Ilmenite ---------- metric tons	r 79,059	87,942	Japan 87,386; Netherlands 305; United Kingdom 150.
Iron and steel, semimanufactures ---- do	59	26	Maldive Islands 23.
Lead metal, all forms, including alloys ---- do	188	503	Republic of South Africa 250; Kenya 180.
NONMETALS			
Clays and clay products, crude clays, n.e.s ---------- do	6	1	NA.
Graphite, natural ---------- do	r 9,786	7,755	Japan 3,281; United States 2,011; France 651; Australia 298.
Limestone ---------- do	409	NA	
Mica, all forms ---------- do	489	316	United Kingdom 154; Thailand 111; Japan 51.
Precious and semiprecious stones (except diamonds) ---------- carats	184,898	[2] 76,344	West Germany 59,490; Japan 14,876.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	[3] 125	NA	
Refinery products:			
Gasoline ---------- do	[3] 788	[4] 693	NA.
Residual fuel oil ---------- do	[3] 255	[4] 232	NA.

r Revised. NA Not available.
[1] Unless otherwise noted, Customs Returns of Sri Lanka 1970, 1971, Colombo 1973, 615 pp.
[2] Partial figure.
[3] Statistical Office of the United Nations. Supplement to the World Trade Annual, 1970. V. 5 (The Far East). Walker and Company, New York, 1972, pp. 169–172.
[4] International Petroleum Annual 1971. Bureau of Mines, March 1972, 37 pp.

Table 8.—Sri Lanka: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum:		
Oxide and hydroxide	4	13
Metal, including alloys, all forms	r1,317	2,769
Chromium oxide and hydroxide	(2)	2
Cobalt oxide and hydroxide	(2)	(2)
Copper metal, including alloys:		
Unwrought, master alloys	6	9
Semimanufacturers	783	696
Iron and steel:		
Pig iron, ferroalloys and similar materials	r476	581
Steel, primary forms	16,828	26,820
Semimanufacturers:		
Bars, rods, angles, shapes, and sections	r11,122	12,435
Universals, plates and sheets	r25,783	30,557
Hoop and strip	r3,224	5,749
Rails and accessories	r115	7,886
Wire	r822	10,947
Tubes, pipes, and fittings	r5,343	3,103
Castings and forgings, rough	r12	8
Lead:		
Oxide	(2)	6
Metal, including alloys, all forms	r336	790
Manganese oxides	529	5
Mercury ---76-pound flasks	277	1
Molybdenum	(2)	(2)
Nickel, including alloys, all forms	9	14
Rare-earth metals:		
Oxides ---kilograms	NA	1,163
Metals, including alloys, all forms ---do	51	863
Silver, including alloys, all forms ---troy ounces	58	58
Tin, including alloys, all forms ---long tons	108	115
Titanium oxides	137	119
Tungsten, including alloys, all forms	2	NA
Zinc:		
Oxides	r37	450
Metal, including alloys, all forms	r1,397	1,270
Other:		
Ores and concentrates of base metals, n.e.s	r154	721
Oxides, hydroxides and peroxides of metals, n.e.s	1	22
Metals, including alloys, all forms, n.e.s	5	14
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	18	38
Grinding and polishing wheels and stones	r4	1
Asbestos	4,139	6,708
Barite	68	11
Boron materials:		
Crude natural borates	(2)	250
Oxide and acid	NA	18
Cement	r1,286	3,071
Chalk	1,118	948
Clays and clay products (including refractory brick):		
Crude clays, n.e.s	634	553
Products	r1,400	616
Diatomite and other infusorial earth	8	1
Fertilizer materials:		
Crude:		
Nitrogenous	57	(2)
Potassic	NA	NA
Other	566	155
Manufactured:		
Nitrogenous	r134,400	96,011
Phosphatic	49,203	79,192
Potassic	r75,523	33,319
Other, including mixed	r3,539	471
Gypsum and plaster	1	151
Lime	357	259
Magnesite	7	6
Mica, all forms	r34	35
Pigments, mineral, including processed iron oxide	r79	308
Salt and brine	6	352
Sodium and potassium, compounds, n.e.s	r2,160	3,866
Stone, sand and gravel:		
Dimension stone	141	28
Dolomite, chiefly refractory grade	9	--
Gravel and crushed rock	468	217
Quartz and quartzite	1	1
Sand, excluding metal bearing	13	4

See footnotes at end of table.

Table 8.—Sri Lanka: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1970	1971
NONMETALS—Continued		
Sulfur:		
Elemental, all forms	NA	1,106
Sulfuric acid	NA	437
Talc, steatite, soapstone, and pyrophyllite	245	1,327
Other nonmetals, n.e.s.:		
Crude	[3]8,972	3,865
Oxides and hydroxdies of magnesiumfi strontium, etc	2	4
Building materials of asphalt, asbestos and fiber cement, and unfired minerals, n.e.s	NA	([2])
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	132	50
Carbon black and gas carbon	[r]755	623
Coal and coke, including briquets	[3]11,383	[4]661
Gas, hydrocarbon	NA	3
Petroleum:		
Crude and partly refined ----------thousand 42-gallon barrels--	[r]13,409	11,347
Refinery products:		
Gasoline (including natural ----------do----	[r]280	[5]103
Kerosine and jet fuel ----------do----	[r]793	[5]535
Distillate fuel oil ----------do----	[r]520	[5]477
Residual fuel oil ----------do----	[r]776	NA
Lubricants ----------do----	[3]78	NA
Other, n.e.s ----------do----	[4]40	NA
Other, n.e.s ----------do----	[4]40	NA

[r] Revised. NA Not available.
[1] Unless otherwise noted, Customs Returns of Sri Lanka 1970, 1971, Colombo, 1973, 615 pp.
[2] Less than ½ unit.
[3] Statistical Office of the United Nations. Supplement to the World Trade Annual, 1970. V. 5 (The Far East), Walker and Company, New York, 1972, pp. 173–183.
[4] Partial figure.
[5] International Petroleum Annual 1971. Bureau of Mines, 1972, 37 pp.

NORTH VIETNAM [25]

North Vietnam's industrial production, particularly concentrated around the capital city of Hanoi, was severely crippled by the war in 1972. The Thai Nguyen iron and steel works, north of Hanoi, and the country's major steel plant, was damaged in mid-1972 by U.S. bombing action. Crippling of the plant cut off the only domestic source of structural steel for railroads, bridges, and buildings. In addition, the Port of Haiphong blockade disrupted the import and export of industrial materials vital to the economy of North Vietnam.

Owing to the war situation, the State Planning Commission was faced with difficulties during the year in insuring a balanced flow of resources to the various sectors of the economy. Some of the problems were unsatisfactory cost controls and wage policies, poor management, high war costs, insufficient manpower, and low value of imports. Although no trade figures were published by North Vietnam in 1972, the U.S.S.R. and the People's Republic of China continued to be the country's principal trading partners.

COMMODITY REVIEW

Metals.—Production of metallic minerals in North Vietnam has not been reported in recent years. Iron ore, zinc, tin, antimony, and chromite are produced annually from various mines, but production was most likely reduced substantially in 1972 because of the war.

North Vietnam exported a small quantity of tin metal (48 tons) to Japan in 1971, but no tin shipments were made in 1972.

Nonmetals.—Although no data for construction materials are available, cement, lime, silica brick, sand and gravel, and stone are produced annually in sufficient quantities to meet domestic requirements. The North Vietnam construction industry was reported to have enjoyed a banner year in 1971; however, 1972 was devoted to the repair of bomb-damaged facilities around Hanoi and other major producing areas.

The country's cement industry produced an estimated 500,000 tons of cement in

[25] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals—Mineral Supply.

1971. The largest cement plant at Haiphong was heavily bombed in 1972, and as a result, at least seven kilns were reported inoperative during the year. Other major cement facilities were also damaged, and it is probable that cement output in 1972 was no more than half of the 1971 total.

Output of salt and phosphate rock (including apatite) in 1972 was estimated to be 100,000 tons and 600,000 tons, respectively.

Mineral Fuels.—Coal production, particularly from the Hongay mines, was consistently interrupted by the war in 1972, and output was estimated to be around 2 million tons.

Exports of Hongay anthracite were suspended in mid-1972, owing to military activity which closed the Port of Haiphong. Shipments of Hongay anthracite to Japan dropped to 67,411 tons in 1972, compared with nearly 410,000 tons in 1971.

SOUTH VIETNAM [26]

South Vietnam in 1972 continued to feel the effects of the war that had underlined the country's dependence on foreign economic assistance and underscored the slowness of industrial development in recent years. War-related industries continued to contribute to the country's gross national product (GNP) in 1972, and most of the domestic requirements for mineral commodities such as fertilizers, iron and steel products, nonferrous metals, and petroleum products were again supplied by imports.

Although the economy of South Vietnam remained quite stable in 1971 and into early 1972, due in large part to the 1971 economic reform program which involved new exchange rates, simplified import duties, and a freeze on import controls, industrial output and a favorable trade balance in 1972 were hindered by a general recession. Reported mineral output, affected by the recession in 1972, was lower than in 1971, and was confined to cement, salt, and limestone. Silica sand, clays, coal, iron and steel mill products, and processed scrap metal were also produced, but quantities were not reported in 1972.

The Government of South Vietnam, in order to stimulate exports and industrial output, enacted legislation in June 1972 to encourage foreign investment in the country's future industrial development. The law, known as the "Law for the Encouragement of Investment in Vietnam," provides numerous incentives to foreign as well as domestic investment, in particular exemptions from income taxes, customs duties, and various registration taxes for periods up to 5 years after the initiation of operations. A grace period for extension of up to 5 more years is also provided.

Priority mineral industry activities eligible for the investment privileges under the new law include chemical manufacturing plants such as basic chemicals, fertilizers, and insecticides; mineral processing plants, such as cement and glass; and metallurgical plants, such as melting of iron scrap and steel rolling.

COMMODITY REVIEW

Metals.—South Vietnam's requirements for manufactured steel products in 1972 continued to be met largely by imports. The value of iron and steel mill products and nonferrous metals imported in 1972 was $55 million and $8 million, respectively, compared with $50 million and $7.5 million in 1971.

The country's small commercial steel fabricating industry was hit hard by the 1972 recession. Although no production data were available, the largest company producing roundbar (rebar) was reported to have operated in 1972 at about one-half of annual capacity. Overall employment in the industry was reduced by about 40%.

For the first time, rebars made from scrap metal were exported by South Vietnam. The quantity (2,500 tons) was valued at $2.5 million and was exported to Indonesia.

Nonmetals.—South Vietnam produces sand and gravel (including silica sand), various types of stone, salt, clays, fertilizer materials, and cement, primarily for domestic consumption. Production in 1972 was reported for only salt, cement, and limestone. The quantity of cement produced in 1972 was 235,000 tons, compared with 263,000 in 1971, and limestone output was 250,000 tons, compared with an estimated 270,000 tons in 1971. Salt output,

[26] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals—Mineral Supply.

which had been averaging about 120,000 tons per year for the past 3 years, was only 40,000 tons in 1972.

Mineral Fuels.—The country's only coalfield at Hong Son was in operation in 1972, but the quantity of coal produced was not reported.

South Vietnam continued to rely heavily on imports in 1972 to meet all domestic requirements for petroleum products.

The Mineral Industry of Other South Pacific Islands

By Staff, Bureau of Mines

CONTENTS

BRITISH SOLOMON ISLANDS [1]

Mineral activity, other than the continuing Geological Survey mapping program, returned to at least two of the main islands of the British Solomon Islands Protectorate (BSIP) during 1972. The Utah Development Co. was diamond drilling its porphyry copper deposit on Guadalcanal, and Buka Minerals NL reported a second bauxite discovery on New Georgia. The deposit is very close to good harbor facilities and preliminary drilling suggests 6 million tons of bauxite with better than 40% alumina and less than 6% silica. There was no reported mineral activity on the other main islands (Choiseul, Santa Isabel, Malaita, San Cristobal, and Santa Cruz).

Mitsui Mining and Smelting Co. was developing its bauxite deposit on Rennell Island. By midyear an air strip and roads had been built and harbor facilities, housing, and ore body stripping had been started.

Conzinc Rio Tinto of Australia Ltd. proved 30 million tons of bauxite on Wagina Island and was looking for a market.

[1] Prepared by Robert A. Clifton, chemist, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Other Pacific Islands: Production of mineral commodities

Area and commodity		1970	1971	1972 p
BRITISH SOLOMON ISLANDS [1]				
Gold	troy ounces	291	444	e 400
CHRISTMAS ISLAND [1]				
Phosphate rock (shipments)	thousand metric tons	r 1,089	991	1,074
FIJI ISLANDS				
Cement, hydraulic	metric tons	60,658	78,091	90,726
Gold, mine output, metal content	troy ounces	103,785	89,129	81,590
Lime	metric tons	2,885	--	3,801
Manganese ore, gross weight	do	r 23,171	7,657	--
Silver, mine output, metal content	troy ounces	26,640	19,893	23,681
Sand, gravel and stone:				
Coral sand for cement manufacture [2]	metric tons	78,856	92,040	100,964
River sand for cement manufacture	do	r 42,381	NA	NA
River sand and gravel	cubic meters	r 257,148	262,698	282,433
Coral sand and limestone	do	r 374	NA	NA
Limestone	metric tons	[3] 4,719	4,621	5,897
Other quarried stone	cubic meters	283,696	158,091	215,782

See footnotes at end of table.

Table 1.—Other Pacific Islands: Production of mineral commodities—Continued

Area and commodity		1970	1971	1972 p
NAURU AND OCEAN ISLAND [1]				
Phosphate rock, marketable (exports):				
Nauru	thousand metric tons	2,114	1,867	1,340
Ocean Island	do	506	620	512
NEW CALEDONIA [1]				
Gioberite	metric tons	1,099	1,432	--
Jade ("Ouen Island jade")	kilograms	118	550	1,400
Nickel:				
Ore:				
Gross weight	thousand metric tons	7,021	7,570	5,450
Metal in ore [4]	metric tons	105,382	102,286	100,175
Metallurgical products, nickel-cobalt content:				
Ferronickel [5]	do	27,965	29,881	39,116
Matte [6]	do	15,856	16,138	20,199
NEW HEBRIDES [1]				
Manganese ore	do	15,355	15,002	28,247
PAPUA NEW GUINEA [1]				
Copper, mine output, metal content	do	1	NA	123,959
Gold, mine output, metal content	troy ounces	23,798	24,071	409,125
Silver, mine output, metal content	do	17,180	17,451	995,443

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Undoubtedly, this area produces crude construction materials (common clays, sand, gravel and/or stone in addition to the listed commodities, but output is unrecorded and information is inadequate to make reliable estimates of output levels.

[2] Erroneously reported as cubic meters in 1971 edition.

[3] Quantity reported for lime production only.

[4] Nickel-cobalt content of metallurgical plant products, plus estimated recoverable nickel-cobalt in exported ores.

[5] Ferronickel averages 23.95% combined nickel-cobalt.

[6] Matte averages 78.57% combined nickel-cobalt.

CHRISTMAS ISLAND [2]

Phosphate rock and phosphate dust were, as in past years, the only mineral commodity produced on Christmas Island during 1972. Christmas Island has an area of about 55 square miles, and is located in the Indian Ocean about 230 miles south of Java.

Christmas Island is composed of coral formations on top of a submerged volcanic mountain. The phosphate deposits occur on top of and between coral pinnacles on the island. The total phosphatic mineral deposits on the island are large, but the composition of the deposits varies from relatively pure calcium phosphate to phosphatic minerals which contain large percentages of iron and aluminum. The international market for phosphate rock requires a rock with a high analysis of calcium phosphate and a minimum of impurities such as iron and aluminum. An upper limit of about 5% mixed oxides of aluminum and iron in the phosphate rock is acceptable for fertilizer production. For these reasons, the high-grade phosphate rock, suitable for the fertilizer industry, has been selectively mined and those deposits containing more than 5% mixed oxides of aluminum and iron have been designated as overburden and stockpiled for possible beneficiation at some future time.

Historically, the phosphatic minerals of Christmas Island have been arbitrarily classified into three grades designated as A-grade, which contains about 38% P_2O_5 equivalent and 4% (Al_2O_3 + Fe_2O_3) equivalent; B-grade, which contains about 35% P_2O_5 equivalent and about 17% (Al_2O_3 + Fe_2O_3 equivalent; and C-grade, which contains about 28.5% P_2O_5 equivalent and about 33% (Al_2O_3 + Fe_2O_3) equivalent.

Down from the island surface, the phosphate deposits start with a vegetation covered C-grade phosphate layer which is predominantly crandallite ($CaO \cdot 2Al_2O_3 \cdot P_2O_5 \cdot 5H_2O$) and millisite ($2CaO \cdot Na_2O \cdot 6Al_2O_3 \cdot 4P_2O_5 \cdot 17H_2O$). The C-grade layer contains varying but minor amounts of apatite. [Fluorapatite, $Ca_5F(PO_4)_3$, is the most common apatite with chloroapatite, $Ca_5Cl(PO_4)_3$, and hydroxylapatite, $Ca_5(OH)(PO_4)_3$, occurring less frequently.] Iron occurs in all C-grade deposits, and all

[2] Prepared by Ted C. Briggs, chemist, Division of Nonmetallic Minerals—Mineral Supply.

of the minerals of the C-grade layer are of extremely fine particle size. The B-grade layer is found beneath the C-grade layer and is a diffused mixture of crandallite, millisite, and apatite, with the apatite becoming dominant at lower depths and gradually changing into the A-grade zone, which consists of apatite adjacent to the limestone pinnacle base.

Mining operations consist of clearing the vegetation, stripping the C-grade ore by tractor scrapers and adjacent stockpiling of this ore. The B-grade layer is removed by a combination of stripping and excavation with draglines. This ore is also stockpiled, but separately from the C-grade ore. The A-grade ore is mined by the use of clamshell excavators extracting the ore among the pinnacle formations and by other selective mining procedures to minimize inclusion of weathered carbonate. At present, only the ore from the A-grade layer is marketed, but considerable work has been done to develop a process to beneficiate the B-grade phosphates.[3]

After mining, the A-grade ore is trucked to a stockpile area and then moved by rail to a drying plant. The ore is dried from about 20% water content, as mined, to less than 4% water in the marketable rock. Dust from the drying plant is collected and bagged for sale as a direct application fertilizer. There is storage capacity for 83,000 tons of dried phosphate rock at a location on the island shore below the drying plant and adjacent to a cantilever ship loader. Each of the two arms of the cantilever loader can load 1,500 tons of rock per hour onto ships which must dock about 200 feet from the shore.

In 1972, most of the phosphate rock produced was shipped to Australia and New Zealand, but most of the phosphate dust, 126,000 tons, was sold to Malaysia. Indonesia increased its imports of phosphate dust from Christmas Island from 11,000 tons in 1971 to 23,000 tons in 1972.[4]

[3] Hoare, J. S. Development of Wash/Screen Process to Beneficiate Christmas Island B-Grade Phosphates. Australasian Inst. Min. and Met., Annual Conf., Paper No. 4, 1971, 27 pp.

Trueman, N. A. The Aluminum-Iron Phosphatic Overburden of Christmas Island, Indian Ocean: Its Mineralogy, Mineral Chemistry and Thermal Transformations. Australasian Inst. Min. and Met., Annual Conf., Paper No. 2, 1971, 20 pp.

[4] Phosphorus and Potassium (London). Ocean, Nauru, and Christmas Islands. March/April 1973, No. 64, pp. 32–32.

Table 2.—Christmas Island: Shipments of phosphate rock

(Metric tons)

Destination	Fiscal year		
	1970	1971	1972
Australia	751,575	658,894	487,382
Indonesia	686	11,763	21,963
Khmer Republic (formerly Cambodia)	7,503	--	--
Malaysia	68,319	74,976	108,572
New Zealand	258,305	241,797	291,552
Singapore	12,340	15,506	25,486
Total	1,098,728	1,002,936	934,955
Value of total—thousand U.S. dollars	$10,482	$8,750	$9,577

Source: The British Phosphate Commissioners.

FIJI ISLANDS [5]

Fiji consists of more than 700 uninhabited and 106 inhabited islands lying about 1,700 miles northeast of Sydney, Australia. The two main islands, Viti Levu and Vanua Levu, comprise 87% of the island group's land area of 7,055 square miles. Since 1970, Fiji has been an independent Dominion in the British Commonwealth. The economy of the islands is largely agricultural, but mining is an important sector of employment, and minerals account for about 10% of the value of all exports. Gold has been by far the most important mineral produced since its discovery over 40 years ago.

[5] Prepared by William C. Butterman, Physical scientist, Division of Nonferrous Metals—Mineral Supply.

The value of all minerals produced in Fiji in 1972 was $7.7 million.[6] Gold accounted for $5.3 million, followed by sand and gravel, $1.0 million; stone, $1.0 million; and all other minerals, $0.4 million.

The output of the only remaining gold producer, Emperor Gold Mining Co. Ltd., dropped by about 7 thousand troy ounces, or 8%, in 1972. However, improvement in the free market gold price raised revenues significantly and was expected to reduce or eliminate the company's dependence on subsidies from the Fijian Government. Development work continued at the mine. A small amount of byproduct silver was produced along with gold. Fijian copper production in 1972 was negligible and manganese ores were not produced.

Sand and gravel, stone, lime, and most of the cement produced in Fiji were used domestically. The production of lime in 1972 (none was produced in 1971) was 32% greater than in 1970; the 1972 production of the other three commodities increased over that of 1971, sand and gravel by 41%, stone by 77%, and cement by 16%.

In 1972 several companies were engaged in mineral exploration in Fiji, but progress reports were generally unavailable. Bauxite Fiji, a subsidiary of three Japanese companies, was developing a 250,000-metric-tons per-year mine on Vanua Levu and had scheduled startup for September 1972. However, extremely heavy rainfall and delays in the delivery of mining equipment forced the company to move the startup date to April 1973. Then in early 1973, a combination of economic factors led to abandonment of the project.

[6] Where necessary, values have been converted from Fiji dollars (FD) to U.S. dollars at the rate of FD1 = US$1.30.

Table 3.—Fiji Islands: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971
METALS		
Aluminum, metal including alloys, all forms	36	83
Copper:		
Matte	6	--
Metal, including alloys, all forms	r 199	145
Gold, bullion, troy ounces	107,632	87,630
Gypsum, anhydrite, etc	4	--
Iron and steel:		
Metal:		
Scrap	r 813	9
Semimanufactures	r 913	716
Lead, metal including alloys, all forms	282	50
Manganese ore and concentrate	38,827	6,177
Platinum-group metals and silver, waste and sweepings, troy ounces	1,280	NA
Silver (in bullion), do	26,982	19,721
Sodium and potassium compounds, caustic soda	5	4
Stone, sand and gravel:		
Gravel and crushed rock	152	--
Sand, excluding metal bearing	5	--
Other:		
Metal, scrap of nonferrous	142	68
NONMETALS		
Cement	r 11,138	24,665
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products: [1]		
Gasoline, motor and aviation, thousand 42-gallon barrels	56	143
Kerosine and jet, do	655	893
Distillate fuel oil, do	183	261
Residual fuel oil, do	r 145	178
Lubricants, do	3	7
Liquefied petroleum gas, 42-gallon barrels	r 270	375
Total, thousand 42-gallon barrels	r 1,042	1,482
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	8	6

r Revised. NA Not available.
[1] Includes bunkers.

Table 4.—Fiji Islands: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1970	1971
METALS			
Copper:			
Metal, including alloys, all forms		r 116	1,246
Gold, metal, unworked or partly worked	troy ounces	r 399	549
Iron and steel:			
Pig iron, ferroalloys, and similar materials		65	168
Steel, primary forms		r 350	868
Semimanufactures		r 21,395	17,924
Lead metal, including alloys, all forms		1	12
Platinum-group metals and silver, unworked and partly worked	value	r $5,876	$2,828
Titanium oxides		138	149
Zinc metal, including alloys, all forms		62	49
NONMETALS			
Abrasives, natural, pumice, emery, natural corundum, etc		--	7
Asbestos		1	1
Barite and witherite		5	11
Cement		220	257
Chalk, earth colors, etc		r 100	86
Crude clays, n.e.s., kaolin and bentonite, etc		r 355	71
Diatomite and other infusorial earths		18	55
Fertilizer materials:			
Crude:			
Potassic		2	5
Mixed		168	663
Manufactured:			
Nitrogenous		24,886	18,153
Phosphatic		3,243	1,552
Potassic		373	255
Mixed		10	122
Gypsum and plasters		3,572	3,390
Lime		62	27
Precious and semiprecious stones, except diamond	value	$10,804	$30,963
Salt		1,127	2,206
Sodium compounds, caustic soda		713	335
Stone, sand and gravel:			
Dimension stone		NA	13
Sand, excluding metal bearing		124	94
Sulfur, elemental, all forms		(1)	44
Talc and steatite		2	6
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		662	22,544
Coal, coke and peat		240	1,697
Petroleum refinery products:			
Gasoline, motor and aviation	thousand 42-gallon barrels	354	333
Kerosine and jet fuel	do	941	1,003
Distillate fuel oil	do	748	861
Residual fuel oil	do	r 3,094	384
Liquefied petroleum gas	do	6	10
Lubricants (including grease)	do	22	26
Other	do	r 2 15	2 8
Total	do	r 5,180	2,625
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	42-gallon barrels	2 862	2 766

r Revised. NA Not available.
1 Less than ½ unit.
2 Partial figure.

NAURU AND OCEAN ISLAND [7]

Phosphate rock was the only mineral commodity produced in Nauru and Ocean Island during 1972.

The Republic of Nauru, a small island with an area of about 8.5 square miles, and Ocean Island, an even smaller island than Nauru, are located near the Equator, about 1,700 miles northeast of Australia and about 160 miles from each other. The phosphate rock deposits on both islands are similar and the islands are essentially coral formations on top of submerged mountains with encircling coral reefs. The central part of the islands consists of high-grade deposits of phosphate rock deposited between coral pinnacles. The phosphate deposits contain various marine fossils, indicating a marine origin of the

[7] Prepared by Ted C. Briggs, chemist, Division of Nonmetallic Minerals—Mineral Supply.

deposits. Most geologists have stated that the phosphate deposits were formed during a dry phase of the Pleistocene period with guano being the source of the phosphate. The guano theory holds that loss of volatiles left the guano virtually as a calcium phosphate and that, following substantial rainfall, phosphatic solutions leached from this material and reacted with underlying rocks that sometimes contained fossils of marine organisms.

Little or no overburden occurs and the deposits vary in depth up to 80 feet with the average depth being about 25 feet. A general covering of tropical vegetation occurs and the top layer of phosphate, which varies in depth between 2 inches and 12 inches, is contaminated with humus. This top layer contains from 1% to 2% organic carbon, while the overall average organic carbon content is 0.4% This carbon content is high when compared with the carbon content of phosphate rock from Florida or from Morocco.

In the mining operation, vegetation is removed and the high carbon layer of phosphate is stripped and stockpiled for possible future treatment. Grabbing cranes mine the phosphate rock from the pinnacle formations, and in some areas phosphate rock is removed by face shovel. Dump trucks transport the rock to a crushing plant, and about 85% of the rock passes, as mined, through a 4-inch sieve. The over 4-inch fraction includes rock up to 30 cubic feet, and these require blasting. Most of the phosphate deposits consist of rubbly and soft rock and relatively little hard rock is present. Occasionally, the phosphate rock is embedded between the pinnacles and requires blasting for removal. A unique hazard in the mining operations is unexploded bombs and shells, relics of World War II. An average of three or four bombs or shells are found each year and are disposed of by detonating in place or by dumping at sea.

On Nauru, the mined phosphate rock is crushed to a nominal 2-inch size, although this size is generally unacceptable in most world markets. Investigations were underway to determine the feasibility of crushing the ore to below ¾-inch size. After crushing, the ore is transported along a double track railway to a drying plant. In 1972 the drying plant had six kilns each supplied by a hopper of 900 tons capacity. Moisture in the rock varied between 9% and 25% before firing in the kilns and between 2% and 4% after firing. There was one electrostatic dust precipitator for each dryer. Each precipitator collects from 2 tons to 4 tons of dust per hour, and the dust is returned to the main kiln discharge collecting system. After drying, the rock is transported by two parallel conveyors to a 114,500-ton storage shed.

For ship loading, a series of conveyors discharge phosphate rock from the main storage shed to shore bins of 6,000-ton and 8,000-ton capacity. Each bin feeds a cantilever shiploading unit, each composed of two loading arms fitted with a retractable conveyor and capable of rotation. Both loading units are situated on the reef edge of the western edge of Nauru Island. Between the months of March and November, the prevailing winds are easterly and the sea is generally smooth, but during the remaining months westerly winds occur causing heavy seas which necessitate intermittent suspension of shiploading operations. These delays are usually of 1 to 3 days duration, but can extend to from 10 to 20 days. The shiploading system can accommodate ships up to 630 feet long, 90 feet wide, and with 35,000 tons displacement.

The main features of Nauru phosphate rock are its high phosphate analysis, low iron and aluminum content, and high chemical reactivity.

A typical analysis of Nauru phosphate rock is listed in table 5. In the production of phosphoric acid from Nauru rock, good overall P_2O_5 recovery is normally achieved and a dark brown acid, low in iron and aluminum, is produced. Consumption of sulfuric acid is relatively low, and crystal formation and filtration rate are both comparatively good. In hemidihydrate plants, hydration time is short and the byproduct gypsum is suitable for the production of wallboard.[8]

There was a reduction in 1972 of imports of phosphate rock by Australia and New Zealand. Since these two countries are the major markets for phosphate rock from Nauru and Ocean Island, there was a 26% drop in 1972 phosphate rock shipments from Nauru and Ocean Island compared with 1971 shipments.

[8] Webb, B. J. Mining and Handling of Nauru Phosphate Rock. Australasian Inst. Min. and Met. Annual Conf. Paper No. 1, 1971, 27 pp.
Phosphorus and Potassium (London). The Nauru Phosphate Industry. November-December 1972, No. 62, pp. 27–29.

Table 5.—Typical chemical analysis of Nauru phosphate rock [1]

Chemical composition or chemical equivalent	Percent, by weight (Dry basis)
P_2O_5	38.4
CaO	52.7
CO_2	2.51
$Al_2O_3 + Fe_2O_3$	.41
F	2.70
SiO_2	.07
MgO	.35
Na_2O	.25
K_2O	.02
Cl	.012
Organic matter and combined water	balance

[1] Phosphorus and Potassium, No. 62, November–December 1972, p. 29.

Table 6.—Nauru and Ocean Island: Production of marketable phosphate rock [1]

(Thousand metric tons)

Year	Nauru	Ocean Island	Total
1968	2,251	532	2,783
1969	2,198	564	2,762
1970	2,114	506	2,634
1971	1,867	620	2,487
1972	1,340	512	1,852

[1] Based on exports.

Source: The British Phosphate Commission. The British Sulphur Corp. Ltd.

NEW CALEDONIA [9]

The French overseas territory of New Caledonia retained its ranking as the second largest nickel producer in the non-Communist countries in 1972, despite the fact that nickel ore production in New Caledonia was 28% below that produced in 1971. Decreased ore production occurred when a large segment of independent miners shutdown as a result of a disagreement over prices with Japanese consumers. Nevertheless, ore mined by that segment of the industry producing for domestic consumption increased. The nickel content of ore produced decreased by 2% when compared with that of 1971, however, ferronickel and matte production increased by 31% and 25%, respectively. Exports of nickel ore to Japan decreased by 42% when compared with that exported in 1971. Plans to develop New Caledonian nickel laterite deposits, which had subsided in 1971, were either delayed or revised in 1972. International Nickel Co. of Canada, Ltd. (INCO), the principal firm in Compagnie Française Industrielle et Minière du Pacifique (COFIMPAC), still had not signed an agreement with the French Government at yearend. A nickel stockpile of 38 million pounds was established by a group of French consumers under French Government guidance in 1972.

PRODUCTION

Nickel ore production decreased in 1972 to 5,450,000 tons compared with 7,570,000 tons in 1971. The decline marked the first time since 1965 that ore production had decreased. Société Le Nickel, S. A. remained the island's principal nickel producer. Its refinery at Donianbo produced 59,315 tons of nickel in 1972 (20,199 tons in matte and 39,116 tons in ferronickel), compared with 46,019 tons of nickel in 1971 (16,138 tons in matte and 29,881 in ferronickel).

A small quantity of jade (1,400 kilograms) was produced during the year.

TRADE

Mineral exports, composed principally of nickel ore, ferronickel, and nickel-cobalt matte, were valued at about $127.4 million in 1972, compared with $195.8 million in 1971. Exports of nickel ore, mainly to Japan, decreased from 3.8 million tons in 1971 to 2.2 million tons in 1972. Shipments of New Caledonian nickel ore were suspended in September 1972 when a dispute between New Caledonian shippers and Japanese importers arose over a price increase. The dispute was settled in December when agreement was reached between the Japanese Nickel Smelter Association and the New Caledonian shippers on the price of nickel ore being shipped to Japan. The agreed upon price for exported ore was 95.01 cents per kilogram of contained nickel-cobalt, retroactive to September 5, 1972. This price was to remain in force until February 1, 1973, when it was to be increased to 97.5 cents, with an additional increase to 99.40 cents scheduled for April 1, 1973. The French Government fixed export quotas at 4.6 million tons for the fiscal year beginning April 1972. Exports of

[9] Prepared by John D. Corrick, physical scientist, Division of Ferrous Metals—Mineral Supply.

ferronickel and matte during 1972 totaled 60,002 tons, 39,358 tons of ferronickel and 20,645 tons of matte. Most of the ferronickel (68%) and matte (64%) exported went to France, but 22% of the exported ferronickel was sent to the United States.

Table 7.—New Caledonia: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1970	1971	1972
Nickel ore—thousand tons	4,127	3,832	2,224
Smelter products, nickel-cobalt content:			
Ferronickel:			
Electric grade (FN4 grade, 25.1% nickel-cobalt)	11,126	11,042	14,714
Sulfur extracted grade (FN3 grade, 24.5% nickel-cobalt)	7,325	9,006	14,219
Refined grade (FN2 grade, 26.3% nickel-cobalt)	1,130	557	598
Overrefined grade (FN1 grade, 27.5% nickel-cobalt)	8,405	8,446	9,826
Nickel matte (79% nickel-cobalt)	15,627	15,796	20,645

Source: Mines Service of New Caledonia.

Table 8.—New Caledonia: Imports of selected mineral commodities

Commodity	1970	1971
Cement, hydraulic	105,949	124,606
Coal and coke	258,403	210,914
Petroleum refinery products	459,539	518,978

COMMODITY REVIEW

Metal.—*Nickel.*—Société Le Nickel S.A. produced 59,315 tons of ferronickel plus matte in 1972 compared with 46,019 tons in 1971. A second furnace was commissioned at Donianbo in 1972, raising current capacity to 65,000 tons per year. Le Nickel expected to commission a third Demag reduction furnace at its Donianbo refinery in October 1973. The three furnaces, each rated at 15,000-tons-per-year capacity of nickel matte, will increase total capacity of the refinery to 80,000 tons per year. Six Elkem furnaces will account for 35,000 tons of the 80,000 tons annual total capacity. Equipment for the expansion program was shipped directly from West Germany. The Sidney, Australia, office of Demag Industrial Equipment, Pty., Ltd. assisted in transferring the equipment to New Caledonia.

Le Nickel in 1972 introduced a new grade of ferronickel identified as FN-C and will market it in 18-kilogram ingots. The new material contained 22% to 28% nickel, 0.65% cobalt, 1.5% to 1.8% carbon, 1.5% to 2.5% silicon, 1.4% to 1.8% chromium, 0.07% sulfur, and less than 0.03% phosphorus. FN-C was expected to strengthen Le Nickel's position with respect to the steel industry, permitting the company production flexibility that would enable it to concentrate output on any one grade according to demand.

The agreement between Le Nickel and Patino Mining Corp. to build a powerplant, erect a town, develop a harbor and port, and build a smelter at Poum on the northern tip of the island was allowed to lapse. However, Patino agreed to continue the project with Péchiney-Ugine-Kuhlmann (PUK) of France and the Gränges Co. of Sweden. The three firms formed a new company, Société Métallurgique de Nickel Patino Péchiney Gränges (SOMMONI), to manage the work. The Patino subsidiary, Compagnie Française d'Entreprises Minières Métallurgiques et d'Investissements (COFRENNI) was to own 42% of SOMMONI, PUK 38%, and Gränges 20%. The new $314 million venture was to produce nearly 80 million pounds per year of nickel contained in ferronickel. The project was to be operational within 4 years to 5 years. PUK was expected to consume most of its share of the production internally in its steelmaking operations. Ore for the project was to be mined from the Tiebaghi and Poum deposits. The Tiebaghi area reserves were estimated at 15 million tons of ore grading over 3% nickel. The Poum reserves were estimated at 33 million tons averaging 2.3% nickel. Reportedly, ore from the Tiebaghi deposit was shipped to France for metallurgical testing during 1972. Late in 1972 officials of Patino announced the decision to proceed with the second phase of the project's development. This phase was planning, financing, and preliminary work on plant and port facilities.

The French Government negotiated with three concerns in 1972 for the mining

rights to lateritic nickel ores of New Caledonia. At yearend INCO still had not reached an agreement with the French Government on organizing a project for the production of 45 million pounds of nickel and 3 million pounds of cobalt annually from New Caledonian ores. The French Government had urged INCO and a group consisting of Société Nationale des Petroles d'Aquitaine (SNPA) and Freeport Minerals to jointly undertake development of the lateritic nickel deposits at Goro. A separate venture proposed to the Government by Freeport (49%) and SNPA (51%) called for the investment of $200 million in a project to produce nearly 50 million pounds per year of nickel. The project was to employ Freeport's laterite process. American Metal Climax, Inc. (AMAX) and Société Minière et Métallurgique de Peñarroya S.A. formed a new company, Penamax, to exploit New Caledonian lateritic ores. Penamax continued operation of a pilot plant testing lateritic nickel ore during 1972. The plant was designed to help ascertain the best flow sheet for Penamax's proposed refinery. Penamax planned on investing $250 million for mining and refining operations. Reportedly, AMAX could use the New Caledonian ore as feed for the company's renovated nickel refinery in Louisiana.

Jean Claude Berton, one of New Caledonia's small miners, closed his nickel mining and exploration activities as a result of his failure to obtain a nickel ore export license from the Government. Reportedly, he had a market for 200,000 tons of 2.2% nickel ore in Japan. With cutbacks in Japanese buying of New Caledonian ore, several other small miners reduced their mining activities. The Government was attempting to restrict exports of ore in order to encourage construction of new smelters on the island.

NEW HEBRIDES [10]

The Forari mine of Efate (Vate) Island remained the only reported mineral activity in the New Hebrides. The production of 42.72% manganese concentrate nearly doubled over that of 1971. Exports were even higher. Ten year production and export data are as follows in tons:

Year	Production	Exports
1963	25,416	23,319
1964	60,546	66,104
1965	67,710	81,650
1966	76,240	65,145
1967	71,400	72,146
1968	55,000	45,000
1969	--	--
1970	15,355	28,543
1971	15,002	14,910
1972	28,247	37,556

[10] Prepared by Robert A. Clifton, chemist, Division of Nonmetallic Minerals—Mineral Supply.

PAPUA NEW GUINEA [11]

In April 1972, the first commercial copper concentrate was produced in Papua New Guinea by Bougainville Copper Pty. Ltd. (BCP). This marked the culmination of 8 years of exploration and construction of the company's $400 million [12] project on Bougainville Island in the Australian administered territories of Papua New Guinea. This project was the chief factor in increasing Papua New Guinea's mineral value from $869,900 in 1971 to approximately $124 million in 1972. Even before production started, the Bougainville operation added substantially to the Papua New Guinea economy. The importance of the operation to the economy was evident in that items such as a new deepwater port and power station at Anewa Bay, new towns at Panguna and Arawa, and all weather roads did not exist before. The start of production, also means the start of revenue to the Papua New Guinea Government which estimated it will receive some $350 million in the first 10 years of operation. As in previous years, mineral production on the small offshore islands of New Britain, New Ireland, Manus, Misima, and many smaller islands remained insignificant.

After several years of surface exploration, diamond drilling and aditing, Kennecott Copper Corp. has proven enough

[11] Prepared by Charlie Wyche, physical scientist, Division of Nonferrous Metals—Mineral Supply.

[12] Unless otherwise indicated, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$1=US$1.27.

copper mineralization at Ok Tedi to make a production feasibility study. The study will include mine development plans, road construction, town planning, transportation, power generation, and shipping port construction.

Production.—The mineral production for Papua New Guinea during the last 3 years is shown in table 1.

COMMODITY REVIEW

Metals.—*Chromite.* American Metal Climax Co. of the United States is exploring a chromite deposit near Hessen Bay, on the Morable District coast south of Lae. Little information on this deposit is available.

Copper.—Based on an ore body estimated at 900 million tons of 0.48% copper and 0.36 pennyweight (0.18 troy ounce) of gold per ton, BCP commenced operations on April 1, 1972. Plans call for the operation, located at Panguna, to have an annual output in its early years of 135,000 tons of copper and 500,000 troy ounces of gold-in-concentrate. The managing company, BCP, is owned 80% by Bougainville Mining Ltd., with 20% held in trust by the Administration of Papua New Guinea. Bougainville Mining, in turn, is owned (two-thirds) by Conzinc Riotinto of Australia Ltd. (CRA), and (one-third) by New Broken Hill Consolidated Ltd.

The Panguna copper deposit is a porphyry-copper type situated in the Kawerong Valley on the western fall of the Crown Prince Range in south central Bougainville. The ore body consists of both disseminated mineralization in specific rock types and mineralized fractures and quartz veins up to several inches in width cutting these rocks. Mineralization is associated with diorite and grandioritic rocks that have been intruded into a series of andesitic volcanic rocks.

There are two main zones of high-grade mineralization, Panguna Hill and Barapinang River. Mining is centered on Panguna Hill because of its higher grade (0.75%) copper. The other high-grade ore zone has a grade of plus 0.60% copper. Much of the disseminated mineralization around these higher grade zones averages 0.40%.

Chalcopyrite is the primary copper mineral but is accompanied in places by bornite and a little molybdenite and silver. Magnetite occurs as an alteration product because of the biotitization of the andesite, and as a primary mineral in quartz veins. Pyrite is widely distributed, but when intimately associated with the copper mineralization it appears to vary inversely with the copper content. Traces of sphalerite and galena have been noted. Gold content varies directly with the copper content.

The base of the oxidized zone rises under the ridges from the level of the main creeks to a depth below the ridge tops. The Kawerong Valley is surrounded by hills up to 5,000 feet, and elevations in the mine area vary between 2,000 feet and 3,000 feet above sea level. Within the Panguna deposit, the oxidized zone may range from zero to 260 feet thick, with an average of 100 feet. Secondary enrichment is generally confined to areas of high topography and relatively high-grade mineralization.

BCP reported a profit despite production problems, loss of Australian dollars through currency changes, and imposition of a 15% withholding tax by the Papua New Guinea Government. For 1972, output was approximately 124,000 tons of copper contained in concentrate and some 375,000 ounces of gold.

In the latter part of the first operating period, the mine started to overcome some of the problems faced in the development of a new mining operation. Some contamination of ore occurred through dilution from the secondary and oxide cap of the ore body which contained acid soluble copper not recovered in the flotation circuit. In the premining phase, most of this was removed by hydraulic sluicing and stripping. As this phase is passed through, recovery is expected to improve beyond the initial 82%.

The company now has contracts for delivery of 180,000 tons of copper in 1973. A contract was signed with a U.S. purchaser for the sale of 7,000 tons to 11,000 tons of contained copper in concentrate for each of 4 years starting January 1, 1973. A second contract was also signed for delivery of 17,550 tons of contained copper between January 1, 1973 and June 30, 1975. In 1971, BCP received vendor's options for sales of up to an additional 82,500 tons of contained copper from the sixth through tenth year of production. Sales arrangements were also made with Norddeutsche

Affinerie of West Germany for 400,000 wet tons of concentrate.

Kennecott Copper plans to hold negotiations with the Papua New Guinea Government before committing itself to spend an additional $5 million on the next phase of exploration at the Ok Tedi copper deposits. The company estimated development costs would be $300 million, and is seeking assurances from the Government on certain points before proceeding with development. Negotiations are expected to take about a year before agreement is reached, and it will be 5 years after that before copper from Ok Tedi is expected to come to the market.

An Australian consortium is prospecting a porphyry copper deposit on Manus Island. Six diamond drill holes were bored during the year and all intersected copper mineralization. Most of the cores assayed about 0.30% copper, but several higher grade sections from 100 to 120 feet in length assayed between 0.40% and 0.52% copper. In addition, Exoil N.L. and Transoil N.L. announced that an agreement was reached with Australian Anglo American Ventures Ltd., for the prospecting area on Manus Island, known as the Arie block. This area, which covers 29.5 square miles, contains porphyry-type copper mineralization.

Mount Isa Mines Ltd. (MIM) conducted intensive exploration work on a Frieda River copper deposit. This ore body is located in western Papua New Guinea. There are no immediate prospects for development. Placer Triako, an affiliate of the Canadian controlled Placer Development Ltd., is investigating a copper deposit in central New Britain.

Nickel.—Papuan Nickel Co. has spent $1.4 million exploring a laterite nickel deposit in the Popondetta area of Papua New Guinea. MIM exploring an ore body north of Kundiawa, but no details were expected to become available before early 1973.

Mineral Fuels.—*Petroleum.*—Most petroleum exploration, both on and offshore, has occurred in the Gulf of Papua vicinity. Australasian Petroleum Co. Pty. Ltd. (APC), a subsidiary of Oil Search Ltd., of Sydney, has done extensive oil and gas exploration in the area. Mobil Oil Co. is a part owner of APC. Two other American companies, Phillips Petroleum Co. and Texaco, Inc., have also been active in the gulf region. Elsewhere, permits have recently been granted for offshore petroleum exploration in the Bougainville and Milne Bay districts. In the East Sepik District at Bongos, General Crude Oil of the United States hopes to spud an onshore well around mid-1973. It is operating on a farmout from Continental Oil Co. of the United States.

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