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Minerals Yearbook
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Volume III

AREA REPORTS: INTERNATIONAL

Prepared by staff of the

BUREAU OF MINES

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

BUREAU OF MINES • Elburt F. Osborn, Director

Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

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Foreword

The 1970 edition of the Minerals Yearbook marks the 89th year in which an annual report on the minerals industry has been published by the Federal Government. This edition provides a statistical record on global mineral industry performance during the year of review, and contains sufficient background information to interpret the year's developments. Although the same format has been followed as in previous editions, we direct the reader's attention to the change in numbering of the individual volumes. The former Volume I–II, Metals, Minerals, and Fuels, has been renumbered Volume I; Volume III, Area Reports: Domestic, has been changed to Volume II; and Volume IV, Area Reports: International, has been renumbered Volume III. The general content of the individual volumes is as follows:

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

Volume II, Area Reports: Domestic, contains chapters covering 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 chapter, identical with that in Volume I, and a chapter on employment and injuries.

Volume III, Area Reports: International, presents the latest available mineral statistics for more than 130 foreign countries and discusses the importance of minerals to the economies of these nations. A separate chapter reviews minerals and their relationship to the world economy.

The continuous effort of the Bureau of Mines to enhance the value of the Yearbook for its readers can be aided by comments and suggestions. Toward that end, the constructive comments of readers will be welcomed.

ELBURT F. OSBORN, *Director*

Acknowledgments

In the preparation of 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. Data were 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 Volume III were the routine and special reports received from the mineral, petroleum, economic, and technical attachés and other members of the embassy and consular service of the Department of State, and their contributions are appreciated.

The individual country 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 summary chapter "Minerals in the World Economy" 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 was 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

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Minerals in the World Economy

By Charles L. Kimbell[1]

In 1970, the mineral industry, cornerstone of world industrial and economic activity, continued to register gains in production, trade, and consumption of most major commodities on a worldwide basis in its effort to satisfy ever-growing requirements of the earth's expanding population. Overall world total industrial output, as measured by the United Nations' index of world industrial production, advanced by 4.7 percent in 1970 over the 1969 level,[2] a growth rate that was measurably exceeded by the growth in output of a number of major mineral commodities. Most notably among major crude mineral products, crude oil, marketed natural gas, chromite, bauxite, potash, iron ore, manganese ore, mine copper, and mine lead registered production gains in excess of the indicated growth in world industrial output. Among major primary manufactures, aluminum and cement production significantly exceeded world industrial output in terms of the rate of growth. These commodities and a number of lesser mineral commodities registered gains exceeding the world industrial output growth rate, but there were several major commodities that failed to attain this growth rate. The most significant of these was crude steel output; other major commodities with slower growth rates were phosphate rock, elemental sulfur, and mine zinc (the latter actually registered a decline in production).

Although comprehensive data on world trade in major mineral commodities during 1970 was not available at this writing, available information assures that the levels of trade reached in 1969 were exceeded in 1970. Preliminary figures on trade in crude oil, the overwhelmingly dominant single commodity traded, indicate that shipments advanced by over 14 percent to about 1,033 million tons in 1970.[3] Trade in refined petroleum products increased by 5.4 percent between 1969 and 1970, reaching 230 million metric tons.

In keeping with the recorded and inferred growth in production and trade of mineral commodities, all available information points to significant increases in consumption of most mineral commodities in 1970. Although average annual prices at a number of major mineral commodities for 1970 were higher than the 1969 average annual level, there were major exceptions (most notably steel prices) and a review of monthly figures for several commodities showed a downturn during the latter part of the year.

The two major areas of international hostilities—Southeast Asia and the Near East—continued to influence mineral commodity supply patterns in 1970. In Southeast Asia, despite reductions in U.S. troop commitments, consumption of fuels for military operations continued at a relatively high level, one far in excess of the modest civilian requirements for that region. In the Near East, despite the absence of major military efforts, the continued closure of the Suez Canal as a route for mineral commodity (chiefly oil) shipments to Europe remained a factor in the European oil price, and further pipeline closures within the area also had a measurable impact on supply patterns.

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

[2] The United Nations' index of world industrial production for 1970, as reported in the United Nations Monthly Bulletin of Statistics for August 1971, stood at 157 (base 1963=100), 7 index points higher, or 4.7 percent above the 1969 level recorded in the same source.

[3] British Petroleum Co. Ltd. Statistical Review of the World Oil Industry 1970. London, 1971, 24 pp.

Space limitations preclude a detailed review of the world's 1970 mineral reserve supply situation on a commodity-by-commodity basis. In general terms, it should be noted that on a worldwide basis, no critical shortage in the reserve of any important mineral commodity is foreseen in the immediate future, but in the longer range view, to the end of the present century, for example, there are a number of commodities for which the adequacy of reserves is questionable in view of demand forecasts. The worldwide adequacy of reserves for the immediate future, of course, does not preclude shortages of some commodities, within some areas or even on a worldwide basis, resulting from temporary supply-demand imbalances.

PRODUCTION

The value of world crude mineral production in 1970 was estimated at roughly $97,600 million, an increase of about $5.5 million over the 1969 revised estimated level of $92,100 million.[4] As in the past, comprehensive, statistically consistent data on the value added by processing of these materials in mineral industry plants in the various nations are not available, but for 1970, an estimate of $220,000 million is regarded as conservative.

PRODUCTION INDEX PATTERNS

United Nations production indexes for various sectors of the world's mineral industry (excluding that of Communist Asia) and for major groups of countries are presented in table 1. This series, using 1963 performance as the base point, indicates that all phases of the mineral industry registered gains in 1970 compared with their 1969 performance, and that all crude extractive sectors except coal exceeded the growth rate for all industrial production. Among the mineral-processing sectors, base metal processing registered a smaller increase than did total industrial production, so that the level of the 1970 index for base metal processing remained below that for overall industrial production. The nonmetallic mineral processing sector index registered gains in excess of those recorded for overall industrial production; the coal, petroleum, and chemical industry production index, which increased markedly in 1969 and for that year stood considerably above the general industrial production index, again in 1970 registered a significant gain, placing this industry sector once again in the forefront of the various sectors of industry that comprise the world's total industrial operations.

Examining the extractive mineral industry by its major component sector—metal, coal, and petroleum (including natural gas)—the pattern of growth of each varied considerably, contributing to a general rise in the index for the overall extractive industry in the first half of 1970, a slight decline in the third quarter, and a significant rise to new highs in the fourth quarter. Metal mining began 1970 with an index 3 points below that of the total extractive industry and 1 point above that registered for the fourth quarter of 1969, advanced more sharply than the total extractive industry in the second quarter into the third quarter, and registered a decline in the fourth quarter. The index for coal mining in the first quarter stood on a par with the fourth quarter 1969 level, then declined through the second and third quarters and again increased in the fourth quarter, following the traditional pattern of poor results during the Northern Hemisphere summer months. Petroleum and natural gas extraction showed a gain over fourth-quarter 1969 results in the first quarter of 1970, maintained that level in the second and third quarters, and advanced sharply in the fourth quarter; the bulk of the overall increase was attributable on a regional basis to consistent increases in performance of the industry in Africa and the Near East. The nations of Communist Europe, after a very modest increase in crude mineral production between 1968 and 1969, recorded a substantial increase in the first quarter of 1970, a slight additional increase in the second quarter, a decline in the third quarter, and a recovery to the first quarter level in the fourth quarter, with the result that the annual average index was 9 points higher than that for 1969. In terms of the annual average index, the non-Communist

[4] For details on basis for estimation, see subsequent portion of this section titled Value of World Mineral Production.

world registered a 9-point gain in 1970 to a level of 140 percent of that of 1963; chiefly as a result of gains in the less developed countries of Latin America, Africa, and Asia and in Australia.

Considering the mineral processing industry sectors in terms of their performance during 1970, world base metals enterprises showed a modest growth comparing the first quarter of the year with the last quarter of 1969, edged upward slightly in the second quarter, declined in the third quarter to a level below that of any quarter since the second quarter of 1969, and edged only slightly upward again in the fourth quarter; thus the overall gain of 4 points in the annual average index number for 1970 compared with that of 1969 was wholly due to the increases of the first half of the year, which were more than enough to compensate for the poor returns in the second half. Nonmetallic mineral processing operations had a relatively poor first quarter, falling 5 points below their fourth-quarter 1969 level of 154 percent of 1963 activity, but recovered sharply (14 points) in the second quarter, registered a 1-point decline in the third quarter, and maintained that level in the fourth quarter. In the case of the petroleum and coal processing and chemical industry, growth was fairly steady through the year, except for a slight decline in the third quarter.

On a regional basis, the Communist countries of Europe showed greater growth in processing industry operations than they did in the extractive industries, and for another year showed greater gains relative to their 1963 performance than did the world's non-Communist countries. However, it should be stressed that these gains are solely relative to performance of the industries of these two areas in 1963, and the reader should consider the relative performance of these two areas in terms of quantitative output, for the gains of the Communist nations are from a lower base level in terms of quantitative output of most commodities.

QUANTITATIVE COMMODITY OUTPUT

Table 2 summarizes total world output of a number of mineral commodities for 1968–70; table 3 gives the regional distribution of 1970 output of these commodities in terms of percent of world total. Tables within the statistical summary section of this chapter provide details on distribution of output of selected major commodities by major producers for 1968–70.

Nonfuel Mineral Commodities.—Of the 39 metallic mineral commodities listed in table 2, 31 registered increases in production in 1970 compared with 1969 results, one was essentially unchanged, and declines were recorded for the remaining seven. Although the 1970 data are in general preliminary and subject to revision, examination of detailed data for the producing countries indicates that in all likelihood, these declines are actual and will not be eradicated by inclusion of additional, as yet unreported, tonnages. In terms of percentage change, the leading metal commodities among those registering gains were nickle (up 28.8 percent), columbium-tantalum concentrates (up 27 percent), refined cobalt (up 23.5 percent), platinum-group metals (up 22.9 percent), and mine cobalt (up 20.3 percent). The most significant declines among metals were those registered for selenium (14.2 percent), tellerium (9.5 percent), and cadmium (8.8 percent). From the viewpoint of actual tonnage increase, the gains by iron ore, pig iron, and crude steel were overwhelmingly dominant, followed by those registered for bauxite, alumina, manganese ore, aluminum ingot, chromite, and copper (both mine and smelter); none of the commodities registering declines showed a substantial decline in terms of tonnage, considering total metal output tonnage.

Among the 23 industrial nonmetallic mineral commodities for which world output data are listed in table 2, 15 showed higher production levels in 1970 than in 1969, and eight registered declines. The most significant increases in terms of percent growth were in the cases of strontium minerals (28.3 percent), gem diamond (16.5 percent), magnesite (9.2 percent), potash (8.9 percent), and fluorspar (7.8 percent); the only sizable percentage decline was that registered by vermiculite (7.3 percent). On a tonnage basis, the 29-million-ton increase in cement output, the 6.8-million-ton increase in salt output, and the 3.5-million-ton increase in phosphate rock production were the most prominent gains and the 816,000 decline in gypsum was the most substantial shortfall.

Tables 30 to 45 in the statistical summary of this chapter give details of output of selected major nonfuel mineral commodities (both metals and nonmetals) by major producers for 1968–70.

Mineral Fuel Commodities.—Preliminary data indicate that world production of energy commodities in 1970 reached a new high in terms of standard coal equivalent (SCE), as output of all major crude mineral fuels reached new production highs. World output of commercial energy commodities[5] totaled almost 7,022 million metric tons SCE, compared with nearly 6,526 million tons in 1969 and 6,144 million tons in 1968. Each of the commercial energy sources listed in table 2 registered new record highs in 1970; previous record highs for all had been the 1969 levels. In 1970, for the fourth consecutive year, crude oil ranked as the leading source of energy on a percentage basis, and continued to increase its share of the total, as did natural gas; both gained at the expense of coal, and hydrogeothermal-nuclear power retained a consistent share of the total as shown in the following tabulation:

Energy source	Share of total energy production (percent)		
	1968 [1]	1969 [1]	1970 [2]
Coal (including lignite)	37.0	35.7	34.4
Petroleum	41.4	42.0	42.8
Natural gas	19.4	20.0	20.5
Hydro, geothermal, and nuclear electricity	2.2	2.3	2.3
Total	100.0	100.0	100.0

[1] Based on data in United Nations. World Energy Supplies 1966–69. Statistical Papers, Series J, No. 14, New York, 1971 p. 10.

[2] Estimate, based on extrapolation of United Nation's data for 1969 using world production data for listed commodities reported to and published by the U.S. Bureau of Mines.

Among the energy products listed in table 2, which include not only the primary energy sources but such processed items as coke and fuel briquets (mainly from coal), available 1970 output data show gains for all commodities except fuel briquets.

Tables 46, 47, and 48, respectively, give output of coal, natural gas, and crude oil, for 1968–70 by major producing countries.

VALUE OF WORLD MINERAL PRODUCTION

The total value of world crude mineral production cannot be derived simply by totaling figures reported by the various countries, chiefly because: (1) some nations fail to report production values for production of some or all of their output at the crude mineral stage and (2) reporting of production of some commodities (notably clays, sand and gravel, stone, and other crude nonmetallics) is incomplete or wholly nonexistent in many nations. It should also be noted that the definitions of "mineral industry" and "mineral commodities" differ rather widely around the world; crude construction materials at times are included under the construction industry, some commodities regarded in the United States as mineral commodities are included as chemical industry products elsewhere (such as bromine, iodine, and fertilizer materials), and some are even included with food products (as in the case of salt in some nations).

The most comprehensive study on value of world mineral output is the series of articles in the French monthly journal, Annales des Mines, which has been released at approximate 5 year intervals since shortly after World War II. Data in this chapter are based on the most recent of this series,[6] extrapolated to 1970 and expanded to include a more complete list of mineral commodities than that contained in the source publication.

The source article provides estimates of the total world production value for 53 major mineral commodities for the year 1968. Wherever possible, reliable reported national value figures have been used, but where reliable data are lacking, an average world price for the commodity in question has been applied to the reported (or estimated) production tonnage.

In this chapter, the world value reported in the source publication has been increased by a factor of 13 percent to compensate for commodities not covered in the source. This factor has been derived by comparing United States value figures for commodities not covered in the source with total recorded United States crude mineral production value. Although this factor may be of questionable value when applied to the less developed countries of Africa, Asia, and

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

[6] Callot, F. Production et de la Consommation Mondiale des Minerais en 1968. Annales des Mines, No. 1, January 1971.

Latin America, it is believed that it has reasonable validity for the major industrialized countries of the world. Using the estimated total 1968 world crude mineral output value derived as indicated in the previous paragraph, the 1968 figure has been extrapolated to 1970 utilizing United Nations indexes of crude mineral production. (See table 1 of this chapter for United Nations index numbers.)

Although it has proved possible to estimate the total world 1970 crude mineral production value in this manner, the country-by-country and commodity-by-commodity details of the Annales des Mines study cannot be so extrapolated with any reasonable degree of accuracy considering the time available for such a study. Therefore, utilizing only the data presented in the source publication, tables 4 and 5 have been prepared, detailing the distribution of world crude mineral production in 1950, 1963, and 1968 for 53 commodities on a country (table 4) and commodity (table 5) basis.

The geographic distribution of crude mineral production on a value basis may be considered from three viewpoints. First, examining simply the relative ranking of the various nations, the United States and the U.S.S.R. ranked first and second respectively, from 1950 through 1968 (and almost unquestionably through 1970). Of other individual countries listed in table 4, mainland China made the most impressive gain in ranking, rising from 17th in 1950 to fourth in 1963, a position which it retained in 1968 despite a decline in output value, just behind third ranked Canada. Libya, almost solely on the basis of crude oil production, rose from the status of insignificant output in 1950 to eighth rank by 1968, but the value of its 1968 output was only slightly better than one half that of mainland China. Other countries registering marked increases in rank between 1950 and 1968 were North Korea, Algeria, Brazil, and Iraq. The most prominent loss in rank was that of Belgium (from 12th in 1950 to 40th in 1968); other notable declines were registered by the Netherlands, Sweden, Spain, France, Malaysia, and India.

Second, considering the geographic distribution of crude mineral production value in terms of the actual dollar value, every one of the 40 countries listed individually in table 4 registered a gain between 1950 and 1968 except Belgium, in which case 1968 output value was less than one half of the 1950 level owing chiefly to reduced coal production. Between 1963 and 1968, however, 11 nations registered declines in actual cash value of production. The countries registering declines were industrialized nations of Europe with two exceptions—mainland China and Venezuela. Included were three countries in communist Europe (Czechoslovakia, East Germany, and Poland) and six in Western Europe (Belgium, France, West Germany, the Netherlands, Sweden, and the United Kingdom).

Third, examining the geographic distribution of value from the viewpoint of percent of total accounted for by each country, it is perhaps most significant to note that although the United States has retained first rank, its share of the total has been steadily eroded and that of the second-ranked U.S.S.R. has consistently increased. Of the 40 top-ranked countries (in 1968) listed individually in table 4, 19 may be classed as developed countries and 21 as developing nations. Of the developed countries, 11 (the United States, West Germany, the United Kingdom, Poland, France, Japan, Czechoslovakia, Spain, Sweden, the Netherlands, and Belgium) showed declines in their percentage share of total world value of output between 1950 and 1968, and eight (the U.S.S.R., Canada, Republic of South Africa, Australia, East Germany, Romania, Italy, and Yugoslavia) showed gains in share. In contrast, 16 of the developing nations gained in relative share of the total and only five declines. It also should be noted that of the eight developed nations listed above as registering gains between 1950 and 1968, the first four all had sizable areas of relatively untouched land from the viewpoint of mineral extraction in 1950.

Another aspect of the percentage distribution of total output value that is worthy of note is the fact that aside from the United States and the U.S.S.R., no other single nation has accounted for 6 percent or more of the total in any of the 3 years listed, and only 19 individually accounted for between 1 and 6 percent each of the total in 1968 (there were 14 such countries in 1963 and 16 in 1950).

Reviewing the commodity distribution of world crude mineral production value (table 5) from the viewpoint of numerical ranking of commodities, probably the most important single change between 1950 and 1968 was the displacement of coal by crude oil as the first-ranked commodity, a situation which would remain true even if lignite (reported separately in the table) were added to anthracite and bituminous coal. Also of significance is the advance of natural gas from sixth rank to third, particularly when it is noted that the data presented is only a measure of marketed production, excluding the large quantities presently produced along with crude oil in a number of countries and reinjected to reservoirs or simply flared without being used, owing to lack of access to markets.

Considering the commodity distribution of world crude mineral output value on the dollar basis, it is significant to note and comment briefly on the few declines registered between 1950 and 1963 and between 1963 and 1968, rather than to emphasize the pattern of increase that has prevailed for most of the 26 listed commodities. Comparing 1963 levels with those of 1950, only lead and zinc registered declines, and these were wholly due to price falls rather than to declines in output. Comparing 1968 levels with those of 1963, and considering the 26 commodities listed individually in the table, five showed a lower value in 1968 than in 1963 (anthracite and bituminous coal, lignite, gold, uranium, and manganese) and of these, only uranium was produced in a smaller quantity in 1968 than in 1963, with the declines for all except uranium then being a result of lower unit prices.

From the viewpoint of the percentage share of total crude mineral production value accounted for by each of the 26 commodities listed individually, probably the most striking feature is the overwhelming perponderance of the total accounted for by fuel commodities. In 1968, fuels including uranium accounted for 72.72 percent of the total. It should be noted, however, that this fuels total has declined from the 76.62 percent recorded for 1963 and the 77.74 percent recorded for 1950 (with uranium excluded), and that although the fuels total has fallen off, this is almost wholly the result of declines registered by coal and lignite. Crude oil and natural gas have regularly shown increases.

TRADE

GENERAL TRENDS

In 1970, the aggregate value of world mineral commodity trade undoubtedly exceeded the estimated $71,390 million level attained in 1969, but data available at this writing was not sufficiently complete to provide a basis for estimation of the 1970 level with any certainty. Despite the absence of complete 1970 trade data, it was apparent that during this year, as in 1969, the less industrialized countries continued to expand their output of mineral commodities for processing in the developed countries at a greater rate than the developed countries increased internal production of these materials. The 1970 aggregate value of mineral commodities traded was increased over that of 1969 both by increased shipments of crude and partly processed mineral commodities from the less developed countries to developed countries, and by a greater flow of mineral semimanufactures from developed countries to the less industralized nations, as the latter's requirements for such materials continued to increase. As in recent years, another contributing factor to the higher value of mineral commodity trade was the continued climb of prices paid for many minerals.

In 1969, the latest year for which largely complete trade returns are available on a worldwide basis, mineral commodities in aggregate were estimated to have accounted for 26.2 percent of total commodity trade, a lower share of the total than in any year 1965–69 except for 1966, as shown 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)
1965	r 49,880	9.3	26.8
1966	r 53,070	6.4	26.1
1967	56,540	r 6.5	26.4
1968	r 63,550	r 12.4	r 26.6
1969	71,390	12.3	26.2

r Revised.
[1] Value estimated from data on major mineral commodities appearing in table 6, to which have been added a factor for 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 6, 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 6 represent about 81.5 percent of total mineral commodity trade.

Although the share of total commodity trade value accounted for by mineral commodities was at a low point for recent years, it should be stressed that this did not result from any lessening in the growth rate for mineral commodity trade value. To the contrary, the 12.3-percent increase in value of mineral commodity trade between 1968 and 1969 was only marginally less on a percentage basis than that between 1967 and 1968, and in terms of dollars, was actually greater.

COMMODITY GROUP TRADE PATTERNS

Table 6 gives the value of world export trade in major mineral commodity groups for 1965–69 and provides for comparative purposes the value of total world commodity exports. Although each major group of mineral commodities has shown an unbroken growth trend during 1965–69 (except for iron and steel, which declined fractionally between 1965 and 1966), there have been significant variations in the proportion of total major mineral commodity trade accounted for by each of the principal groups of these commodities, as shown in table 7. These variations are the result of different growth rates registered by the several commodity groups listed. These growth rates are given in table 8. The patterns of generally declining proportion of total major mineral commodity trade accounted for by ores, concentrates and scrap, a pattern extending from 1964 (or before) through 1968, was reversed in 1969, with these commodities accounting for slightly more of the total than in 1968. Iron and steel and nonferrous metals also showed gains in share of total over those of 1968; the former exceeding the share that it held in any year since 1964 except 1965, the latter reaching a higher level than any since 1964. Crude nonmetals registered a small decline in share of total; the only significant downturn in share of total was that of mineral fuels, which fell to a lower level than any recorded during 1964–68.

Table 8 emphasizes the general upturn in the value of export trade in each of the major mineral commodity groups. Within the 5-year span covered by the table, only in the case of iron and steel was there a decline registered relative to the previous year's level, and this decline was only a fraction of 1 percent. Comparing the growth rates recorded for the aggregate of the five individual commodity groups listed with that of overall commodity export trade, the major mineral commodities in 1970 did not register as large an increase as did total commodity trade. This reversed the pattern established for the preceding 5 years, during which growth in total commodity trade value was greater than in major mineral commodity trade value only in 1 year (1966).

REGIONAL TRADE PATTERNS

Data on the geographic distribution of world trade in major mineral commodities (metal ores, concentrates and scrap, ingots and semimanufactures of iron and steel and of nonferrous metals, crude nonmetals, and all mineral fuels) are presented in terms of dollar value in tables 9, 10, and 11 for 1969, the latest year for which reasonably comprehensive data are available. Table 9 is designed to show the importance of total major mineral commodity export trade relative to total commodity export trade for the world as a whole and for selected individual countries and country groups. Table 10 gives the breakdown by commodity groups of total major mineral commodity trade, in terms both of exports from and exports to each of these selected countries and country groups, reflecting to some extent regional self-sufficiency or lack thereof for each commodity group. Table 11 shows the direction of flow of total value of major mineral commodity trade by selected countries and areas in matrix form.

The following tabulation gives the distribution of world trade in major mineral commodities between industrialized nations and less developed countries for 1969:

Destinations [1]	Sources of exports [1]			
	Market economy countries		Centrally-planned economy countries	Total
	Industrialized	Less developed		
Value in million dollars:				
To market economy countries:				
Developed	23,620	18,175	1,975	43,770
Less developed	3,592	4,112	446	8,150
To centrally-planned economy countries	1,648	443	4,169	6,260
Total	28,860	22,730	6,590	58,180
Share of world total in percent:				
To market economy countries:				
Developed	40.6	31.2	3.4	75.2
Less developed	6.2	7.1	.7	14.0
To centrally-planned economy countries	2.8	.8	7.2	10.8
Total	49.6	39.1	11.3	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, Netherlands, New Zealand, Norway, Portugal, Republic of South Africa, Spain, Sweden, Switzerland, Turkey, U.S.S.R., United Kingdom, 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, U.S.S.R., and North Vietnam; less-developed market economy countries includes all countries not specifically listed previously in this footnote.

The data presented in the foregoing tabulation are comparable with that provided in the 1969 edition of the Minerals Yearbook insofar as the range of mineral commodities included, but differ in the geographic breakdown, in that the communist nations have been reported separately. Thus, complete comparison with the results published previously is not possible. Comparing the foregoing data with similarly arrayed data for 1968, all entries in the tabulation increased in actual value. From the viewpoint of relative shares of the total, however, the developed market economy countries increased their share of total major mineral commodity export shipments from 48.9 percent in 1968 to 49.6 percent in 1969, at the same time maintaining their share of export receipts at the 75.2 percent level. Both the less developed market economy nations and the centrally planned economy nations recorded declines in their shares of export shipments, the former from 39.7 percent in 1968 to 39.1 percent in 1968 and the later from 11.4 percent. In terms of export receipts, the less developed market economy nations received only 14 percent of the 1969 total compared with 14.2 percent of the 1968 total, while the centrally planned economy nations registered an increase from 10.6 percent to 10.8 percent.

As in past years, table 9 illustrates the marked disparity between regions in the share of total regional commodity exports accounted for by the major mineral commodities. For example, in the Near East, largely as a result of its oil exports, the major mineral commodities accounted for 81.7 percent of total commodity exports. Other areas registering very high shares of total commodity trade accounted for by minerals include those nations classified as "rest of world" with 53 percent; nonindustrialized Africa (Africa excluding the Republic of South Africa) with 51.4 percent; and Latin America with 39.1 percent. It may be significant to note, however, that of these three areas, only nonindustrialized Africa registered a higher percentage in 1969 than in 1968. At the other end of the spectrum are the United States, where major mineral commodities accounted for only 10.6 percent of total commodity trade, and Communist Asia, which registered only 5.6 percent. It should be noted that the figures presented in the table for the Republic of South Africa represent only the value of fuels exports; thus the 4.6-percent share of total commodity trade reported in the table is not indicative of this nation's true position. Addition of value data for gold (not included in any figures for commodity trade) and of unreported data for the nation's substantial exports of diamond and a variety of metals would raise the percentage appreciably.

Considering the exports recorded in table 9 from the viewpoint of indicated recipients, the variation in terms of percent of total commodity trade accounted for by major mineral commodities is not nearly as wide as the variation from the viewpoint of origin. Japan, for which major mineral commodities account for 41.4 percent of total commodity trade, ranks far ahead of the other countries and/or areas listed. As in past years, most of the industrialized nations other than Japan registered 18 to 25 percent of their total receipts as major mineral commodities. The notable exceptions to this continue to be Canada, the Republic of South Africa and Australia-New Zealand; nations, which with low population densities and sizable undeveloped mineral resources, more closely follow the import pattern of the less developed areas, with major mineral commodities accounting for 12 to 15 percent of total commodity export receipts. Among the specifically identified less developed areas in table 9, only Communist Asia is reported to have received export shipments of major mineral commodities in quantities sufficient for the value to reach a level in excess of 20 percent of the total of commodity shipments to the area. Here, the condition results more from the low level of nonmineral commodity imports rather than from the receipt of substantial quantities of major mineral commodities.

Table 10 requires little in the way of explanation, but the reader should note the principal exclusions of information—no figures appear for metals for the Republic of South Africa, and no data are included for crude nonmetals for Latin America, the Republic of South Africa, the Near East, South Asia-Far East, and Australia-New Zealand. Because a portion of these figures are apparently included under "not reported" and thus apparently do swell the world total to an appropriate level, the importance of these commodities to the specific countries or areas is not shown. Moreover, owing to the scheme of reporting used, Standard International Trade Classification, Revised (SITC), gold is excluded from all the totals.

Table 11, generally speaking, requires no detailed explanation or discussion, but it should be noted that the data contained therein are not exactly comparable to those in outwardly similar tables appearing in any previous editions of this chapter except the 1969 edition (data for 1968). This is because the category of crude nonmetals was included only beginning in the 1969 edition. For general purposes, the reader may compare the 1969 data in table 11 in this chapter with 1968 data appearing in the equivalent table in the 1969 edition, it should be noted that the data appearing in the previous edition is subject to some minor revisions owing to receipt of additional data.

Table 11 is designed to illustrate the relative importance of major geographic and economic regions of the world in terms of their exports and imports of major mineral commodities. As in the case of the preceding five tables (tables 6 to 10), the values entered in this table are all based on the valuation of the materials as exported (excluding shipping costs). Comparison of the total export shipment credited to each country or region (vertical grand total column on last page of table) with total export receipts (horizontal grand total line at the bottom of each page of the table) will indicate the relative position of each area as a net importer or net exporter of major mineral commodities.

CONSUMPTION

NONFUEL MINERAL COMMODITIES

World consumption of most nonfuel mineral commodities, metals and nonmetals, again advanced in 1970 both in terms of gross tonnage and on a per capita basis, but the latter gains were more modest and less universally consistent as world population continued to increase. Considering individual major commodities, world consumption of iron ore apparently reached a record high. Complete data on iron ore consumption for 1970 were not available at this writing; however, for a selected group of 21 nations, including all major world producers of pig iron except mainland China, iron ore consumption in agglomerating plants, blast furnaces, and steelmaking totaled over 602 million tons (total includes some estimates), a figure nearly 4 percent greater than the level recorded for the same nations in 1969, as indicated in table 12. Of total iron ore consumption, over one half is treated in agglomerating plants prior to being fed to the blast furnace; a relatively small part of the total, about 8 million to 9 million tons annually, is consumed directly in steelmaking and the balance, with or without agglomeration, is fed to blast furnaces and other facilities for the production of pig iron and similar products.

As in the case of iron ore, complete world data for consumption of iron and steel scrap are not available, but for 23 countries listed in table 13, 1970 scrap consumption totaled over 264 million tons, compared with 262 million tons in 1969 and 242 million tons in 1968. It should be noted that the data in table 13 are incomplete even for the countries listed as indicated by the exclusion footnotes in the table.

World consumption of iron and steel, although not recorded, undoubtedly reached a new record, in keeping with the production growth.

In the case of major nonferrous metals, for which estimated world consumption data appear in table 14, world use of aluminum, copper, and lead again recorded increases in 1970 as they had in 1969; zinc and tin consumption were lower in 1970 than in 1969. As in 1969 aluminum showed the greatest increase among major nonferrous metals, 5.4 percent over the 1969 level, but this growth on a tonnage basis was only about 72 percent of that registered in 1969. Growth in copper consumption, totaling only 58,000 tons, constituted an increase of slightly less than 1 percent, considerably below the level attained within each of the past 5 years. As in the case of aluminum and copper, lead consumption advanced more modestly in 1970 than in 1969, only 2.3 percent (78,000 tons), or less than one-third as much as the growth logged between 1968 and 1969. Zinc consumption declined by 3.9 percent in 1970, in contrast to an 8.7-percent increase registered for 1969, and tin recorded a 3.3-percent decline in use in 1970, compared with a 4.6-percent increase in 1969.

Although complete data on worldwide consumption of most nonmetallic mineral commodities are not available, it is certain that use of most major commodities in this group, limestone, cement, sulfur, and fertilizer materials, again advanced in 1970. World consumption of nitrogen fertilizers for the fertilizer year 1969–70 (year ending June 30, 1970) was reported[7] to have reached 31.4 million tons, almost 7.3 percent greater than the total for the preceding fertilizer year. Similarly, consumption of phosphate and potassic fertilizers also were reported to be on the increase, the former by 4.1 percent to about 20.1 million tons of contained P_2O_5 and the latter by 7.5 percent to about 15.8 million tons in terms of K_2O equivalent.[8]

MINERAL FUEL COMMODITIES

Total world consumption of traditional commercial mineral fuels (coal, oil, and natural gas) and of primary electric power (that power produced by means other than the burning of the aforementioned fuels) was estimated to have reached 6,900 million metric tons in terms of standard coal equivalent (SCE) in 1970, but final returns may alter this estimate appreciably. In 1969, the latest year for which reasonably complete returns are available, total consumption of energy as defined previously, including primary electric power, reached 6,416 million metric tons SCE, 6.5 percent above the 1968 level. Table 15 details energy consumption of major source (solid fuels, liquid fuels, natural gas, and primary electric power) and by continental areas for 1965–69 as reported by the Statistical Office of the United Nations. On the basis of data in this table, liquid fuels remained the leading energy source for the third consecutive year, accounting for nearly 40.7 percent of total consumption (40.1 percent in 1968), followed by solid fuels with 36.7 percent of the 1969 total (37.9 percent in 1968). Gaseous hydrocarbons accounted for 20.3 percent of the 1969 total (19.7 percent in 1968), and primary electricity accounted for the remaining 2.3 percent. Liquid and gaseous fuels again registered substantial gains on a quantitative basis and in doing so registered growth rates in excess of that recorded for solid fuels; this further eroded the position of solid fuels in terms of share of total energy consumption. Growth rates for each of the categories on a percentage basis were as follows: Solid fuels, 3.3; liquid fuels, 8.0; gaseous fuels, 9.6; and primary electric power, 7.2.

Even though data for 1970 are not sufficiently complete to determine growth rates

[7] Statistical Office of the United Nations, Statistical Yearbook, 1970. New York, 1971, pp. 538–539.

[8] The British Sulfur Corp. Ltd. Statistical Supplement No. 4, November-December 1971. London, England 1972.

for each class of fuel or the share of each in total consumption, it is certain that the solid fuel consumption growth rate did not equal that of overall energy consumption and that the solid fuel share was thus further eroded in 1970, with liquids and gases increasing their respective shares.

Examining the data in table 15 from a regional viewpoint, the distribution of total 1969 energy consumption varied only slightly from that of 1968, despite some rather significant differences in regional growth rates, owing to the overwhelming dominance of three main areas—North America, Western Europe, and Communist Europe—Asia (the latter being the dominant element in the group of unspecified countries). In terms of regional share of the total, North America remained the overwhelmingly dominant single region, accounting for about 37.0 percent of the total, compared with 28.6 percent for the Communist nations (together with a few minor non-Communist consumers) and to 19.4 percent for Western Europe. North America's share of the total, however, was lower than in 1968 (when it was 37.5 percent), the Communist nations and Western Europe recorded modest gains in share of total, and the Far East (chiefly as a result of Japan's growing industrial activity) registered the most substantial gain (from 7.2 percent of total world energy consumption in 1968 to 7.6 percent in 1969).

From the viewpoint of per capita consumption, each of the world areas listed recorded gains except Caribbean America (down marginally) and Africa (no change between 1968 and 1969).

INVESTMENT

In the absence of comprehensive data on world investment in mineral industry operations, partial data on investment in selected geographic areas and in a few major commodity sectors of the total industry are summarized within this section. Although the data are hardly adequate as a base for extrapolation to estimate worldwide investment, they at least are illustrative of the continued expansion of the industry.

Table 16 summarizes steel industry investment expenditures for countries and country groups within the Organization for Economic Cooperation and Development (OECD). The reported data show that 1970 investment, at $6,549 million was $1,306 million greater than the annual investment in 1969, an increase of over 24.9 percent. This increase was unparalleled in recent years, far exceeding the $469 million, 9.8 percent increase registered between 1968 and 1969. The upsurge in investment was related to three major factors: (1) the increase demand for steel in late 1968 and during 1969; (2) the necessity of increasing productivity and product quality relative to other producers; and (3) the sharply rising costs for the construction and installation of virtually any type of iron or steelmaking facility. Even though the world steel industry continued to register gains in productive capacity, the gains were far less than proportional to the investment recorded.

On a country basis, the distribution of investment growth varied considerably in 1970; Japan led the way, with investment there totaling $395 million more than in 1969, followed by West Germany with 1970 investment $320 million greater than in 1969, and the United Kingdom with 1970 investment $167 million greater than in 1969. In sharp contrast to the increased levels registered in these countries, and smaller but nonetheless substantial increases in other nations, the United States in 1970 recorded a decline of $136 million compared with the 1969 level. Of other nations included, only the Netherlands (among European Economic Community nations) registered a 1970 steel industry investment level lower than that of 1969.

Table 17 summarizes non-Communist world petroleum industry capital expenditures and exploration expenses for 1968–70, distributing the totals on a geographic basis, and table 18 provides the distribution of the same totals on the basis of the various sectors of the industry. In 1970, overall capital expenditures and exploration expenses were 8.7 percent higher than those of 1969, a substantially greater increase than the 2.7 percent logged between 1968 and 1969 but appreciably less than the 14.7 percent growth registered between 1967 and 1968.

From the viewpoint of geographical distribution, the Far East, Western Europe, Western Hemisphere (excluding the United States) and the regionally undistributed investment in foreign flag tanker construction all registered higher levels of annual investment in 1970 than in 1969, and gains in these areas more than compensated for the lower levels registered for the Near East, Africa, and the United States.

Reviewing the various individual regions in order of their share of the 1970 total, the United States, with 41.4 percent of the total, registered a very small decline (0.1 percent with respect to 1969) but, owing to increased investment and expenditures elsewhere, fell short of the 45.1 percent of non-Communist world total that it accounted for in 1969 and appreciably below its 49.3 percent share of the total registered in both 1967 and 1966. In the United States investment for production facilities and chemical plants and exploration expenses fell below 1969 levels and gains in investment in pipelines, marine facilities, refineries, marketing, and other were insufficient to raise the 1970 total above the 1969 level. In Western Europe, which accounted for 15.7 percent of the 1970 non-Communist world total, the level of capital expenditures and exploration expenses exceeded that of 1969 by almost 29 percent, raising that nation's share of the total significantly from the 13.2 percent level of 1969. This upturn was chiefly the result of increased investment in refineries and chemical plants.

In "other western hemisphere" countries—Canada and all of Latin America—a 1.7 percent increase in investment level was recorded between 1969 and 1970, but the region's share of the non-Communist world total declined from 15.1 percent to 14.1 percent as other areas registered greater increases. Within the region increases in capital expenditures and exploration expenses increased for all categories except chemical plants, which showed a substantial decline.

Those capital expenditures not credited to any world area, comprising the expenditures for foreign-flag tankers, accounted for 11.5 percent of total non-Communist world petroleum industry capital expenditures and exploration expenses in 1970, 26.9 percent more than in 1969, when they accounted for only 9.9 percent of the total. This upward shift reflected the continuing trend toward use of more supertankers.

Within the Far East, which accounted for 10.2 percent of total non-Communist world expenditures and expenses in 1970, expanded refinery construction accounted for by far the largest part of the overall increase of 35.4 percent with respect to the 1969 regional figure and was primarily responsible for raising the region's share of the world total from the 8.2 percent level of 1969. Increases in investment were recorded also, however, in every investment category except chemical plants.

For Africa, a decline of 2.2 percent in total capital expenditure and exploration expense was recorded between 1969 and 1970 as a result of lower levels of investment in crude production facilities and in refineries; other categories of investment were at higher levels in 1970, but increased expenditures on these fell short of balancing the lower levels for production and refineries. The region accounted for 4.1 percent of the non-Communist world total in 1970 compared with 4.6 percent in 1969.

Within the Near East, the level of investment fell 21.2 percent, with a 64.3 percent lower level of investment in pipeline construction as the largest single component of the decline. However, lesser investment in crude production facilities and miscellaneous expenditures also contributed. The region accounted for only 2.9 percent of the non-Communist world total in 1970, compared with 3.9 percent in 1969.

Considering total 1970 non-Communist world petroleum industry capital expenditure by sectors of the industry (table 18), crude oil and natural gas production facility expenditures once again headed the list, accounting for 31.0 percent of the total, with capital expenditures for refining ranking second with 18.6 percent followed by marketing, 15.0 percent; marine facilities, 12.2 percent; chemical plants, 7.1 percent; exploration expenses, 6.2 percent; pipelines, 4.0 percent; and natural gasoline plants, 2.7 percent; and miscellaneous expenditures accounting for the remainder, 3.2 percent. Although these percentages differed from those recorded for 1969, the differences were not sufficient to change the relative ranking of the industry sectors except in the case of exploration expenses, which ranked ahead of chemical plants in 1969.

Table 19 details U.S. direct investment in, and earnings and income from, mining, smelting and metal refining and petroleum industry activities in foreign areas for 1968 and 1969. The overall growth rate of this investment in mining, smelting and refining was 8.5 percent between 1969 and 1970, considerably greater than the 4.1 percent growth between 1968 and 1969 but less than 11.5 percent increase between 1967 and 1968. In the case of petroleum investment, the 1970 level was 9.6 percent above that of 1969, compared with a 5.3 percent increase between 1968 and 1969 and an 8.6 percent increase between 1967 and 1968. On a regional basis, U.S. mining, smelting and refining investment showed declines between 1969 and 1970 in Europe and Africa with increases in other geographic areas, and petroleum industry investment was higher in all areas except the Near East international shipping.

TRANSPORTATION

MARINE TRANSPORT

Three major classes of vessels are engaged in transporting mineral commodities; oil tankers, bulk carriers, and freighters. Table 20, derived from a U.S. Maritime Commission report, summarizes the world's total merchant fleet in terms of number of vessels and tonnage, listing these classes separately. In the case of each of these major classes, not all of the vessels listed are engaged wholly or even partly in transporting mineral commodities. Tankers, although unquestionably most heavily devoted to trade in crude oil and refinery products, move some chemicals and other materials such as whale oil. Bulk carriers, heavily engaged in movement of metal ores, cement, and fertilizers, also move substantial quantities of bulk agricultural products. Freighters are not primarily engaged in mineral commodity shipment but nonetheless move sizable quantities of metal ingots and semimanufacturers, as well as some ores and concentrates.

Although data are not available on a worldwide basis as to the share of mineral commodity trade in total commodity movement, it is significant that in fiscal 1971, 61 percent by weight of all goods transiting the Panama Canal were mineral commodities. On the basis of this figure, it may be inferred with reasonable certainty that mineral commodities' share of the world total movement of goods is even higher, because of the fact that the dimensions of the Canal's locks exclude the large tankers and bulk carriers that account for a growing proportion of mineral commodity movement.

From data in table 20, the world merchant fleet [9] at yearend totaled 19,980 vessels with a gross tonnage of 211,401,000 tons and a deadweight tonnage of 326,999,000 tons, increases of 2.1 percent, 7.7 percent, and 9.9 percent, respectively, over 1969 totals. The percentage increases registered for the total merchant fleet during 1970 exceeded those recorded between 1968 and 1969, and except for number of vessels, were greater than those recorded between 1967 and 1968.

Although increases were recorded for all classes of vessels comprising the merchant fleet in all catagories of measurement (number, gross tonnage, and deadweight tonnage), the percentage increases were radically different between the various ship classes. Tankers and bulk carriers, which have consistently recorded gains in both number of vessels and tonnage, continued to show growth, and reversing the 1968–69 declines, both freighters and other vessels (passenger-cargo, passenger-refrigerated cargo and refrigerated freighters) increased, but at much more modest rates. Distribution of the world merchant fleet by vessel type continued to shift in 1970, with tankers and bulk carriers accounting for an increased share of both in numbers and tonnage.

Tankers.—Expansion of the world tanker fleet in 1970 continued at a more rapid pace than that of the total world merchant fleet. On a tonnage basis the growth recorded exceeded that registered for any of the last 5 years. On the basis of number of vessels, the growth was at a lower rate than any recorded since 1966–67, reflecting the continued heavy expansion in supertankers. Between yearend 1969 and yearend 1970, the total tanker fleet increased by 3.9 percent in number of vessels, 11.9 percent in gross tonnage, and 14.1 percent

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

in deadweight tonnage; comparable figures for the previous corresponding period were 4.5 percent, 10.9 percent, and 13.9 percent, respectively.

The average gross tonnage of tankers in service increased from 19,518 tons in 1969 to 21,006 tons in 1970; in terms of deadweight tonnage the increase was from 32,774 tons to 36,171 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 shift toward larger tankers is more dramatic when examined in detail by various size groups, and is particularly pronounced when data for existing vessels are compared with those for planned new construction. Table 21, compiled from a source other than the U.S. Maritime Commission (and thus differing slightly in totals given by that source and appearing elsewhere in this section), indicates that of the total world's 1970 tanker fleet of almost 156 million deadweight tons, 28.9 percent was in tankers of over 105,000 tons, compared with 11.2 percent in 1968 and only 3.6 percent in 1966. Even more significant is the fact that 18.4 percent of the total 1970 tanker fleet on a tonnage basis was in vessels exceeding 205,000 deadweight tons. When and if additions underway or on order at yearend 1970 are completed, and discounting reductions in deadweight tonnage owing to losses, scrapping, and other deletions from the roster of vessels in service at yearend 1970, 48.8 percent of the tanker fleet at that time will be in ships of over 105,000 deadweight tons including 39.2 percent in vessels exceeding 205,000 tons.

The rapid changeover in the world tanker fleet continued in 1970 and is reflected in the breakdown of the total tonnage of vessels by age groups. The following tabulation compares the 1970 distribution of total tonnage by age groups with that recorded for 1969:

Year of completion	Percent of total tonnage	
	1969	1970
Up to yearend 1945	4.5	3.8
1946–50	2.1	1.7
1951–55	11.1	9.2
1956–60	21.6	18.9
1961–65	26.0	22.7
1966–70	34.7	43.7

Source: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry—1970. Bayard Press, London, 1970, p. 14.

Distribution of the world tanker fleet at yearend 1970 by flag of registry ranked in order of national aggregate deadweight tonnage was as follows:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	730	36,802
United Kingdom	434	20,863
Norway	363	17,351
Japan	368	16,036
United States	294	7,739
Greece	216	7,714
France	135	5,799
Panama	173	5,692
U.S.S.R.	394	5,167
Italy	198	4,585
Netherlands	92	3,532
Germany, West	59	2,956
Sweden	80	2,887
Spain	109	2,533
Denmark	53	2,337
Other	534	11,082
Total	4,232	153,075

Bulk Carriers.—As in the case of tankers, world bulk carrier fleet growth between yearend 1969 and yearend 1970 exceeded the level of growth of the total merchant fleet during that period. In fact, growth in the bulk carrier fleet exceeded that registered for tankers in both number of vessels and gross tonnage, with tankers leading bulk carriers only in deadweight tonnage growth. The number of bulk carriers increased 7.5 percent, their gross tonnage advanced 13.1 percent, and their deadweight tonnage increased by 14.1 percent. Although these figures significantly exceeded those registered for 1968–69, they did not approach the 1967–68 growth rates.

As noted above, this class of vessel includes both those moving crude minerals and concentrates and those hauling bulk agricultural products. However, the continued significant growth is attributed chiefly to additions of large ore carriers and of large combination (ore-oil-other material) carriers. Although Maritime Commission data do not distinguish mineral commodity-oriented bulk carriers from those engaged in agricultural trade, other sources indicate that at yearend 1968 the aggregate deadweight tonnage of combined ore-oil-other material carriers was 11 million tons, with 7 million deadweight tons of such vessels under construction; at yearend 1969, 13.6 million deadweight tons of such ships were reported under construction (no figure for completed vessels available).

As in the case of tankers, there has been a marked upturn in the average size of bulk carriers. At yearend 1966, such vessels had an average gross tonnage of 10,967 tons (16,762 deadweight tons), and at yearend 1970, the average gross tonnage was 15,978 tons (26,125 deadweight tons).

Almost 82 percent of the total number of bulk carriers in service at yearend 1970 and over 88 percent of the aggregate deadweight tonnage of such vessels was registered under the flags of 13 nations shown in the following tabulation, ranked in order of the deadweight tonnage under each flag:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	590	19,191
Japan	429	13,249
Norway	341	11,637
United Kingdom	296	6,603
Greece	177	3,988
Italy	123	3,316
Germany, West	92	2,859
Sweden	78	2,375
India	37	1,334
France	61	1,240
U.S.S.R.	132	846
Denmark	26	781
United States	38	767
Other	534	8,987
Total	2,954	77,173

Freighters.—Freighters, which constituted 55 percent of the world's merchant fleet in terms of number of vessels at yearend 1970 accounted for only 30 percent of the aggregate gross tonnage and 27 percent of the aggregate deadweight tonnage of the total merchant fleet in that year. Compared with tankers and bulk carriers, a much smaller proportion of the total number of these vessels are engaged in moving mineral commodities; nonetheless mention of this class of ship is in order since they are the prime class of ocean carrier for processed mineral goods, particularly metal smelter and mill products. Although the number of freighters in service at yearend 1970 increased very slightly relative to those in use at yearend 1969, the growth was far less than in the case of tankers and bulk carriers; the same was true for tonnage data.

Although the trend toward gigantism noted for tankers and bulk carriers did not extend to freighters, there has been a modest increase in size in the average of such vessels, from 5,595 gross tons and 7,871 deadweight tons in 1966 to 5,742 gross tons and 7,949 deadweight tons in 1970.

Principal nations of registry of freighters are listed in the following tabulation in order of their share of aggregate deadweight tonnage of total world freighter fleet at yearend 1970:

Country	Number of vessels	Deadweight tonnage (thousand tons)
United States	1,048	11,574
Japan	1,222	9,583
United Kingdom	829	7,465
U.S.S.R.	1,138	7,214
Greece	738	6,270
Germany, West	768	5,473
Liberia	470	4,697
Norway	416	3,217
Netherlands	292	2,487
Panama	350	2,259
India	180	1,792
Other	3,547	25,447
Total	10,998	87,428

PANAMA AND SUEZ CANALS

The Panama Canal in 1970 registered a record level of mineral commodity transit in 1970. Of the grand total of 116,091,000 metric tons of cargo passing through the canal in vessels classified as commercial ocean traffic, 72,462,000 ton, or 62.4 percent, consisted of mineral commodities. The 1970 figure exceeded that of 1969 by nearly 13.5 percent and in terms of percentage of total goods transiting the canal was about 0.43 percent higher than in 1969. The fact that the mineral commodity share of the total was once again higher than in the previous year remained particularly significant in view of the previously mentioned trend toward construction of vessels too large to transit the canal. The following tabulation, which summarizes Panama Canal activities, shows the importance of mineral commodities to total trade:

	Fiscal years		
	1968	1969	1970
Number of transits:			
Commercial ocean traffic	13,199	13,150	13,658
Other traffic	2,312	2,177	1,865
Total	15,511	15,327	15,523
Cargo moved (million metric tons):			
Commercial ocean traffic:			
Mineral commodities	60.3	63.9	72.5
Other commodities	37.8	39.1	43.6
Subtotal	98.1	103.0	116.1
Other traffic, all commodities	9.1	7.5	4.7
Total	107.2	110.5	120.8

Details on the distribution of commercial ocean traffic transiting the canal by vessel type, by direction of movement (Atlantic to Pacific or Pacific to Atlantic), and by the status of the vessel (in ballast or laden) are given in table 22 together with the tonnage of cargo moved by each type. Table 23 lists movements of specific mineral commodities and commodity groups on a tonnage basis for 1968–70, also indicating direction of movement.

Of total Panama Canal traffic in mineral commodities in recent years, about three-quarters has been from the Atlantic to Pacific. Of this material destined for the Pacific, coal and coke and petroleum (crude and refined) have been the dominant commodities; in 1970, coal and coke together accounted for 40.9 percent of the total and petroleum for 27.8 percent. Of the approximate one-quarter of total Panama Canal mineral commodity movement that is in the Pacific to Atlantic direction, steel semi-manufactures have been the dominant commodity group, accounting for 31.9 percent of the 1970 total.

In 1970, Pacific to Atlantic mineral commodity movement increased 25.9 percent on a tonnage basis over the 1969 level, chiefly as the result of a 1,577,000-metric-ton (96 percent) increase in petroleum shipments in that direction. This increase, together with those recorded for other commodity groups that were lesser on a tonnage basis if not on a percentage basis, more than compensated for a decline registered for 10 of the 36 commodity groups listed in table 23. In comparison, Atlantic to Pacific mineral commodity movement increased only 9.5 percent between 1969 and 1970, largely as a result of the 31-percent increase in coal and coke shipments and a 29.9-percent increase in bauxite and alumina shipments, increases that were in part offset by lower levels of shipment for 17 of the 36 commodities listed in table 23. The most significant decline on a tonnage basis was that for phosphatic fertilizers that fell by 945,000, a 20-percent decline.

The Suez canal continued to have only a negative influence on marine mineral transport patterns, as this maritime shortcut from the Indian Ocean producing areas to European consuming centers remained closed for the third full year as a result of continued confrontation between the United Arab Republic and Israel along the Canal. Deliveries of Persian Gulf oil to European markets continued to increase, and except for shipments moving overland by pipeline from the producing areas to Eastern Mediterranean ports, which were limited by pipeline capacity, the entirety of such oil shipments were forced into the Cape of Good Hope shipping route.

OCEAN FREIGHT RATES

Table 24 presents United Nations indexes of selected ocean freight rates for 1967–70, including quarterly figures for 1969 and 1970. Owing to the fact that the United Nations has revised the list of selected rates chosen for publication, data are not available for 1969 and 1970 for all rates used in previous editions of this chapter, but it is clear from series that have been continued that 1970 rates advanced sharply, not only reversing the general downtrend of the period 1967–69, but reaching levels greater than any recent previous high.

PIPELINES

Although space limitations and the unavailability of complete worldwide summaries of existing pipeline systems prohibit any detailed reporting of pipeline development on a worldwide basis, some mention of major projects of international significance appears in order and is presented in the following paragraphs without any pretense as to completeness.

In the Western Hemisphere, the most newsworthy crude oil pipeline projects under study were those planned to move crude oil from Alaska's northern slope, the

Prudhoe Bay field, to Canadian and U.S. markets. By yearend, considerable construction equipment and supplies for the proposed Trans-Alaska Pipeline System (TAPS) were in Alaska on or near the construction site, but work was held up pending the settlement of ecological and native land claim disputes. This line, if and when built, will link the Prudhoe Bay area to the Gulf of Alaska. The second proposal, a line from Prudhoe Bay to the Edmonton, Alberta, area in Canada was also under assault from environmentalists, and those proposing such an installation had established a test installation to determine the effect of a hot oil pipeline on permafrost, one of the environmental problems that had been raised.

In Latin America, the 364-mile, 16-20-26 inch Trans-Ecuadorian Pipelines Systems crude oil line from Lago Agria to Esmeraldas was underway to provide a means of moving crude from the inland fields to the coast for export.

In the Near East, continued closure of the Suez Canal coupled with the knowledge that even should the Canal be reopened, its depth and width preclude its use by supertankers led to several proposals for additional pipeline facilities. One major proposal that received considerable initial backing was a line paralleling the Suez Canal from the head of the Red Sea to the Mediterranean. Such a line would permit supertankers to move oil to the southern end of the Canal, where the oil would be offloaded, piped to the northern end, and there loaded on other supertankers for delivery to Europe. In theory, at least, such a scheme would have considerable economic advantages, at least in the near future, even if the Canal should be reopened.

Another Suez Canal bypass scheme was that of the Petroleum Transport Authority, an Iranian-Turkish Government venture, for a 1,055-mile, 42-inch crude line from the southern Iranian oilfields to the Turkish Mediterranean port of Iskenderun.

One of the traditional Suez Canal bypass pipelines, the long operative Trans Arabian Pipeline (TAPLine), operated through the first four months of 1970, but was closed from May 3 through yearend, following a rupture of the line by a bulldozer. Iraqi Government action prevented repair of the line during the year. This major disruption in oil deliveries followed close on the heels of interruptions in 1969 when the line was shut down for a total of 110 days. The Iraq Petroleum Company pipeline system, which also crosses Syria, suffered no major interruptions during 1970.

Within West Europe, expansion and extension of the Southern European and Trans-Alpine (TAL) crude oil systems continued, and in East Europe, expansion of the Comecon crude oil pipeline network also was furthered.

Studies and negotiations continued regarding a proposed 4,200-mile, 40-inch crude oil line from the Tyumen oil fields in the U.S.S.R. across Siberia to the port of Nakhodka on the Sea of Japan, from where crude would be moved to Japan. A tentative completion date of 1974 had been set at yearend, but work evidently had not started.

In a continuing effort to utilize natural gas produced in conjunction with crude oil, and heretofore not used owing to inadequate markets, Iran and the U.S.S.R. completed a natural gas line linking fields in the former country with market areas in the latter and the line was being placed into operation at yearend. This was the second such international line for the Soviets, preceded by a shorter line connecting gas deposits in northern Afghanistan with adjacent areas in the U.S.S.R.

In a similar case, a feasibility study was completed and planning started on a gas pipeline to link Algerian fields with Sicily and (across the Messina Strait) to Italy. At yearend, completion of this line was forecast for 1975.

Iraq indicated plans for a 750-mile, 42-inch gas line to link North Rumaila field to the Mediterranean coast, with a completion target of some time in 1972.

In connection with exploitation of the Groningen gas field in the Netherlands, additional gas pipelines were being laid in Western Europe, not only in the Netherlands but also within West Germany and Switzerland.

In East Europe, work was underway on a 1-trillion-cubic-foot-per-year gas pipeline to carry Soviet produced natural gas to Austria, Italy, East Germany, and West Germany, with completion of the first phase of the 56-inch line, which crosses Czechoslovakia, scheduled for 1973 (final phase after 1975).

The U.S.S.R. asked Japanese interests to consider a cooperative effort on a proposed 1,800-mile gas line to link the Yakutsk fields of the Soviet Union with Japanese markets.

In Australia, surveys were underway for an 825 mile gas line from the Gidgealpa-Moomba area of South Australia to Sydney and other market areas in New South Wales, with completion of the line expected in 1972. Also, a 255-mile gas line was under way from Longara field to Perth and thence to Pinjarra, with completion expected in 1971.

In the field of international petrochemical pipelines, additional construction was announced and underway in 1970 linking chemical plants in West Germany, the Netherlands, and Belgium, and at least one such line under construction in 1969 was completed.

PRICES

With the notable exception of steel, most mineral commodities registered higher average prices for 1970 than for 1969, but examination of monthly average prices indicated a general downturn in a number of areas toward the end of the year. In the case of steel, following slight increases registered in early 1970 above mid-1969 levels, prices for steel semimanufactures on European markets turned markedly downward and by yearend in general were 20 percent or more lower than on January 1, although they had not fallen to the level of mid-1969. In Japan, there was a downturn fairly early in the year, with a subsequent increase in the third quarter followed by another decline; in the United States little if any decline was evident, with the 1970 average annual price still remaining above the 1969 level.

Major nonferrous metal prices for 1968–70, with 1970 data on a monthly basis are presented for the United States, the United Kingdom, and Canadian markets in tables 25, 26, and 27, respectively. The aluminum price advanced in April in the United States and the United Kingdom reflecting market firmness; there was no change in the Canadian price.

The monthly average copper price advanced on all three markets in the first quarter of 1970; then advanced on the U.S. market in the second quarter but failing to change in Canada and declining on the London market. In the third quarter, the U.S. price joined the London price in a decline (a further lowering on the London market) with the Canadian price again remaining unchanged. Finally, in the fourth quarter, all three markets recorded declines. Nevertheless, the average 1970 price in both the United States and Canada was substantially above that for 1969; only on the London market was the 1969 average price higher. World output of copper (both mine and smelter) reached new highs in 1970, in response to the demand that had steadily driven the price upward, and the fall-off in the price reflected an approach to supply-demand advilibrium.

The 1970 annual average lead and zinc prices on all three markets stood at higher levels than those of either 1968 or 1969, but the December 1970 monthly average price for both metals on each of the markets was lower than the previous year's average, as a result of declines beginning about midyear.

The tin price on both the London and U.S. markets fluctuated irregularly through 1970 with a considerable downturn at yearend, but on the whole was higher than the 1969 average; the silver price on all three markets, although fluctuating over the course of the year, was lower in terms of annual average than in 1969 and 1968.

Tables 28 and 29 give the United Nations calculated export price indexes (1963 = 100) for mineral commodities. The declining trend of 1964–68 for overall crude mineral prices had been reversed in 1969, and the reversal continued in 1970, with the 1970 index standing at 109, 5 points higher than that of 1969. Considering metal ores only, the 1970 annual average index at 122 was considerably higher than the 114 average for 1969, but within the year there was a downturn after the first quarter. In contrast, the index for fuels only increased in each quarter of 1970, with the 1970 average standing 5 points above that of 1969.

As in 1969, the developed nations' export price indexes for mineral commodities stood at an appreciably higher level than did the index for mineral commodities for less developed areas. The total minerals index for the developed areas increased throughout the year from 118 for the first quarter to 126 for the fourth quarter, giving an average of 122, and that for the less developed countries stood at 104 throughout the year, 1 point higher than the 1969 average. In the case of nonferrous base metals, the annual average index for less developed countries was higher than that for developed areas, and, although both areas registered a 1970 average above that of the previous year, there was a downward trend from the first quarter onward.

Details on world prices of other mineral commodities are generally not available in forms that are suitable for comparison without detailed analysis. Nonetheless it appears almost certain that the general trend in prices for crude oil and petroleum refinery products, the broad group that accounts for the largest part of total world mineral production value, advanced again in 1970.

STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR COMMODITIES

The final 30 tables in this chapter (tables 30 to 59) 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, and 1969 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 1970 Minerals Yearbook and on a country basis in Volume III.

The data presented here on production (tables 30 to 48) in most instances are the metric unit equivalents of world production tables included in Volume I; as such they may differ somewhat from data appearing in the individual country chapters of Volume III, some of which were prepared prior to the Volume I tables and some of which were prepared after the Volume I tables. The differences between the figures appearing in these two volumes are chiefly the result of receipt of more recent information. Two additional commodities, nitrogenous fertilizers (reported in terms of nitrogen content) and salt have been added to the list of commodities covered in the summary tables in consideration of their inportance from the viewpoint of value of production.

The data on world trade in major mineral commodities presented in this chapter (tables 49 to 59) may not correspond exactly to those presented elsewhere in the Minerals Yearbook because these summary tables were 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

(1963 = 100)

Industry sector and geographic area	1968	1969	1970	1970 by quarters: 1st	2d	3d	4th
EXTRACTIVE INDUSTRIES							
Metals:							
Non-Communist world	121	126	134	126	138	138	135
Industrialized countries [2]	122	124	135	125	140	139	136
United States and Canada	123	124	141	131	147	147	141
Europe	116	120	120	107	129	116	128
European Economic Community [3]	95	96	90	93	90	84	91
European Free Trade Association [4]	134	135	131	105	151	123	147
Australia and New Zealand	159	184	194	171	197	205	203
Less industrialized countries [5]	121	130	133	129	134	137	131
Latin America [6]	124	133	136	134	138	139	134
Asia [7]	120	126	138	128	136	145	144
Communist Europe [8]	160	167	181	182	179	182	180
World	130	135	145	139	147	148	145
Coal:							
Non-Communist world	91	89	89	90	90	85	91
Industrialized countries [2]	89	87	86	87	87	82	89
United States and Canada	114	114	124	116	126	120	132
Europe	80	77	74	77	74	69	75
European Economic Community [3]	80	79	77	78	76	74	80
European Free Trade Association [4]	77	71	66	73	70	58	63
Australia and New Zealand	151	168	182	158	186	199	181
Less industrialized countries [5]	114	120	120	120	121	116	121
Latin America [6]	131	135	138	NA	NA	NA	NA
Asia [7]	114	119	118	120	121	113	119
Communist Europe [8]	112	116	121	120	118	119	126
World	100	101	103	103	102	99	106
Crude petroleum and natural gas:							
Non-Communist world	136	147	159	156	156	157	165
Industrialized countries [2]	119	124	131	131	128	127	136
United States and Canada	120	123	130	129	126	126	135
Europe	131	143	158	165	151	148	169
European Economic Community [3]	133	147	164	173	157	152	177
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]	158	177	196	189	194	196	204
Latin America [6]	117	118	121	120	120	122	123
Asia [7]	155	173	191	183	187	192	201
Communist Europe [8]	155	162	174	176	176	174	169
World	140	150	162	160	160	160	166
Total extractive industry:							
Non-Communist world	124	131	140	137	139	139	145
Industrialized countries [2]	115	117	124	122	123	122	128
United States and Canada	120	123	131	127	130	130	135
Europe	101	103	108	112	106	101	114
European Economic Community [3]	105	111	120	127	113	110	129
European Free Trade Association [4]	90	86	83	83	88	77	81
Australia and New Zealand	149	166	175	154	179	188	180
Less industrialized countries [5]	147	163	177	171	176	177	183
Latin America [6]	119	123	126	124	125	128	127
Asia [7]	149	165	180	174	178	180	189
Communist Europe [8]	138	142	151	151	152	150	151
World	129	135	143	142	143	142	147
PROCESSING INDUSTRIES							
Base metals:							
Non-Communist world	134	148	150	153	155	145	145
Industrialized countries [2]	133	148	149	153	155	143	144
United States and Canada	122	132	126	131	133	122	117
Europe	130	142	146	151	152	136	144
European Economic Community [3]	133	148	151	157	159	144	147
European Free Trade Association [4]	117	123	124	131	129	110	127
Australia and New Zealand	136	143	150	144	149	153	155
Less industrialized countries [5]	139	157	160	154	155	164	167
Latin America [6]	140	164	168	154	163	178	178
Asia [7]	139	151	150	157	147	145	154
Communist Europe [8]	147	155	165	165	165	165	166
World	138	150	154	157	158	151	152

See footnotes at end of table.

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

(1963 = 100)

Industry sector and geographic area	1968	1969	1970	1970 by quarters			
				1st	2d	3d	4th
PROCESSING INDUSTRIES—Continued							
Nonmetallic mineral products:							
Non-Communist world	131	141	144	129	149	151	148
Industrialized countries [2]	130	139	141	125	145	148	144
United States and Canada	124	132	128	120	132	134	127
Europe	129	137	142	119	149	152	150
European Economic Community [3]	125	133	140	111	148	153	147
European Free Trade Association [4]	130	136	135	123	140	135	140
Australia and New Zealand	132	147	151	140	153	158	151
Less industrialized countries [5]	143	157	172	161	177	173	178
Latin America [6]	144	152	166	155	166	168	173
Asia [7]	141	163	181	167	188	185	183
Communist Europe [8]	153	164	182	180	184	180	185
World	140	150	159	149	163	162	162
Chemicals, petroleum and coal products:							
Non-Communist world	154	168	178	176	180	176	182
Industrialized countries [2]	155	169	179	177	180	176	182
United States and Canada	146	157	158	158	160	157	159
Europe	161	178	194	192	197	188	199
European Economic Community [3]	166	184	201	201	204	196	204
European Free Trade Association [4]	145	159	171	167	175	163	176
Australia and New Zealand	147	159	174	159	176	177	184
Less industrialized countries [5]	147	160	174	170	171	177	179
Latin America [6]	146	159	176	NA	NA	NA	NA
Asia [7]	147	160	172	165	167	173	182
Communist Europe [8]	177	199	212	203	209	211	225
World	159	175	185	182	186	183	191
OVERALL INDUSTRIAL PRODUCTION							
Non-Communist world	135	145	150	148	151	146	152
Industrialized countries [2]	134	144	148	147	150	143	150
United States and Canada	133	139	136	138	138	134	133
Europe	128	139	146	144	149	137	154
European Economic Community [3]	128	141	150	148	152	140	158
European Free Trade Association [4]	123	129	133	132	135	123	140
Australia and New Zealand	136	146	154	145	154	156	160
Less industrialized countries [5]	142	155	165	159	165	166	170
Latin America [6]	136	145	154	NA	NA	NA	NA
Asia [7]	144	158	169	165	167	169	176
Communist Europe [8]	151	162	177	177	178	173	179
World	140	150	157	156	159	153	160

NA Not available.

[1] Excludes a number of countries of the Near East and Africa as well as mainland China, North Korea, and North Vietnam.

[2] All countries having a per capita value added in manufacturing in 1958 equivalent to US$125 or more.

[3] Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands.

[4] Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom.

[5] Countries having a per capita value added in manufacturing in 1958 of less than US$125.

[6] Central and South America and the Caribbean Islands.

[7] Afghanistan, Brunei, Burma, Ceylon, Hong Kong, India, Indonesia, Iran, South Korea, Malaysia (excluding Sabah), Mongolia, Pakistan, Philippines, Singapore, Taiwan, Thailand, and South Vietnam.

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

Source: United Nations. Monthly Bulletin of Statistics. August 1971, pp. x–xxiii.

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

Commodity		1968	1969	1970 p
METALS				
Aluminum:				
Bauxite	thousand metric tons	46,001	52,658	57,968
Alumina	do	17,251	19,506	20,865
Unalloyed ingot metal	do	8,019	9,008	9,672
Antimony	do	61	66	66
Arsenic, white [2]	do	61	50	51
Beryl	metric tons	6,555	7,996	7,449
Bismuth [2]	do	3,770	3,838	3,849
Cadmium	do	15,016	17,533	15,987
Chromite	thousand metric tons	4,937	5,349	5,949
Cobalt:				
Mine [2]	metric tons	19,231	19,631	23,623
Refined [2]	do	17,139	17,800	21,981
Columbium-tantalum concentrates [2 3]	do	10,821	15,675	19,912
Copper:				
Mine	thousand metric tons	5,114	5,628	5,950
Smelter	do	5,492	6,004	6,227
Gold	thousand troy ounces	46,165	46,526	47,356
Iron and steel:				
Iron ore	thousand metric tons	679,247	718,856	766,689
Pig iron and blast furnace ferroalloys	do	382,386	414,200	434,679
Electric furnace ferroalloys	do	5,691	6,149	6,425
Crude steel	do	529,495	573,826	593,739
Lead:				
Mine	do	3,012	3,238	3,405
Smelter	do	2,949	3,232	3,294
Magnesium	do	193	201	221
Manganese ore	do	16,899	17,414	18,497
Mercury	thousand 76-pound flasks	260	290	284
Molybdenum	metric tons	66,582	73,710	83,289
Nickel	thousand metric tons	497	483	622
Platinum-group metals	thousand troy ounces	3,394	3,431	4,216
Selenium [4]	metric tons	883	1,265	1,084
Silver	thousand troy ounces	275,264	290,469	301,745
Tellurium [2]	metric tons	117	179	162
Tin:				
Mine [2]	thousand long tons	228	224	227
Smelter	do	230	223	222
Titanium concentrates:				
Ilmenite [3]	thousand metric tons	2,923	3,213	3,576
Rutile [2 3]	do	302	396	417
Tungsten, mine output, metal content	metric tons	31,017	32,091	33,574
Uranium oxide (U_3O_8) [3]	do	20,871	20,915	21,504
Vanadium [3]	do	11,237	12,539	13,938
Zinc:				
Mine	thousand metric tons	4,975	5,345	5,499
Smelter	do	4,626	4,964	4,905
NONMETALS				
Asbestos	do	2,987	3,301	3,474
Barite	do	3,517	3,959	3,924
Cement, hydraulic	do	515,347	542,332	571,348
Diamond:				
Gem	thousand carats	10,674	11,773	13,712
Industrial	do	25,879	29,090	28,643
Diatomite	thousand metric tons	1,603	1,618	1,615
Feldspar	do	2,244	2,383	2,336
Fluorspar	do	3,644	3,868	4,170
Graphite [1]	do	437	375	380
Gypsum	do	49,428	51,242	50,426
Magnesite [2]	do	10,725	11,491	12,547
Mica	do	157	159	158
Nitrogen fertilizers, contained nitrogen [5]	do	25,844	28,710	30,600
Phosphate rock	thousand metric tons	84,001	81,709	85,208
Potash (marketable), K_2O equivalent	do	16,209	17,064	18,586
Pumice [3]	do	13,757	14,768	14,549
Pyrites, including cupreous	do	21,095	20,931	22,162
Salt	do	126,255	135,764	142,637
Strontium minerals [3]	metric tons	12,839	27,797	35,660
Sulfur, elemental:				
Native	thousand metric tons	12,250	12,632	12,956
Byproduct	do	7,542	8,473	9,117
Talc, soapstone, and pyrophyllite	do	4,351	4,660	4,813
Vermiculite [3]	do	352	423	392

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

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite million metric tons	182	180	183
Bituminous do	1,594	1,619	1,658
Lignite do	734	760	787
Mixed grades do	290	318	355
Total do	2,800	2,877	2,983
Coke:			
Metallurgical thousand metric tons	315,406	332,031	346,842
Other types do	28,386	27,081	25,058
Fuel briquets do	143	144	104
Gas, natural, marketed billion cubic feet	31,334	34,380	37,907
Peat thousand metric tons	188	185	197
Petroleum, crude million barrels	14,093	15,214	16,690

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, mainland China, Cuba, Czechoslovakia, East Germany, Hungary, Mongolia, North Korea, North Vietnam, Poland, Romania, U.S.S.R., and Yugoslavia.
[4] Excludes production from countries listed in footnote 2 except for Yugoslavia.
[5] Years ending June 30 of that stated.

Table 3.—Approximate percentage distribution of world mineral commodity production, by major areas in 1970 [1]

Commodity	Western Hemisphere			Eastern Hemisphere							World	
	North and Central America [2]	South America	Total	Europe: Non-Communist [3]	Europe: Communist [4]	Africa	Near East and Asia: Non-Communist	Near East and Asia: Communist [5]	Oceania	Total	Non-Communist	Communist [2]
METALS												
Aluminum:												
Alumina	44.9	6.8	51.7	13.0	13.0	2.9	8.0	1.2	10.2	48.3	85.8	14.2
Bauxite	27.2	17.9	45.1	13.1	12.3	5.9	6.5	.9	16.2	54.9	86.8	13.2
Ingot	47.6	1.3	48.9	20.8	15.4	1.7	9.8	1.3	2.1	51.1	83.3	16.7
Antimony	9.5	18.2	27.7	6.1	10.9	28.5	8.1	17.6	1.1	72.3	71.5	28.5
Arsenic, white	[6] 13.8	2.1	15.9	60.4	14.0	8.0	1.7	(7)	--	84.1	86.0	14.0
Beryl	(6)	49.7	49.7	.2	16.8	15.6	17.7	--	(8)	50.3	83.2	16.8
Bismuth	[6] 21.0	34.3	55.3	4.4	3.2	.1	25.0	6.2	5.8	44.7	90.6	9.4
Cadmium	33.4	1.2	34.6	22.7	19.3	3.6	15.3	.7	3.8	65.4	80.0	20.0
Chromite	(7)	.5	.5	3.6	37.1	33.1	25.7	--	--	99.5	62.9	37.1
Cobalt	7.2	--	7.2	15.7	7.0	70.1	(7)	--	--	92.8	93.0	7.0
Columbium-tantalum [9]	23.8	66.7	90.5	(8)	XX	9.2	.3	XX	--	9.5	100.0	XX
Copper:												
Mine	37.9	15.4	53.3	3.2	12.2	21.1	5.8	1.9	2.5	46.7	85.9	14.1
Smelter	32.7	13.5	46.2	6.0	11.9	20.4	11.9	1.8	1.8	53.8	86.3	13.7
Gold	9.2	1.2	10.4	.4	13.8	71.1	2.3	.4	1.6	89.6	85.8	14.2
Iron and steel:												
Iron ore	18.8	11.0	29.8	17.2	26.8	7.3	5.4	6.8	6.7	70.2	66.4	33.6
Pig iron	21.6	1.5	23.1	25.8	25.3	1.2	17.5	5.7	1.4	76.9	69.0	31.0
Ferroalloys	36.7	1.8	38.5	27.7	4.5	--	29.3	--	--	61.5	95.5	4.5
Steel ingots and castings	22.7	1.6	24.3	27.1	26.1	1.0	17.1	3.3	1.1	75.7	70.6	29.4
Lead:												
Mine	31.5	7.4	38.9	13.7	19.9	5.7	3.6	5.0	13.2	61.1	75.1	24.9
Smelter	28.5	4.0	32.5	20.3	20.5	4.6	6.8	4.6	10.7	67.5	74.9	25.1
Magnesium	50.0	--	50.0	22.2	22.6	--	4.7	.5	--	50.0	76.9	23.1
Manganese ore	1.5	10.6	12.1	.5	38.9	27.7	10.8	5.4	4.6	87.9	55.7	44.3
Mercury	28.9	1.3	30.2	38.4	17.6	(8)	6.8	7.0	--	69.8	75.4	24.6
Molybdenum	90.1	9.0	99.1	.3	--	(7)	.6	--	--	.9	100.0	--
Nickel	52.5	.4	52.9	2.2	17.9	2.6	2.9	--	21.5	47.1	82.1	17.9
Platinum-group metals	11.4	.6	12.0	--	52.2	35.6	.2	--	--	88.0	47.8	52.2
Selenium [10]	69.0	.6	69.6	11.3	XX	--	19.0	XX	.1	30.4	100.0	XX
Silver	45.5	16.5	62.0	6.4	14.9	2.7	4.9	.4	8.7	38.0	84.7	15.3
Tellurium [9]	60.7	17.3	78.0	--	XX	--	22.0	XX	--	22.0	100.0	XX
Tin:												
Mine	[6] .5	14.6	15.1	1.1	12.4	8.3	50.3	8.8	4.0	84.9	78.8	21.2
Smelter	(6)	1.4	1.4	16.3	12.7	4.4	53.9	9.0	2.3	98.6	78.3	21.7
Titanium:												
Ilmenite [9]	43.4	(7)	43.4	21.5	XX	--	10.1	XX	25.0	56.6	100.0	XX
Rutile [9]	--	--	--	--	XX	10.6	1.2	XX	88.2	100.0	100.0	XX
Tungsten	15.8	11.7	27.5	6.4	20.0	.9	11.2	30.3	3.7	72.5	49.7	50.3
Uranium oxide (U_3O_8) [9]	69.9	.2	70.1	7.9	XX	20.6	--	XX	1.4	29.9	100.0	XX
Vanadium [9]	38.8	--	38.8	16.0	XX	45.2	--	XX	--	61.2	100.0	XX

Zinc:												
Mine	36.9	7.6	44.5	13.3	17.3	4.7	7.2	4.2	8.8	55.5	78.5	21.5
Smelter	26.3	2.3	28.6	22.6	22.1	3.0	14.5	3.9	5.3	71.4	74.0	26.0
NONMETALS												
Asbestos	46.7	.4	47.1	4.2	30.1	11.7	1.7	5.1	.1	52.9	64.8	35.2
Barite	34.0	4.8	38.8	29.8	13.1	3.5	6.7	7.1	1.0	61.2	79.8	20.2
Cement, hydraulic	15.2	4.1	19.3	31.4	23.9	3.1	18.9	2.5	.9	80.7	73.6	26.4
Diamond:												
Gem	--	2.1	2.1	--	12.0	85.8	.1	--	--	97.9	88.0	12.0
Industrial	--	2.0	2.0	--	22.0	76.0	(8)	--	--	98.0	78.0	22.0
Diatomite	35.3	1.9	37.2	38.4	23.0	.9	.2	--	.3	62.8	77.0	23.0
Feldspar	32.2	2.1	34.3	46.5	11.9	.9	6.2	--	.2	65.7	88.1	11.9
Fluorspar	32.0	1.6	33.6	29.1	14.0	5.1	9.0	9.2	--	66.4	76.8	23.2
Graphite	14.7	.1	14.8	13.8	19.9	5.0	18.7	27.8	--	85.2	52.3	47.7
Gypsum	32.0	2.5	34.5	40.4	12.6	1.9	7.8	1.2	1.6	65.5	86.2	13.8
Magnesite	--	1.9	1.9	22.6	48.7	.7	5.1	21.0	--	98.1	30.3	69.7
Mica, including scrap	68.8	1.7	70.5	4.4	--	5.6	19.5	--	--	29.5	100.0	--
Nitrogen fertilizers, contained nitrogen	29.5	.7	30.2	26.3	24.8	1.1	12.9	4.1	.6	69.8	71.1	28.9
Phosphate rock	41.5	.2	41.7	(8)	24.1	23.7	4.2	3.0	3.3	58.3	72.9	27.1
Potash K_2O equivalent (marketable)	30.1	--	30.1	29.0	36.7	1.3	2.9	--	--	69.9	63.3	36.7
Pumice	20.9	1.2	22.1	77.7	--	.1	--	--	.1	77.9	100.0	--
Pyrites, including cupreous	1.4	--	1.4	37.4	27.3	4.4	18.3	10.6	.6	98.6	62.1	37.9
Salt	36.0	2.9	38.9	24.5	15.0	1.5	7.1	11.8	1.2	61.1	73.2	26.8
Strontium minerals [9]	74.4	--	74.4	24.8	XX	--	.8	XX	--	25.6	100.0	XX
Sulfur:												
Native	65.8	1.4	67.2	.4	29.5	--	2.0	.9	--	32.8	69.6	30.4
Byproduct, elemental	65.4	.1	65.5	24.6	6.6	.1	1.8	1.4	--	34.5	92.0	8.0
Talc, soapstone, and pyrophyllite	20.8	.7	21.5	15.4	9.1	.3	47.5	4.8	1.4	78.5	86.1	13.9
Vermiculite [9]	66.1	2.1	68.2	--	XX	31.6	.2	XX	--	31.8	100.0	XX
MINERAL FUELS AND RELATED MATERIALS												
Coal, all grades including lignite	19.2	.3	19.5	16.1	41.7	1.9	4.9	13.3	2.6	80.5	45.0	55.0
Coke:												
Metallurgical	19.2	.7	19.9	27.1	30.7	1.2	13.6	6.0	1.5	80.1	63.3	36.7
Other types	--	.8	.8	21.4	38.1	.4	36.3	--	3.0	99.2	61.9	38.1
Fuel briquets	--	--	--	20.2	65.9	--	12.5	--	1.4	100.0	34.1	65.9
Gas, natural (marketed)	65.6	1.8	67.4	7.2	22.0	.3	3.0	--	.1	32.6	78.0	22.0
Peat	.4	--	.4	4.6	94.9	--	.1	--	--	99.6	5.1	94.9
Petroleum, crude	25.1	10.3	35.4	.8	16.3	13.1	33.1	.9	.4	64.6	82.8	17.2

XX Not applicable.

[1] Data presented in this table have been calculated from production figures that include additions and revisions to all data appearing elsewhere in 1970 Minerals Yearbook. Data revised through Sept. 30, 1971.

[2] Includes Cuba.

[3] Includes Yugoslavia.

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

[5] Includes mainland China, Mongolia, North Korea, and North Vietnam.

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

[7] Quantity of production not known. No estimate included in total.

[8] Less than .05 percent.

[9] Excludes production from Communist countries: Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, mainland China, Mongolia, North Korea, North Vietnam, Poland, Romania, U.S.S.R. and Yugoslavia.

[10] **Excludes production from Communist countries other than Yugoslavia.**

Table 4.—Geographic distribution of world crude mineral production value

Country	Value of production (million 1968 U.S. dollars)			Country's share of total [1] (percent)			Country's rank among world producers		
	1950	1963	1968	1950	1963	1968	1950	1963	1968
United States	14,165	17,883	20,232	38.06	26.66	25.97	1	1	1
U.S.S.R.	4,207	11,567	14,258	11.34	17.25	18.30	2	2	2
Canada	989	2,469	3,599	2.66	3.67	4.62	6	7	3
China, mainland	406	3,447	3,263	1.09	5.13	4.19	17	4	4
Venezuela	1,967	3,167	3,116	5.28	4.72	4.00	4	5	5
Germany, West	1,788	3,508	2,479	4.80	5.23	3.18	5	3	6
United Kingdom	2,103	3,024	2,073	5.65	4.50	2.66	3	6	7
Libya	--	419	1,992	--	.63	2.55	--	23	8
Saudi Arabia [2]	698	1,224	1,865	1.87	1.82	2.39	10	12	9
South Africa, Republic of	750	1,533	1,826	2.01	2.28	2.34	11	8	10
Iran	847	984	1,722	2.27	1.46	2.21	8	13	11
Kuwait [2]	438	1,481	1,713	1.18	2.20	2.20	16	9	12
Poland	783	1,345	1,268	2.10	[3] 2.01	1.63	9	10	13
France	907	1,328	1,103	2.44	1.98	1.42	7	11	14
Iraq	173	826	951	.46	1.24	1.22	26	15	15
Japan	466	774	884	1.25	1.15	1.13	14	16	16
Australia	386	517	881	1.04	.78	1.13	18	21	17
Chile	347	561	847	.93	.85	1.09	19	19	18
Mexico	513	644	823	1.38	.96	1.06	13	18	19
Algeria	30	407	804	.08	.61	1.03	52	24	20
Germany, East	227	942	790	.61	1.40	1.01	22	14	21
India	462	665	678	1.24	.98	.87	15	17	22
Zambia	176	360	678	.47	.54	.87	25	27	23
Indonesia	270	482	569	.72	.73	.73	20	22	24
Peru	131	339	497	.35	.51	.64	32	29	25
Czechoslovakia	232	554	462	.62	.82	.59	21	20	26
Romania	123	377	446	.33	.57	.57	33	26	27
Congo (Kinshasa)	198	255	426	.53	.38	.55	23	34	28
Abu Dhabi	--	45	342	--	.07	.44	--	64	29
Brazil	61	275	337	.16	.41	.43	46	31	30
Argentina	97	291	321	.26	.44	.41	37	30	31
Spain	192	268	311	.52	.40	.40	24	32	32
Italy	83	201	301	.22	.30	.39	38	38	33
Korea, North	15	177	288	.04	.26	.37	64	40	34
Yugoslavia	107	231	272	.29	.35	.35	36	36	35
Malaysia	154	230	253	.41	.35	.32	27	37	36
Qatar	43	155	243	.11	.23	.31	49	43	37
Sweden	147	235	228	.39	.35	.29	30	35	38
Netherlands	151	346	222	.40	.52	.28	29	28	39
Belgium	534	392	207	1.44	.59	.27	12	25	40
All others [4]	1,858	3,114	4,338	5.00	4.67	5.59	XX	XX	XX
Total	37,224	67,042	77,908	100.00	100.00	100.00	XX	XX	XX

XX Not applicable.
[1] Percentages as reported in source; some differ slightly from percentages calculated from corresponding value data in this table due to rounding of value data.
[2] Includes ½ share of value of production in Kuwait–Saudi Arabia Neutral Zone.
[3] Figure adjusted from that reported in source due to evident error in source.
[4] All figures derived by difference between sum of individually listed countries and reported total; for this reason percentages given may not be calculable from listed values.

Source: Annales des Mines, No. 1, January 1971, pp. 24–25.

Table 5.—Commodity distribution of world crude mineral production value

Commodity	Value of production (million 1968 U.S. dollars)			Commodity's share of total [1] (percent)			Commodity's rank among listed commodities		
	1950	1963	1968	1950	1963	1968	1950	1963	1968
Petroleum, crude	13,310	24,283	31,392	[2] 35.76	36.21	40.29	2	1	1
Coal, anthracite and bituminous	13,884	19,453	16,317	[2] 37.30	29.02	20.94	1	2	2
Gas, natural	657	3,678	5,053	1.76	5.47	6.49	6	4	3
Copper	1,376	2,809	4,965	3.69	4.18	6.37	4	5	4
Iron ore	1,670	4,067	4,600	4.48	6.05	5.90	3	3	5
Coal, lignite	500	2,184	1,923	1.35	3.25	2.47	10	6	6
Gold	1,374	1,743	1,619	3.69	2.60	2.08	5	7	7
Natural gas liquids	584	1,041	1,476	1.57	1.54	1.90	7	8	8
Salt	255	623	733	.69	.92	.94	13	10	9
Sulfur (excluding pyrite)	150	263	703	.40	.40	.90	17	22	10
Zinc	529	483	703	1.43	.73	.90	9	12	11
Phosphates	180	467	690	.48	.70	.89	16	15	12
Nickel	124	462	661	.33	.70	.85	19	16	13
Lead	557	469	632	1.50	.71	.81	8	14	14
Tin	450	481	618	1.20	.73	.79	11	13	15
Silver	183	359	591	.49	.54	.76	15	19	16
Diamond	124	327	560	.33	.49	.72	20	20	17
Potash	218	548	558	.59	.82	.72	14	11	18
Asbestos	138	404	517	.37	.61	.66	18	17	19
Uranium	NA	761	493	XX	1.13	.63	XX	9	20
Platinum	46	96	391	.12	.14	.50	28	26	21
Bauxite	73	264	374	.20	.40	.48	24	21	22
Manganese	276	371	351	.75	.55	.45	12	18	23
Kaolin	81	177	242	.21	.27	.31	22	24	24
Molybdenum	41	145	233	.11	.22	.30	31	25	25
Pyrite	59	197	228	.16	.30	.29	26	23	26
Other [3]	385	887	1,285	1.04	1.32	1.66	XX	XX	XX
Total	37,224	67,042	77,908	100.00	100.00	100.00	XX	XX	XX

NA Not available. XX Not applicable.

[1] Percentages as reported in source; some differ slightly from percentages calculated from corresponding value data in this table due to rounding of value data.

[2] Figure adjusted from that reported in source due to evident error in source.

[3] Commodities included are as follows, in descending order of value in 1968: tungsten, mercury, borates, talc, fluorspar, magnesite, chromite, bentonite, barite, ilmenite, natural sodium carbonate, vanadium, mica, cobalt, antimony, natural sodium sulfate, rutile, feldspar, natural nitrates, natural asphalt, graphite, zircon, columbite-tantalite, kyanite, asphaltic limestone, cryolite, and beryl. Percentage figures are derived by difference between sum of individually listed commodities and 100.00 percent; for this reason percentages given may not be calculable from listed values.

Source: Annales des Mines, No. 1, January 1971, p. 14.

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

(Million U.S. dollars)

Commodity group [1]	1965	1966	1967	1968 [r]	1969
Metals:					
All ores, concentrates and scrap	4,580	4,770	5,050	5,590	6,410
Iron and steel	9,700	9,670	10,330	11,430	13,690
Nonferrous metals	6,690	8,020	8,030	9,470	10,890
Total	20,970	22,460	23,410	26,490	30,990
Nonmetals (crude only)	1,760	1,900	2,010	2,180	2,260
Mineral fuels	17,920	18,890	20,660	23,120	24,930
Grand total	40,650	43,250	46,080	51,790	58,180
All commodities	186,390	203,400	214,190	239,140	272,710

[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; mineral fuels—SITC Section 3. Major items not included are the metals, metalloids, and metal oxides of SITC Division 52; manufactured fertilizers of SITC Division 56; and nonmetallic mineral manufactures of SITC Groups 661, 663, and 667.

Table 7.—Distribution of total value of export trade in major mineral commodity groups, by group [1]

(Percent)

Commodity group [1]	1965	1966	1967	1968 [r]	1969
Metals:					
All ores, concentrates and scrap	11.3	11.0	11.0	10.8	11.0
Iron and steel	23.9	22.4	22.4	22.1	23.5
Nonferrous metals	16.4	18.5	17.4	18.3	18.7
Total	51.6	51.9	50.8	51.2	53.2
Nonmetals (crude only)	4.3	4.4	4.4	4.2	3.9
Mineral fuels	44.1	43.7	44.8	44.6	42.9
Grand total	100.0	100.0	100.0	100.0	100.0

[r] Revised.
[1] For detailed definition of groups, see footnote 1, table 6.

Table 8.—Growth of value of export trade in major mineral commodity groups [1]

(Percent increase over previous year)

Commodity group [1]	1965	1966	1967	1968 [r]	1969
Metals:					
All ores, concentrates and scrap	4.8	4.1	5.9	10.7	14.7
Iron and steel	12.3	−.3	6.8	10.6	19.8
Nonferrous metals	18.8	19.9	.1	17.9	15.0
All metals	12.5	7.1	4.2	13.2	17.0
Nonmetals (crude only)	15.0	8.0	5.8	8.5	3.7
Mineral fuels	5.4	5.4	9.4	11.9	7.8
All major mineral commodity groups	9.3	6.4	6.5	12.4	12.3
All commodity groups	8.3	9.1	5.3	11.6	14.0

[r] Revised.
[1] For detailed definitions of groups, see footnote 1, table 6.

Table 9.—Significance of trade in major mineral commodity groups[1] to total trade of various world areas, 1969

Area and country[2]	Value, million U.S. dollars: Major mineral commodity groups[1]: Exports from	Value, million U.S. dollars: Major mineral commodity groups[1]: Exports to	Value, million U.S. dollars: All commodities: Exports from	Value, million U.S. dollars: All commodities: Exports to	Major mineral commodities' share of total (percent): Exports from	Major mineral commodities' share of total (percent): Exports to
Northern North America:						
Canada	3,535	1,674	13,750	12,420	25.7	13.5
United States	3,985	7,465	37,460	35,320	10.6	21.1
Total	7,520	9,139	51,210	47,740	14.7	19.1
Latin America	[3] 5,285	1,984	13,510	13,290	[4] 39.1	14.9
Europe:						
Non-Communist:						
EEC	11,805	17,840	75,690	72,320	15.6	24.7
EFTA	4,305	8,250	35,620	38,910	12.1	21.2
Other	1,070	2,440	7,410	12,320	14.4	19.8
Subtotal	17,180	28,530	118,720	123,550	14.5	23.1
Communist	6,375	4,770	27,500	25,240	23.2	18.9
Total	23,555	33,300	146,220	148,790	16.1	22.4
Africa:						
Republic of South Africa	[5] 98	310	2,140	2,950	[4] 4.6	10.5
Other	[6] 5,900	1,327	11,470	10,040	[4] 51.4	13.2
Total	[7] 5,998	1,637	13,610	12,990	[4] 44.1	12.6
Near East	[5] 7,660	912	9,380	7,090	[4] 81.7	12.9
South Asia and Far East:						
Non-Communist:						
Japan	[8] 2,395	5,180	15,990	12,500	[4] 15.0	41.4
Other	[3] 2,140	2,607	12,940	17,470	[4] 16.5	14.9
Subtotal	[7] 4,535	7,787	28,930	29,970	[4] 15.7	26.0
Communist	[8] 126	562	2,250	2,550	[4] 5.6	22.0
Total	[7] 4,661	8,349	31,180	32,520	[4] 14.9	25.7

Table 9.—Significance of trade in major mineral commodity groups[1] to total trade of various world areas, 1969—Continued

Area and country [2]	Value, million U.S. dollars: Major mineral commodity groups [1]		Value, million U.S. dollars: All commodities		Major mineral commodities' share of total (percent)	
	Exports from	Exports to	Exports from	Exports to	Exports from	Exports to
Australia and New Zealand	[8] 590	609	5,110	4,500	[4] 11.5	13.5
Rest of world	[9] 1,320	1,306	2,490	3,790	[4] 53.0	34.5
Not reported	[10] 1,591	944	--	2,000	([11])	47.2
Grand total	58,180	58,180	272,710	272,710	21.3	21.3

[1] For detailed definitions of groups, see footnote 1, table 6.

[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 corresponds to the United Nations category "Other Asia;" (9) Communist Far East consists of China (mainland), North Korea, Mongolia, and North Vietnam; (10) Rest of the world is taken directly from source and reportedly consists mainly of Caribbean and Pacific Islands; (11) Not reported is derived by subtracting all listed figures from reported totals.

[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, value of mineral fuels 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; see exclusions as indicated by footnotes to regional detail above.

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

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

[10] Direct arithmetic sum of the differences between world totals and individual detailed figures for each major commodity reported in source publications.

[11] Not calculable, owing to the fact that a considerable part of total dollar value of major mineral commodity exports was not distributed by specific areas and thus appears as a part of the not reported total; but in the case of total commodity trade, the total dollar value was fully distributed.

Table 10.—Export origins and destinations for major mineral commodity group[1] shipments, by value, in 1969

(Million U.S. dollars)

Area and country[2]	Exports from: Metal ores, concentrates and scrap	Exports from: Iron and steel	Exports from: Nonferrous metals	Exports from: Nonmetals	Exports from: Mineral fuels	Exports to: Metal ores, concentrates and scrap	Exports to: Iron and steel	Exports to: Nonferrous metals	Exports to: Nonmetals	Exports to: Mineral fuels
Northern North America:										
Canada	1,060	280	1,140	315	740	180	460	190	74	770
United States	710	970	860	315	1,130	940	1,810	1,620	255	2,840
Total	1,770	1,250	2,000	630	1,870	1,120	2,270	1,810	329	3,610
Latin America	940	105	1,190	([3])	3,050	47	740	320	77	800
Europe:										
Non-Communist:										
EEC	590	5,690	2,190	415	2,920	1,990	3,900	4,060	750	7,140
EFTA	415	1,730	1,520	265	640	860	1,550	2,000	330	3,510
Other[4]	145	190	310		160	170	760	310	110	1,090
Subtotal	1,150	7,610	4,020	680	3,720	3,020	6,210	6,370	1,190	11,740
Communist	620	1,950	770	325	2,710	590	1,910	550	280	1,440
Total[4]	1,770	9,560	4,790	1,005	6,430	3,610	8,120	6,920	1,470	13,180
Africa:										
Republic of South Africa	([3])	([3])	([3])	([3])	98	2	48	67	8	185
Other	465	([3])	1,720	205	3,510	14	510	98	35	670
Total[4]	465	([3])	1,720	205	3,608	16	558	165	43	855
Near East	([3])	([3])	([3])	([3])	7,660	3	395	95	24	395
South Asia and Far East:										
Non-Communist:										
Japan	([3])	2,160	185	([3])	50	1,470	165	840	165	2,540
Other	465	165	440	([3])	1,070	84	870	270	73	1,310
Subtotal[4]	465	2,325	625	([3])	1,120	1,554	1,035	1,110	238	3,850
Communist	([3])	68	41	([3])	17	17	270	160	17	98
Total	465	2,393	666	([3])	1,137	1,571	1,305	1,270	255	3,948
Australia and New Zealand	([3])	145	245	([3])	200	5	160	59	45	340
Rest of world	350	([3])	([3])	([3])	970	6	96	17	17	1,170
Not reported[4]	650	237	279	420	5	32	46	234	--	632
Grand total	6,410	13,690	10,890	2,260	24,930	6,410	13,690	10,890	2,260	24,930

[1] For detailed definitions of groups, see footnote 1, table 6.
[2] For detailed definitions of areas listed below, see footnote 2, table 9.
[3] Not listed separately for this area, presumably included under "Not reported."
[4] Not reported in source but derived from data therein.

Table 11.—Direction of trade in major mineral commodities [1] in 1969

(Million U.S. dollars)

Sources [2]	Destinations [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	835	835	489	965	387	148	1,500	31	29
Canada	2,110	XX	2,110	74	344	534	47	925	6	10
Total [3]	2,110	835	2,945	563	1,309	921	195	2,425	37	39
Latin America [5]	1,633	379	2,012	449	833	566	81	1,480	51	4
Europe:										
Non-Communist:										
EEC	828	63	891	212	6,490	2,014	521	9,025	396	193
EFTA [6]	359	71	430	79	1,485	1,271	324	3,080	208	88
Other [3]	81	4	85	16	455	285	65	805	119	15
Subtotal	1,268	138	1,406	307	8,430	3,570	910	12,910	723	296
Communist	34	11	45	165	703	477	487	1,667	3,690	64
Total [3]	1,302	149	1,451	472	9,133	4,047	1,397	14,577	4,413	360
Near East [7]	215	62	277	135	2,330	1,170	380	3,880	2	340
Africa:										
Republic of South Africa [7]	1	--	1	--	3	--	1	4	--	--
Other [8]	238	26	264	47	3,545	1,007	228	4,780	50	5
Total [3]	239	26	265	47	3,548	1,007	229	4,784	50	5
Far East and South Asia:										
Non-Communist:										
Japan [5 9]	794	58	852	200	143	42	75	260	57	93
Other	273	11	284	21	114	48	16	178	51	38
Subtotal [3]	1,067	69	1,136	221	257	90	91	438	108	131
Communist [5 9]	--	--	--	4	18	5	1	24	52	1
Total [3]	1,067	69	1,136	225	275	95	92	462	160	132
Australia and New Zealand [5 9]	39	3	42	5	33	102	11	146	1	4
Rest of world [10]	650	137	787	80	47	137	11	195	--	1
Grand total [4]	7,465	1,674	9,139	1,984	17,840	8,250	2,440	28,530	4,770	912

Sources [2]	Destinations [2]: Africa: Republic of South Africa	Africa: Other	Africa: Total [3]	Non-Communist Far East and South Asia: Japan	Non-Communist Far East and South Asia: Other	Non-Communist Far East and South Asia: Total [3]	Communist Far East	Australia and New Zealand	Rest of world	Grand total [4]
Northern North America:										
United States	19	56	75	680	272	952	--	37	35	3,985
Canada	26	3	29	285	50	335	2	39	6	3,535
Total [3]	45	59	104	965	322	1,287	2	76	41	7,520
Latin America [5]	--	12	12	344	14	358	4	1	911	5,285
Europe:										
Non-Communist:										
EEC	25	406	431	50	99	149	121	15	61	11,805
EFTA [6]	32	87	119	43	82	125	80	55	29	4,305
Other [3]	1	27	28	13	4	17	4	4	2	1,070
Subtotal	58	520	578	106	185	291	205	74	92	17,180
Communist	--	97	97	164	75	239	143	--	--	6,375
Total [3]	58	617	675	270	260	530	348	74	92	23,555
Near East [7]	150	290	440	1,680	560	2,240	--	210	67	7,660
Africa:										
Republic of South Africa [7]	XX	20	20	5	--	5	--	--	--	98
Other [8]	34	147	181	410	22	432	20	2	49	5,900
Total [3]	34	167	201	415	22	437	20	2	49	5,998
Far East and South Asia:										
Non-Communist:										
Japan [5, 9]	14	77	91	XX	585	585	188	67	11	2,395
Other	--	19	19	716	690	1,406	1	104	12	2,140
Subtotal [3]	14	96	110	716	1,275	1,991	189	171	23	4,535
Communist [5, 9]	--	4	4	22	20	42	NA	--	--	126
Total [3]	14	100	114	738	1,295	2,033	189	171	23	4,661

Table 11.—Direction of trade in major mineral commodities[1] in 1969—Continued

(Million U.S. dollars)

Sources [2]	Destinations [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]				
Australia and New Zealand [5 9]	3	3	6	216	84	300	3	60	20	590
Rest of world [10]	1	23	24	62	33	95	--	2	87	1,320
Grand total [4]	310	1,327	1,637	5,180	2,607	7,787	562	609	1,306	58,180

NA Not available. XX Not applicable.
[1] For detailed listing of commodities included, see footnote 1, table 6. It should be noted that certain commodities excluded for specific areas indicated by footnotes 5 through 10 are presumably included in grand totals.
[2] For detailed definitions of areas listed, see footnote 2, table 9.
[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] Excludes crude nonmetals; however, figures for crude nonmetals for this area are included with "Other Europe" on following line, and thus are included in subtotal for non-Communist Europe and total for Europe, as well as in "Grand total."
[7] Includes mineral fuels only.
[8] Excludes iron and steel.
[9] Excludes metal ores and scrap.
[10] Includes metal ores and scrap and mineral fuels only.

Table 12.—Iron ore consumption by selected major countries

(Million metric tons)

Countries	1968	1969	1970
European Economic Community:			
Belgium	18.6	19.4	18.7
France	41.7	43.7	45.4
Germany, West	42.9	47.7	47.2
Italy	e 9.9	10.0	10.2
Luxembourg	14.3	14.8	14.5
Netherlands	4.1	4.9	5.2
Total	131.5	140.5	141.2
European Free Trade Association:			
Austria	4.7	5.4	5.6
Norway [1]	r .8	.9	.9
Portugal	.2	.3	.3
Sweden	6.5	e 6.8	e 6.9
United Kingdom	31.0	30.4	32.0
Total	r 43.2	43.8	45.7
Other non-Communist Europe:			
Finland	1.5	1.7	1.6
Spain	5.6	6.8	e 7.6
Total	7.1	r 8.5	9.2
Communist Europe:			
Czechoslovakia e	13.1	13.2	13.2
Hungary	3.2	3.2	5.7
Poland	r 12.9	r 12.9	e 12.1
U.S.S.R. e	145.0	150.0	160.0
Yugoslavia	r 2.4	r 2.1	2.4
Total	r 176.6	r 181.4	193.4
Other:			
Japan	59.4	73.6	86.1
Turkey	r .9	1.0	e 1.2
United States	122.4	130.6	125.2
Total	182.7	205.2	212.5
Grand total	r 541.1	r 579.4	602.0

e Estimate. r Revised.
[1] Includes agglomerated products.

Source: United Nations. Quarterly Bulletin of Steel Statistics for Europe. V. 22, No. 3, 1971, except for estimates which were prepared by the U.S. Bureau of Mines from partial data in the source just cited.

Table 13.—Iron and steel scrap consumption by selected major countries

(Thousand metric tons)

Countries	1968	1969	1970
European Economic Community:			
Belgium [1 2]	2,752	3,266	3,487
France [3]	7,213	8,015	8,789
Germany, West [4]	21,671	23,479	23,684
Italy	11,827	11,623	[e] 12,273
Luxembourg	1,244	1,563	1,663
Netherlands	1,751	2,110	2,281
Total	46,458	50,056	52,177
European Free Trade Association:			
Austria [2 4]	1,326	1,525	1,551
Denmark [2]	503	527	435
Norway [3]	410	429	443
Portugal [3]	89	123	143
Sweden [1 3]	3,045	3,258	[e] 3,232
United Kingdom [1 4]	18,273	19,162	20,220
Total	23,646	25,024	26,024
Other non-Communist Europe:			
Finland	546	619	637
Spain	[e] 3,364	[e] 4,132	[e] 5,045
Total	3,910	4,751	5,682
Communist Europe:			
Czechoslovakia [3 5]	5,157	4,491	4,584
Hungary	[3] 1,552	[1 4] 1,971	[1 4] 2,000
Poland	[3] 6,031	6,373	6,488
Romania [1 4]	2,404	[e] 2,712	[e] 3,880
U.S.S.R. [6]	42,695	42,414	43,362
Yugoslavia [1 4]	1,072	1,330	1,482
Total	58,911	59,291	61,796
Other:			
Japan [4]	30,405	37,001	40,994
Turkey [1 4]	176	147	[e] 150
United States [1]	78,980	86,017	77,619
Grand total	242,486	262,287	264,442

[e] Estimate.
[1] Excludes scrap consumption by rerollers.
[2] Excludes scrap consumption by iron foundries.
[3] Scrap consumption in blast furnaces and steelworks only.
[4] Excludes scrap consumption by industries other than the iron and steel industries.
[5] U.S. Bureau of Mines estimate based on official Czechoslovakian data.
[6] Consumption in blast furnaces and open hearth steel furnaces only (excludes consumption in other types of steel furnaces, rerolling mills, iron foundries, and industries other than the iron and steel industries).

Source: Except where otherwise noted, United Nations Economic Commission for Europe. Quarterly Bulletin of Steel Statistics for Europe. V. 22, No. 4, New York, 1972.

Table 14.—Estimated world [1] consumption of major nonferrous metals

Commodity		1968	1969	1970
Aluminum [2]	thousand metric tons	[r] 8,322	[r] 8,997	9,484
Copper [3]	do	[r] 6,464	[r] 7,075	7,133
Lead [4]	do	3,159	[r] 3,448	3,526
Zinc [5]	do	[r] 4,379	[r] 4,760	4,575
Tin [6]	thousand long tons	[r] 173	181	175

[r] Revised.
[1] In general, figures are totals for major consuming countries only; sum of consumption by excluded minor consumers may be significant; 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 International Tin Council. Communist countries (except Yugoslavia) are excluded; consumption of primary and secondary tin by these countries is estimated at about 60,000 tons annually.

Source: Yearbook of the American Bureau of Metal Statistics. Fiftieth Annual Issue for the Year 1970. New York, 1971, 148 pp.

Table 15.—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	Total energy: Per capita (kilograms)
North America:						
1965	448	795	657	40	1,940	9,053
1966	471	834	707	42	2,053	9,460
1967	463	875	744	46	2,128	9,686
1968	481	930	799	47	2,257	10,164
1969	489	973	861	52	2,376	10,586
Caribbean America:						
1965	4	68	26	2	100	944
1966	4	69	31	2	107	972
1967	5	74	34	2	115	1,017
1968	5	83	34	3	126	1,078
1969	6	84	36	3	129	1,075
Other America:						
1965	6	61	10	4	80	578
1966	6	65	10	5	86	602
1967	7	67	11	5	90	608
1968	7	75	12	5	99	650
1969	8	82	13	6	108	691
Western Europe:						
1965	515	463	28	39	1,045	3,050
1966	480	518	33	43	1,080	3,123
1967	459	550	41	44	1,094	3,142
1968	456	602	58	46	1,161	3,314
1969	457	663	79	46	1,246	3,525
Africa:						
1965	53	32	2	2	88	283
1966	53	36	2	2	93	288
1967	54	37	2	2	94	284
1968	56	39	2	2	99	294
1969	57	40	2	2	102	294
Near East:						
1965	6	32	6	([3])	44	481
1966	6	34	7	([3])	48	512
1967	6	38	8	([3])	52	545
1968	6	40	10	1	57	578
1969	6	43	14	1	64	634
Far East:						
1965	151	152	10	12	324	321
1966	155	174	10	14	353	340
1967	164	206	11	13	393	371
1968	169	241	12	13	436	401
1969	179	278	13	15	486	436
Oceania: [4]						
1965	32	26	([3])	2	60	3,469
1966	32	28	([3])	2	63	3,525
1967	33	30	([3])	2	66	3,633
1968	34	33	([3])	2	70	3,784
1969	35	35	([3])	3	73	3,878
Countries not elsewhere specified: [5]						
1965	1,035	291	196	16	1,538	1,444
1966	1,080	317	218	18	1,633	1,513
1967	985	342	242	17	1,585	1,450
1968	1,065	372	263	19	1,719	1,552
1969	1,119	408	284	21	1,832	1,634
World total:						
1965	2,250	1,919	933	118	5,220	1,583
1966	2,294	2,075	1,018	128	5,515	1,640
1967	2,175	2,218	1,092	132	5,616	1,640
1968	2,281	2,415	1,189	138	6,023	1,727
1969	2,357	2,608	1,303	148	6,416	1,805

[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 in space 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 revisions have not been identified as such by footnotes.

[2] Areas listed are those appearing in the 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] All figures revised from those presented in 1969 edition of this chapter.

[5] The greatest part of the consumption listed under this heading is that of Eastern Europe—Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and the U.S.S.R.

Source: United Nations. World Energy Supplies 1965–69. Statistical Papers, Series J, No. 13, New York, 1970, pp. 6–9.

Table 16.—Annual investment expenditures in the steel industry for selected countries

(Million dollars)

Country	1968	1969	1970
European Economic Community (EEC)	[1] 802	r 1,039	1,688
European Free Trade Association (EFTA) [2]	211	r 237	465
Other countries:			
Canada	NA	105	175
Finland	1	6	48
Ireland	([3])	r 5	NA
Japan [4]	1,167	1,494	1,889
Spain	213	221	253
Turkey	8	NA	31
United States	2,372	2,136	2,000

r Revised. NA Not available.

[1] Source, European Coal and Steel Commission. Investment in the Community Coal Mining and Steel Industries. Report on the 1970 Survey, 1970, p. 8.

[2] Totals given exclude expenditures, if any, for Denmark and Switzerland in every year and any non-British Steel Corp. investment in the United Kingdom.

[3] Less than ½ unit.

[4] Japanese fiscal years.

Source: Except where otherwise noted, Organization for Economic Cooperation and Development, The Iron and Steel Industry in 1970 and Trends in 1971 and previous editions of the same publication covering 1968 and 1969.

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

(Million dollars)

	1968	1969	1970
United States:			
Capital expenditures	8,350	8,175	8,225
Exploration expenses	715	725	665
Total	9,065	8,900	8,890
Other Western Hemisphere:			
Capital expenditures	2,490	2,715	2,760
Exploration expenses	265	270	275
Total	2,755	2,985	3,035
Western Europe:			
Capital expenditures	2,625	2,480	3,260
Exploration expenses	125	125	100
Total	2,750	2,605	3,360
Africa:			
Capital expenditures	785	825	790
Exploration expences	75	85	100
Total	860	910	890
Near East:			
Capital expenditures	625	730	565
Exploration expenses	50	50	50
Total	675	780	615
Far East:			
Capital expenditures	1,425	1,500	2,050
Exploration expenses	100	125	150
Total	1,525	1,625	2,200
Unspecified: Capital expenditures (no exploration expenditures)	1,600	1,950	2,475
Total:			
Capital expenditures	17,900	18,375	20,125
Exploration expenses	1,330	1,380	1,340
Total	19,230	19,755	21,465

Source: Energy Division, Chase Manhattan Bank N.A. Capital Investments of the World Petroleum Industry—1968, 1969, and 1970, pp. 20–21.

Table 18.—Non-Communist world petroleum industry capital expenditures by industry sector and exploration expenses

(Million dollars)

	1968	1969	1970
Capital expenditures:			
Production:			
Crude oil and natural gas	6,875	7,075	6,650
Natural gasoline plants	585	465	580
Pipelines	1,080	910	850
Marine	1,675	2,090	2,615
Refineries	2,950	3,210	4,000
Chemical plants	1,480	1,310	1,525
Marketing	2,665	2,805	3,220
Other	590	510	685
Total	17,900	18,375	20,125
Exploration expenses	1,330	1,380	1,340
Grand total	19,230	19,755	21,465

Source: Energy Division, Chase Manhattan Bank, N.A. Capital Investments of the World Petroleum Industry—1968, 1969, and 1970, pp. 24–25.

Table 19.—U.S. direct foreign investment in mineral industries: Value, earnings and income

(Million dollars)

Area and country	Mining, smelting and refining			Petroleum		
	Value	Earnings [1]	Income [2]	Value	Earnings [1]	Income [2]
1967 total	4,876	[r] 746	596	[r] 17,399	[r] 2,120	1,989
1968 total	5,435	[r] 795	[r] 644	18,887	[r] 2,449	[r] 2,271
1969 total	5,658	782	664	19,882	2,452	2,638
1970: [p]						
Canada	3,014	294	201	4,809	318	188
Latin America and other Western Hemisphere:						
Latin American Republics:						
Chile	455	59	62	NA	NA	NA
Venezuela	NA	NA	NA	1,734	285	283
Other	929	118	123	1,433	82	39
Subtotal	[3] 1,384	[3] 177	[3] 185	[3] 3,167	[3] 367	[3] 322
Other Western Hemisphere	652	103	106	762	49	24
Total	2,036	280	291	3,929	416	346
Europe:						
European Economic Community	15	NA	NA	2,525	22	7
United Kingdom	1	NA	NA	1,852	−12	40
Other West Europe	55	NA	NA	1,111	−25	−7
Total	71	8	--	5,488	−15	40
Africa:						
South Africa, Republic of	90	39	35	172	(4)	(4)
Other	350	58	32	1,916	594	544
Total	440	97	67	2,088	[3] 594	[3] 544
Near East	3	--	--	1,466	1,161	1,194
Far East and Pacific:						
Japan	--	--	--	540	29	6
Australia	478	70	52	737	[5] 37	[5] 25
New Zealand	4	--	--			
Other	91	−2	−1	1,066	134	98
Total	[3] 573	[3] 68	[3] 51	2,343	[5] 200	[5] 129
International shipping	--	--	--	1,667	275	164
Grand total [6]	6,137	748	609	21,790	2,950	2,603

[p] Preliminary. [r] Revised. 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; includes no figure for detail indicated as not available.

[4] Included with Australia and New Zealand below.

[5] Includes Republic of South Africa reported total.

[6] Detail may not add to totals shown because of independent rounding.

Table 20.—World merchant fleet distribution, by type[1]

	1966	1967	1968	1969	1970
Number of vessels:					
Tankers	3,610	3,740	3,895	4,071	4,232
Bulk carriers	2,039	2,368	2,609	2,748	2,954
Freighters	10,908	10,963	11,052	10,980	10,998
Other	1,746	1,729	1,805	1,771	1,796
Total	18,303	18,800	19,361	19,570	19,980
Gross tonnage:					
Tankers thousand tons	58,999	65,804	71,641	79,457	88,896
Bulk carriers do	22,350	31,644	37,596	41,746	47,199
Freighters do	61,025	61,821	62,559	62,960	63,159
Other do	12,674	12,253	12,446	12,084	12,147
Total do	155,048	171,522	184,242	196,247	211,401
Deadweight tonnage:					
Tankers do	93,022	105,542	117,135	133,421	153,075
Bulk carriers do	34,177	49,638	59,926	67,638	77,173
Freighters do	85,852	86,107	86,702	87,250	87,428
Other do	9,363	9,116	9,447	9,214	9,323
Total do	222,414	250,403	273,210	297,523	326,999

[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 21.—Distribution of world oil tanker tonnage by size groups[1]

Size group (deadweight tons)	1966		1970			
			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	28.3	18.2	1.3	1.8
25,000-45,000	25.3	25.5	27.4	17.6	2.1	3.0
45,000-65,000	21.2	21.3	22.5	14.5	.2	.3
65,000-85,000	12.7	12.8	17.1	11.0	.6	.9
85,000-105,000	6.6	6.6	15.4	9.9	.8	1.1
105,000-125,000	2.5	2.5	6.0	3.8	1.5	2.1
125,000-145,000	--	--	2.7	1.7	2.6	3.7
145,000-165,000	--	--	2.5	1.6	.6	.9
165,000-185,000	1.1	1.1	1.2	.8	--	--
185,000-205,000	--	--	3.9	2.5	.6	.9
205,000 and over	--	--	28.7	18.4	60.0	85.3
Total	[3] 99.4	100.0	155.7	100.0	70.3	100.0

[1] Includes vessels 2,000 deadweight tons and over.
[2] Excludes 20.3 million deadweight tons in bulk (multiple-cargo) carriers.
[3] Data differ slightly from total given in table 20 because of difference in source.

Source: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry. Baynard Press, London, 1966, p. 15; 1970, p. 14.

Table 22.—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
1969								
Number of transits:								
In ballast:								
Atlantic to Pacific	2	27	7	--	20	142	602	800
Pacific to Atlantic	2	898	11	--	277	141	118	1,447
Total	4	925	18	--	297	283	720	2,247
Laden:								
Atlantic to Pacific	11	993	75	32	1,075	3,029	522	5,737
Pacific to Atlantic	6	163	16	29	753	3,036	1,163	5,166
Total	17	1,156	91	61	1,828	6,065	1,685	10,903
In ballast and laden:								
Atlantic to Pacific	13	1,020	82	32	1,095	3,171	1,124	6,537
Pacific to Atlantic	8	1,061	27	29	1,030	3,177	1,281	6,613
Grand total	21	2,081	109	61	2,125	6,348	2,405	13,150
Cargo moved (thousand metric tons):								
Atlantic to Pacific	312	16,681	3,258	129	27,009	17,464	937	65,790
Pacific to Atlantic	128	1,942	392	132	14,355	17,390	2,889	37,228
Total	440	18,623	3,650	261	41,364	34,854	3,826	103,018
1970								
Number of transits:								
In ballast:								
Atlantic to Pacific	1	42	14	1	29	128	595	810
Pacific to Atlantic	--	764	--	--	219	153	116	1,252
Total	1	806	14	1	248	281	711	2,062
Laden:								
Atlantic to Pacific	--	932	99	66	1,274	3,213	630	6,214
Pacific to Atlantic	6	216	18	70	909	3,040	1,123	5,382
Total	6	1,148	117	136	2,183	6,253	1,753	11,596
In ballast and laden:								
Atlantic to Pacific	1	974	113	67	1,303	3,341	1,226	7,024
Pacific to Atlantic	6	980	18	70	1,128	3,193	1,239	6,634
Grand total	7	1,954	131	137	2,431	6,534	2,464	13,658
Cargo moved (thousand metric tons):								
Atlantic to Pacific	--	14,721	4,911	281	34,271	19,297	1,363	74,844
Pacific to Atlantic	156	3,377	569	334	17,164	16,685	2,962	41,247
Total	156	18,098	5,480	615	51,435	35,982	4,325	119,091

Source: Panama Canal Company. Annual Reports for 1969 and 1970.

Table 23.—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		
	1968	1969	1970	1968	1969	1970	1968	1969	1970
METALS									
Aluminum:									
Bauxite and alumina	1,372	1,243	1,615	416	132	157	1,788	1,375	1,772
Metal, except scrap	44	101	65	69	74	183	113	175	248
Chromium, chromite	59	14	2	119	155	161	178	169	163
Copper:									
Ore and concentrate	124	68	101	251	170	187	375	238	288
Metal, except scrap	25	30	12	684	701	666	709	731	678
Iron and steel:									
Iron ore	34	179	289	3,127	2,924	3,993	3,161	3,103	4,282
Pig iron, steel ingots and other crude forms, except scrap	2,117	1,248	1,325	49	18	19	2,166	1,266	1,344
Semimanufactures (excluding tinplate)	1,869	1,881	2,002	4,216	5,510	6,243	6,085	7,391	8,245
Lead:									
Ore and concentrate	13	19	12	127	128	170	140	147	182
Metal, except scrap	13	3	5	203	147	183	216	150	188
Manganese ore and concentrate	77	109	99	48	133	76	125	242	175
Tin:									
Ore and concentrate	--	1	2	77	89	78	77	90	80
Metal (including tinplate)	142	145	134	90	94	90	232	239	224
Zinc:									
Ore and concentrate	129	150	140	215	153	216	344	303	356
Metal, except scrap	8	19	11	129	148	153	137	167	164
Other and unclassified:									
Ore and concentrate	47	91	54	403	533	623	450	624	677
Metal, except scrap	30	35	31	78	102	118	108	137	149
Metal scrap, all metals	2,845	2,683	3,975	25	33	34	2,870	2,716	4,009
NONMETALS									
Asbestos	182	193	229	29	46	50	211	239	279
Borax	6	9	8	360	340	456	366	349	464
Cement	106	116	169	46	13	15	152	129	184
Clays and clay products:									
Fire clay and kaolin	185	230	301	15	21	35	200	251	336
Brick and tile	40	59	77	103	136	151	143	195	228
Diatomaceous earth	6	8	4	66	55	52	72	63	56
Fertilizer materials:									
Nitrogenous:									
Ammonium compounds	248	390	350	5	16	58	253	406	408
Sodium nitrate	17	21	23	449	392	388	466	413	411
Phosphatic	4,296	4,737	3,792	104	94	6	4,400	4,831	3,798
Potassic	127	155	186	654	721	509	781	876	695
Unclassified	565	636	794	13	43	184	578	679	978
Sodium compounds:									
Salt	278	196	144	320	376	512	598	572	656
Other	99	99	77	17	60	29	116	159	106
Sulfur	466	193	213	198	182	306	664	375	519

MINERAL FUELS AND RELATED MATERIALS									
Coal and coke	13,354	16,522	21,648	52	30	26	13,406	16,552	21,674
Petrochemicals	368	479	354	154	126	237	522	605	591
Petroleum:									
Crude	5,406	6,092	4,199	661	581	1,710	6,067	6,673	5,909
Refinery products	10,953	10,168	10,526	1,022	1,065	1,513	11,975	11,233	12,839
Total	45,650	48,322	52,902	14,594	15,541	19,560	60,244	63,863	72,462

Table 24.—Indexes of ocean freight rates

(1963 = 100)

	Trip charter										Time charter	
	London tanker brokers panel	West Germany		Nether-lands (general)	Norway		United Kingdom				Norway (dry cargo)	United Kingdom (dry cargo)
		Dry cargo	Tankers		Dry cargo	Tankers	General	Coal trade	Ore trade	Fertilizer trade		
1967	109	102	154	92	104	155	111	95	85	186	113	124
1968	108	100	158	[1] 94	102	142	114	92	NA	206	118	132
1969: [2]												
First quarter	91	92	111	NA	93	103	108	86	NA	190	112	133
Second quarter	83	97	102	NA	93	98	100	86	NA	140	110	141
Third quarter	90	101	136	NA	93	122	100	84	NA	168	111	127
Fourth quarter	NA	111	201	NA	101	186	109	101	NA	184	120	136
Annual average	90	100	127	NA	94	119	108	90	NA	172	114	131
1970: [2]												
First quarter	101	157	164	NA	133	180	NA	NA	NA	NA	145	NA
Second quarter	106	151	231	NA	134	215	NA	NA	NA	NA	169	NA
Third quarter	134	159	335	NA	142	322	NA	NA	NA	NA	190	NA
Fourth quarter	150	130	291	NA	132	280	NA	NA	NA	NA	174	NA
Annual average	119	146	250	NA	122	243	NA	NA	NA	NA	166	NA

NA Not available.
[1] Quarterly average for first quarter only.
[2] Quarterly figures are those for the last month in the quarter.

Source: United Nations. Monthly Bulletin of Statistics. December 1970, p. xviii; and September 1971, p. xvi.

Table 25.—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]
1968	25.583	[7] 41.847	13.012	13.500	148.151	214.460
1969	27.176	47.534	14.695	14.600	164.498	179.067
1970:						
January	28.000	55.753	16.300	15.500	179.738	187.650
February	28.000	56.000	16.300	15.500	175.208	189.579
March	28.000	56.000	16.300	15.500	177.113	188.848
April	28.591	49.300	16.300	15.500	183.875	185.286
May	29.000	59.700	16.300	15.500	180.563	167.000
June	29.000	59.700	16.300	15.500	170.284	163.936
July	29.000	59.600	15.482	15.500	164.773	168.659
August	29.000	59.600	14.895	15.333	174.429	179.767
September	29.000	59.600	14.318	15.000	174.738	180.162
October	29.000	58.500	14.300	15.000	173.625	174.581
November	29.000	55.600	14.300	15.000	172.250	176.035
December	29.000	52.600	13.936	15.000	163.864	163.477
Annual average	28.716	57.700	15.419	15.319	174.205	177.085

[1] Unalloyed ingot, 99.5 percent, delivered United States.
[2] Electrolytic copper, domestic refineries, Atlantic Seaboard.
[3] Refined lead, St. Louis.
[4] Prime Western slab, f.o.b., East St. Louis.
[5] Straits tin, New York.
[6] Cents per troy ounce, 0.999 fine, New York.
[7] Based on last 9 months of 1968.

Source: Yearbook of the American Bureau of Metal Statistics. Fiftieth Annual Issue for the year 1970. New York, New York, 1971, 148 pp.

Table 26.—Nonferrous metal prices in the United Kingdom

(Average, £ per long ton unless otherwise noted) [1]

Year and month	Aluminum [2]	Copper [3]	Lead [4]	Zinc [5]	Tin [6]	Silver [7]
1968	233.981	523.975	101.796	111.175	1,323.863	219.529
1969	248.449	621.254	122.700	121.150	1,451.838	180.774
1970:						
January	256.666	677.619	135.167	125.875	1,602.571	185.881
February	256.666	690.525	139.194	123.981	1,570.850	188.800
March	256.666	730.875	139.675	123.269	1,582.150	187.575
April	259.011	725.659	133.659	122.097	1,604.955	184.227
May	261.333	666.250	130.444	121.494	1,599.000	167.813
June	261.333	607.341	128.267	121.966	1,477.409	164.125
July	261.333	568.065	125.087	123.967	1,458.609	168.777
August	261.333	527.775	118.863	124.500	1,509.100	180.200
September	261.333	519.568	118.460	124.898	1,519.545	181.591
October	261.333	476.068	118.659	123.426	1,529.500	175.568
November	261.333	452.190	116.536	121.661	1,507.619	176.589
December	261.333	435.682	115.165	120.398	1,457.864	163.665
Annual average	259.973	587.902	126.427	123.120	1,530.384	177.068

[1] London Metal Exchange, average settlement prices.
[2] Ingots, 99.5 percent.
[3] Electrolytic wirebars.
[4] Refined pig lead, 99.97 percent.
[5] Virgin zinc, 98 percent.
[6] Standard tin.
[7] Pence per troy ounce, 0.999 fine.

Table 27.—Nonferrous metal prices in Canada

(Average, Canadian cents per pound unless otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [3]	Silver [4]
1968	27.07	48.020	13.443	13.500	230.557
1969	28.70	50.794	15.163	14.642	192.803
1970:					
January	29.50	57.000	16.500	15.500	201.300
February	29.50	57.000	16.500	15.500	203.370
March	29.50	59.000	16.500	15.500	202.576
April	29.50	59.000	16.500	15.500	198.773
May	29.50	59.000	16.500	15.500	178.100
June	29.50	59.000	16.500	15.500	170.250
July	29.50	59.000	16.114	15.500	174.095
August	29.50	59.000	15.643	15.357	183.676
September	29.50	59.000	15.500	15.000	183.071
October	29.50	58.433	14.500	15.000	178.310
November	29.50	57.300	14.500	15.000	179.000
December	29.50	54.072	14.500	15.000	166.327
Annual average	29.50	58.067	15.813	15.321	184.904

[1] Ingot 99.5 percent, f.o.b. delivered 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] Canadian cents per troy ounce, average price of Cominco Ltd.

Source: Yearbook of the American Bureau of Metal Statistics. Fiftieth Annual Issue for the year 1970. New York, New York, 1971, 148 pp.

Table 28.—Mineral commodity export price indexes

(1963=100)

Year and quarter	Metal ores	Fuels	All crude minerals
1968	108	100	102
1969	114	100	104
1970:			
First quarter	124	103	108
Second quarter	122	104	108
Third quarter	121	106	110
Fourth quarter	121	108	110
Annual average	122	105	109

Source: United Nations. Monthly Bulletin of Statistics. New York, September 1971, p. xiii.

Table 29.—Analysis of export price indexes

(1963=100)

Year and quarter	Developed areas		Less developed areas	
	Total minerals	Nonferrous base metals	Total minerals	Nonferrous base metals
1968	104	142	102	165
1969	107	158	103	187
1970:				
First quarter	118	176	104	211
Second quarter	120	174	104	205
Third quarter	124	162	104	181
Fourth quarter	126	154	104	166
Annual average	122	167	104	191

Source: United Nations. Monthly Bulletin of Statistics. New York, September 1971, p. xiii.

Table 30.—Leading world producers of bauxite

(Gross weight, thousand metric tons)

Country	1968	1969	1970 p
Jamaica	8,525	10,499	12,009
Australia	r 4,955	7,924	9,389
Surinam	r 5,658	5,450	e 5,340
U.S.S.R. e 1	5,000	5,000	5,000
Guyana	3,722	4,306	e 4,560
France	2,713	2,773	2,992
Guinea	r 2,117	2,459	e 2,600
Greece	r 1,836	1,916	2,278
United States	1,691	1,872	2,115
Yugoslavia	2,072	2,128	2,099
Hungary	1,959	1,935	2,022
Total	r 40,248	46,262	50,404
All others	r 5,753	6,396	7,564
Grand total	r 46,001	52,658	57,968

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

Table 31.—Leading world producers of aluminum

(Thousand metric tons)

Country	1968	1969	1970 p
United States	2,953	3,441	3,607
U.S.S.R. e	1,000	1,050	1,100
Canada	888	996	965
Japan	482	569	733
Norway	468	507	530
France	366	372	380
Germany, West	257	263	309
Australia	97	126	204
India	120	131	161
Italy	142	142	146
China, mainland e	r 90	120	130
Total	6,863	7,717	8,265
All others	1,156	1,291	1,407
Grand total	r 8,019	9,008	9,672

e Estimate. p Preliminary. r Revised.

Table 32.—Leading world producers of mine copper

(Copper content of ore, thousand metric tons)

Country	1968	1969	1970 p
United States 1	r 1,093	1,401	1,560
Chile	667	699	686
Zambia	665	748	683
Canada 1	r 575	520	613
U.S.S.R. e	r 520	550	570
Congo (Kinshasa)	325	357	386
Peru	213	199	212
Australia	109	131	146
Philippines	110	131	145
South Africa, Republic of	r 128	126	149
Japan	120	121	124
Total	r 4,525	4,983	5,274
All others	r 589	645	676
Grand total	r 5,114	5,628	5,950

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

Table 33.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates

(Thousand metric tons)

Country	1968	1969	1970 p
U.S.S.R.	176,616	186,134	194,200
United States	r 87,243	89,746	91,201
France	55,238	55,425	56,800
Australia	r 26,625	39,094	51,104
Canada	r 43,040	36,337	48,271
China, mainland e	38,000	40,000	44,000
Brazil	25,123	e 33,000	e 40,200
Sweden	r 32,419	33,185	31,774
India	27,433	29,564	30,780
Liberia	19,571	22,866	22,294
Venezuela	16,190	19,716	22,200
United Kingdom	r 13,936	12,298	12,018
Chile	11,916	11,534	11,265
Total	r 573,350	608,899	656,107
All others	105,897	109,957	110,582
Grand total	679,247	718,856	766,689

e Estimate. p Preliminary. r Revised.

Table 34.—Leading world producers of steel ingots and castings

(Thousand metric tons)

Country	1968	1969	1970 p
United States	119,260	128,151	119,308
U.S.S.R.	106,537	110,328	116,000
Japan	r 66,893	82,166	93,322
Germany, West	41,159	45,316	45,041
United Kingdom	r 26,277	26,846	28,316
France	r 20,409	22,511	23,773
Italy	16,964	16,428	17,277
China, mainland e	15,000	16,000	17,000
Belgium	11,568	12,832	12,607
Poland	11,007	11,291	11,792
Czechoslovakia	10,555	10,802	11,480
Canada	10,207	9,350	11,200
Spain	4,924	6,005	7,388
Australia	6,502	7,017	6,822
Romania	4,751	5,540	6,517
Total	r 472,013	510,583	527,843
All others	r 57,482	63,243	65,896
Grand total	r 529,495	573,826	593,739

e Estimate. p Preliminary. r Revised.

Table 35.—Leading world producers of mine lead

(Lead content of ore, recoverable where indicated, thousand metric tons)

Country	1968	1969	1970
United States [1]	326	462	519
Australia	389	451	450
U.S.S.R. e	420	440	440
Canada	327	300	358
Mexico [1]	174	171	177
Peru [1]	155	155	155
Yugoslavia	112	118	127
Bulgaria	94	91	e 120
China, mainland e	100	100	100
Total	2,097	2,288	2,446
All others	915	950	959
Grand total	r 3,012	3,238	3,405

e Estimate. r Revised.
[1] Recoverable.

Table 36.—Leading world producers of manganese ore

(Thousand metric tons)

Country	1968	1969	1970 p
U.S.S.R.	6,564	6,551	e 7,000
South Africa, Republic of	1,972	2,204	2,679
Brazil	r 1,680	1,965	1,929
India	1,602	1,485	1,651
Gabon	r 1,255	1,363	1,453
China, mainland e	900	1,000	1,000
Australia	r 744	922	804
Ghana (dry weight)	413	333	405
Congo (Kinshasa)	322	311	347
Mexico	59	144	274
Japan	312	301	271
Total	r 15,823	16,579	17,813
All others	r 1,076	835	684
Grand total	r 16,899	17,414	18,497

e Estimate. p Preliminary. r Revised.

Table 37.—Leading world producers of mine tin

(Tin content of ore, long tons)

Country	1968	1969	1970 p
Malaysia	75,069	72,167	72,628
Bolivia	r 29,101	29,572	28,916
U.S.S.R.[1]	26,000	27,000	27,000
Thailand	r 23,601	20,759	21,140
China, mainland [1]	20,000	20,000	20,000
Indonesia	r 16,671	17,138	18,761
Australia	r 6,537	8,013	8,735
Nigeria	r 9,649	8,603	7,833
Total	r 206,628	203,252	205,013
All others	r 21,704	20,827	21,556
Grand total	r 228,332	224,079	226,569

p Preliminary. r Revised.
1 Estimated smelter production.

Table 38.—Leading world producers of mine zinc

(Zinc content of ore, thousand metric tons)

Country	1968	1969	1970 p
Canada	1,155	1,194	1,239
U.S.S.R.e	r 540	610	610
United States	480	502	485
Australia	422	507	484
Peru	291	300	317
Japan	264	269	280
Mexico	240	253	264
Poland	r 164	171	e 190
Korea, North e	120	125	130
Germany, West	110	111	123
Italy	140	132	109
Congo (Kinshasa)	r 108	86	105
Yugoslavia	95	97	101
China, mainland e	100	100	100
Total	r 4,229	4,457	4,537
All others	r 746	888	962
Grand total	r 4,975	5,345	5,499

e Estimate. p Preliminary. r Revised.

Table 39.—Leading world producers of hydraulic cement

(Thousand metric tons)

Country	1968	1969	1970 [p]
U.S.S.R.	87,512	89,740	95,200
United States (including Puerto Rico)	[r] 70,274	71,060	69,367
Japan	[r] 47,677	51,387	57,189
Germany, West	[r] 33,443	35,078	38,325
Italy	[r] 29,465	31,498	33,128
France	[r] 25,393	27,543	28,900
United Kingdom	17,873	17,422	17,053
Spain (includes Canary Islands)	[r] 14,954	15,774	16,536
India	11,940	13,260	13,543
Poland	11,600	11,830	12,180
China, mainland [e]	9,000	10,000	10,000
Brazil	7,281	7,823	9,002
Romania	7,026	7,515	8,127
Germany, East	7,551	7,410	[e] 7,500
Czechoslovakia	6,493	6,733	7,401
Canada	7,408	7,484	7,316
Mexico	6,126	6,787	7,126
Total	[r] 401,016	418,344	437,893
All others	[r] 114,331	123,988	133,455
Grand total	[r] 515,347	542,332	571,348

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

Table 40.—Leading world producers of nitrogen fertilizer compounds

(Thousand metric tons of contained nitrogen)

Country	1968 [1]	1969 [1]	1970 [1] [p]
United States (including Puerto Rico)	6,607	7,139	7,632
U.S.S.R.	3,753	4,177	4,509
Japan	2,035	2,099	2,152
Germany, West	1,559	1,598	1,574
France	1,233	1,366	1,313
China, mainland	850	940	[e] 1,089
Italy	1,096	1,089	960
Poland	594	759	938
Netherlands	849	954	906
India	403	563	731
Total	18,979	20,684	21,804
All others	6,865	8,026	8,796
Grand total	25,844	28,710	30,600

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

Table 41.—Leading world producers of phosphate rock [1]

(Thousand metric tons)

Country	1968	1969	1970 [p]
United States	37,422	34,224	35,143
U.S.S.R. [e] [2]	17,700	19,250	20,400
Morocco	10,512	10,662	11,399
Tunisia	3,444	2,685	3,016
Nauru Island [3]	2,254	2,198	2,200
Total	71,332	69,019	72,158
All others	[r] 12,669	12,690	13,050
Grand total	[r] 84,001	81,709	85,208

[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 42.—Leading world producers of marketable potash

(Thousand metric tons K_2O equivalent)

Country	1968	1969	1970 p
U.S.S.R.	3,120	e 3,180	e 4,450
Canada	r 2,695	3,168	3,106
Germany, West	2,561	2,626	2,645
United States	r 2,469	2,544	2,476
Germany, East	2,293	2,346	e 2,400
France	1,857	1,938	e 1,914
Total	r 14,995	15,802	16,991
All others	r 1,214	1,262	1,595
Grand total	r 16,209	17,064	18,586

e Estimate. p Preliminary. r Revised.

Table 43.—Leading world producers of pyrite

(Gross weight, thousand metric tons)

Country	1968	1969	1970 p
U.S.S.R. e	3,500	3,500	4,000
Japan	r 2,916	2,966	2,751
Spain	2,403	2,474	2,736
China, mainland e	1,500	1,800	2,000
Italy	1,406	1,474	1,518
Finland	774	855	963
Cyprus	r 1,050	927	871
South Africa, Republic of	704	837	868
Norway	693	767	747
Romania	e 360	e 360	807
Sweden	474	495	575
Germany, West	616	640	554
Total	16,396	17,095	18,390
All others	4,699	3,836	3,772
Grand total	r 21,095	20,931	22,162

e Estimate. p Preliminary. r Revised.

Table 44.—Leading world producers of salt

(Thousand metric tons)

Country	1968	1969	1970 p
United States (including Puerto Rico)	37,472	40,167	41,582
China, mainland e	15,000	15,000	16,000
U.S.S.R.	11,000	12,000	e 13,000
Germany, West	7,558	8,359	9,932
United Kingdom	7,755	8,727	9,188
India (including Goa)	5,044	6,380	5,588
France	4,442	4,882	e 5,084
Canada	4,413	4,225	4,583
Italy	3,918	3,947	4,367
Mexico	3,598	3,889	4,153
Poland	2,632	2,817	2,903
Netherlands	2,413	2,669	2,869
Romania	2,368	e 2,400	2,862
Germany, East	1,970	1,972	e 2,060
Spain	1,820	1,847	e 1,900
Brazil	1,248	1,629	1,823
Australia	914	1,680	e 1,700
Total	113,565	122,590	129,594
All others	12,690	13,174	13,043
Grand total	126,255	135,764	142,637

e Estimate. p Preliminary.

Table 45.—Leading world producers of elemental sulfur

(Thousand metric tons)

Country	1968	1969	1970 [p]
United States	8,955	8,698	8,668
Canada	[r] 3,201	3,860	4,442
Poland	[r] 1,337	1,981	[e] 2,684
France	[r] 1,635	1,732	1,733
U.S.S.R. [e]	1,500	1,600	1,600
Mexico	1,685	1,716	1,380
Japan	336	348	340
China, mainland [e]	250	250	250
Germany, West	127	129	176
Italy	131	124	117
Total	[r] 19,157	20,438	21,390
All others	[r] 635	667	683
Grand total	[r] 19,792	21,105	22,073

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

Table 46.—Leading world producers of coal (all grades)

(Million metric tons)

Country	1968			1969			1970 [p]		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
U.S.S.R. [1]	138	456	594	140	467	607	[e] 150	[e] 474	[e] 624
United States	4	501	505	5	513	518	5	550	555
China, mainland [e]	(2)	[r] 300	300	(2)	330	330	(2)	360	360
Germany, East	247	2	249	255	1	256	261	1	262
Germany, West	102	[3] 112	214	108	[3] 112	220	108	[3] 113	221
Poland	27	129	156	31	134	165	33	140	173
United Kingdom	--	167	167	--	153	153	--	145	145
Czechoslovakia	75	26	101	80	27	107	81	28	109
India	4	71	75	4	75	79	4	72	76
Australia	23	41	64	23	46	69	24	49	73
South Africa, Republic of	--	52	52	--	53	53	--	60	60
Japan	(4)	47	47	(4)	45	45	(4)	40	40
France	3	42	45	3	41	44	3	37	40
Bulgaria	[r] 28	(4)	[r] 28	29	(4)	29	29	(4)	29
Yugoslavia	26	1	27	26	1	27	28	1	29
Hungary	23	4	27	22	4	26	24	4	28
Korea, North [e]	(2)	23	23	(2)	25	25	(2)	27	27
Total	[r] 700	[r] 1,974	[r] 2,674	726	2,027	2,753	750	2,101	2,851
All others	[r] 34	[r] 92	[r] 126	34	90	124	37	95	132
Grand total	[r] 734	[r] 2,066	[r] 2,800	760	2,117	2,877	787	2,196	2,983

[e] Estimate. [p] Preliminary. [r] Revised.
[1] Excludes output from U.S.S.R. controlled portion of Svalbard (Spitzbergen).
[2] Output small, included under bituminous and anthracite.
[3] Includes pech coal.
[4] Less than ½ unit.

Table 47.—Leading world producers of marketed natural gas

(Billion cubic feet)

Country	1968	1969	1970 p
United States	19,322	20,698	21,921
U.S.S.R.	r 6,032	6,457	7,063
Canada	1,692	1,978	2,295
Netherlands	r 487	763	1,107
Romania	r 768	843	875
Mexico	r 371	417	481
Italy	368	422	464
Germany, West	r 224	311	e 440
Iran	56	98	396
United Kingdom	71	179	392
Venezuela	301	314	349
France	r 198	230	243
Argentina	189	188	212
Kuwait	176	192	204
Total	r 30,255	33,090	36,442
All others	r 1,079	1,290	1,465
Grand total	r 31,334	34,380	37,907

e Estimate. p Preliminary. r Revised.

Table 48.—Leading world producers of crude oil

(Million 42-gallon barrels)

Country	1968	1969	1970 p
United States	3,329	3,372	3,517
U.S.S.R.	r 2,272	2,413	2,595
Iran	1,039	1,232	1,397
Saudi Arabia	r 1,114	1,174	1,387
Venezuela	1,319	1,312	1,353
Libya	r 951	1,134	1,209
Kuwait	r 964	1,022	1,090
Iraq	r 549	555	570
Canada	379	411	461
Nigeria	52	197	396
Algeria	r 331	345	372
Indonesia	220	271	312
Trucial States	182	223	284
Mexico	142	150	157
China, mainland e	r 72	106	146
Argentina	125	130	143
Qatar	124	130	132
Oman	88	120	121
United Arab Republic	62	90	119
Romania	r 101	101	102
Total	r 13,415	14,488	15,863
All others	r 678	726	827
Grand total	14,093	15,214	16,690

e Estimate. p Preliminary. r Revised.

Table 49.—Major world trade in bauxite and alumina [1]

(Thousand metric tons)

Source countries	1969 production by source country [2]	1969 export by source country [2]	Recipient countries [3]: United States	Canada	Austria	France	West Germany	Italy	Norway	Sweden	United Kingdom	U.S.S.R.	Japan	Selected other [4]
Bauxite:														
Australia	7,924	NA	--	70	--	316	542	--	--	--	--	--	1,558	196
Dominican Republic	1,093	NA	1,133	--	--	--	--	--	--	--	--	--	--	--
France	2,773	148	--	--	--	XX	77	--	--	--	71	--	--	3
Ghana	270	288	--	--	--	--	--	--	--	--	278	--	--	--
Greece	1,916	1,309	22	--	--	84	298	--	22	40	75	529	11	146
Guinea	2,459	NA	17	19	--	--	--	28	--	--	--	44	--	--
Guyana	4,306	2,635	516	1,760	--	47	58	36	--	6	9	--	65	71
Haiti	665	NA	696	--	--	--	--	--	--	--	--	--	--	--
Hungary	1,935	656	--	--	7	--	80	--	--	--	--	--	--	--
India	992	55	--	14	--	--	8	59	--	--	24	--	31	10
Indonesia	765	838	--	--	--	--	--	70	--	--	--	--	768	--
Jamaica	10,499	7,723	8,626	533	--	--	--	--	--	--	--	--	--	--
Malaysia	1,073	877	--	106	--	--	--	--	--	--	--	--	669	--
Sierra Leone	454	442	--	--	--	--	346	76	--	--	--	--	--	--
Surinam	5,450	3,678	2,887	503	18	32	41	7	--	--	25	--	14	--
United States	1,872	3	XX	218	--	--	--	--	--	3	--	--	--	4
Yugoslavia	2,128	1,983	--	--	--	--	571	282	--	--	--	827	--	--
Other and not specified	11,394	NA	350	1	1	1	3	30	(5)	19	1	--	6	20
Total	57,968	NA	14,247	3,224	26	480	2,019	588	22	68	478	1,400	3,122	450
Alumina:														
Australia	1,931	NA	1,188	70	11	--	--	--	--	--	--	--	220	--
Canada	e 1,000	18	164	XX	--	2	--	1	--	--	2	--	--	--
France	1,106	287	(5)	--	--	XX	3	34	4	--	1	29	--	176
Germany, West	680	108	1	(5)	101	2	XX	2	2	14	2	--	1	30
Greece	300	119	(5)	--	--	--	--	28	--	--	--	38	--	25
Guinea	572	NA	--	--	17	--	68	--	179	--	1	5	--	96
Guyana	303	301	--	129	--	--	--	--	96	32	--	--	--	39
Hungary	408	383	--	--	31	--	--	--	--	--	--	169	--	5
Jamaica	1,155	1,196	94	533	--	--	--	--	335	87	--	--	--	16
Japan	1,064	113	62	--	--	--	--	--	--	--	--	--	XX	3
Surinam	e 967	856	365	20	--	--	10	--	145	--	--	--	--	140
United States	6,654	1,349	XX	212	--	1	4	3	202	13	1	354	1	1
Yugoslavia	122	24	--	--	23	--	--	--	--	--	--	--	--	1
Other and not specified	3,272	NA	3	(5)	11	1	1	5	24	2	2	1	1	30
Total	19,534	NA	1,877	964	194	6	86	73	987	148	9	596	223	562

e Estimate. NA Not available. XX Not applicable.

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

[2] As reported in latest country chapter of Minerals Yearbook, V. III. 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. 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, 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 the Statistical Office of the United Nations except for U.S.S.R. figures which were obtained from official Soviet sources.

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

[5] Less than ½ unit.

Table 50.—Major world trade [1] in unrefined and refined unwrought copper in 1969

(Thousand metric tons)

Source countries	Destinations							
	Belgium-Luxembourg	Brazil	Czechoslovakia	France	Germany		Italy	Japan
					East	West		
Belgium-Luxembourg	XX	2	--	101	(2)	52	24	--
Canada	1	2	--	14	--	10	2	--
Chile	12	8	--	43	--	52	63	56
Congo (Kinshasha) [3]	246	--	--	31	--	3	37	13
Germany, West	7	2	--	21	--	XX	2	--
Peru	14	--	--	1	--	18	(2)	15
U.S.S.R.	--	--	38	--	--	(2)	--	--
United Kingdom	2	(2)	1	7	(2)	30	16	--
United States	3	15	--	15	--	26	34	14
Zambia	(2)	8	2	70	--	96	77	182
Other and unspecified [4]	15	--	--	17	--	53	5	20
Total	300	37	41	320	(2)	340	260	300

Source countries	Destinations							
	Netherlands	Spain	Sweden	Switzerland	United Kingdom	United States	Other and unspecified	Total
Belgium-Luxembourg	39	9	11	10	1	(2)	12	261
Canada	2	1	1	1	73	76	8	191
Chile	75	23	25	--	110	102	16	585
Congo (Kinshasha) [3]	4	--	--	--	3	--	4	341
Germany, West	5	1	--	10	14	4	35	101
Peru	18	(2)	--	--	2	97	4	169
U.S.S.R.	2	--	--	--	--	--	67	107
United Kingdom	13	2	2	1	XX	--	33	107
United States	8	2	4	2	22	XX	41	186
Zambia	6	17	17	10	190	2	49	726
Other and unspecified [4]	11	2	2	4	42	8	37	216
Total	183	57	62	38	457	289	306	2,990

XX Not applicable.
[1] Data are compiled chiefly from export statistics for countries listed as source countries in stub of table.
[2] Less than ½ unit.
[3] Import statistics of listed trading partners.
[4] Includes the following countries (total exports in thousand tons in parentheses following country name): Australia (42); Austria (6); Denmark (1); Finland (6); France (18); Italy (5); Japan (15); the Netherlands (9); New Zealand (4); Norway (30); Sweden (39); Switzerland (4); Turkey (7); Yugoslavia (18).

Table 51.—Major world trade in iron ores, concentrates, and agglomerates (excluding roasted pyrite)[1] in 1969

(Thousand metric tons)

Source country	Recorded total 1969 export of source country [2]	Recorded imports of principal recipient countries [3]: Canada	United States	Belgium-Luxembourg	Czechoslovakia	France	Germany, West	Hungary
Algeria	2,765	--	--	372	--	39	13	--
Angola	5,109	--	51	73	--	261	2,182	--
Australia	26,871	--	320	579	--	443	824	--
Brazil	21,478	177	1,252	1,344	135	1,465	6,382	--
Canada	28,354	XX	19,284	7	--	32	2,057	--
Chile	9,645	41	1,811	--	--	--	153	--
France	18,515	--	--	13,284	--	XX	5,276	--
India	20,425	--	--	380	810	--	84	151
Liberia	[4] 21,700	--	3,195	1,178	--	1,222	6,666	--
Malaysia	5,347	--	--	--	--	--	--	--
Mauritania	8,576	28	--	1,093	--	1,757	1,237	--
Norway	2,732	--	273	79	--	19	1,436	--
Peru	9,041	--	1,019	--	--	354	55	--
Philippines	1,625	--	11	--	--	--	--	--
Sierra Leone	2,417	--	--	--	--	10	543	--
South Africa, Republic of [5]	4,739	--	--	--	--	--	8	--
Spain	1,676	--	--	--	--	243	796	--
Sweden	31,713	--	158	9,044	372	1,083	13,582	--
U.S.S.R.	33,071	--	--	--	9,100	--	41	2,763
United States	5,243	2,031	XX	--	--	--	--	--
Venezuela	18,992	20	13,972	49	--	--	1,734	--
Other countries and origin unreported [6]	3,852	--	41	35	299	13	352	--
Total	283,886	2,297	41,387	27,517	10,716	6,941	43,421	2,914

Source country	Recorded imports of principal recipient countries [3]: Italy	Netherlands	Poland	Romania	United Kingdom	Other Europe [7]	Japan	Total of listed imports
Algeria	820	--	485	--	206	19	--	1,954
Angola	--	--	--	--	335	119	1,996	5,017
Australia	734	160	--	--	308	42	23,235	26,645
Brazil	1,255	515	134	--	1,038	1,627	4,185	19,509
Canada	1,185	1,010	--	--	2,942	77	2,044	28,638
Chile	--	--	--	--	--	--	7,769	9,774
France	--	--	--	--	26	--	--	18,586
India	--	8	348	--	11	256	13,633	15,681
Liberia	2,197	1,342	--	--	1,527	417	2,300	20,044
Malaysia	--	--	--	--	--	--	5,352	5,352
Mauritania	1,157	260	--	--	1,988	228	491	8,239
Norway	--	524	89	--	2,074	418	--	4,912
Peru	212	--	--	--	--	--	8,623	10,263
Philippines	--	--	--	--	--	--	1,612	1,623

Sierra Leone	20	581	--	--	378	--	788	2,320
South Africa, Republic of [5]	100	--	--	--	--	--	4,670	4,778
Spain	--	--	--	--	541	36	--	1,616
Sweden	304	562	499	--	3,473	779	146	30,002
U.S.S.R.	1,012	--	9,994	[8] 3,832	1,378	2,812	1,211	32,143
United States	--	--	--	--	--	--	3,153	5,184
Venezuela	1,211	--	--	--	1,553	--	--	18,539
Other countries and origin unreported [6]	751	--	26	[9] 1,557	490	431	2,037	6,032
Total	10,958	4,962	11,575	5,389	18,268	7,261	83,245	276,851

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 7. Only in the cases of India (where recorded exports exceed recorded receipts by 4,741,000 tons) and Norway (where recorded exports total 2,180,000 tons less than reported receipts) are there indications that there may be an error in available information.

[2] Source: Official trade returns of countries listed, except for Angola, Liberia, and Mauritania (data from Annales des Mines, October 1971, pp. 43–72) and Australia and India (data from Government publications of the respective countries other than official trade returns).

[3] Source: Statistical Office of the United Nations. 1969 World Trade Annual V. I, Walker and Company, New York 1970, pp. 161–162, except for data on Czechoslovakia, 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.

[4] Data are for year ending August 31, 1969.

[5] Includes exports from Swaziland.

[6] Recorded 1969 export total is a total of exports from the following countries (exports for each follow the country name in parentheses in thousand tons): Austria (4); Belgium-Luxembourg (66); Bolivia (2); China, mainland (15—Japanese imports only); Denmark (24); Finland (226); Germany, West (17); Ghana (1); Hong Kong (166); Korea, North (544—Japanese imports only); Korea, Republic of (South) (673); Morocco (868); Netherlands (8); Poland (2); Sudan (9); Thailand (497); Tunisia (567); Turkey (9); Yugoslavia (154). Recorded imports of principal recipient countries include receipts from the foregoing list of countries as well as receipts credited to the following countries for which either: 1) no iron ore export was recorded in 1969 trade returns; or 2) trade returns for 1969 were not available: Iran, Libya, Mozamdia, Nigeria, Senegal.

[7] Includes the following countries with recorded total imports as indicated in parentheses in thousand tons: Austria (1,605); Finland (1,207); East Germany (2,464); Greece (471); Norway (47); Portugal (148); Spain (979); Sweden (47); Switzerland (29); Yugoslavia (264).

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

[9] Figure derived by difference between total reported Romanian import and U.S.S.R. export to Romania; origin unreported.

Table 52.—Major world trade in steel ingots and semimanufactures in 1969, by area

(Thousand metric tons)

Exporting country and area	Destinations [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	476.5	31.2	11.4	32.8	3.6	--
United States	919.1	XX	1,081.7	1,081.7	359.1	433.8	111.2
Total	919.1	476.5	1,112.9	1,093.1	391.9	437.4	111.2
Europe:							
European Economic Community:							
Belgium-Luxembourg	119.0	1,314.0	285.0	8,649.0	1,078.0	396.0	86.0
France	71.6	930.9	199.0	2,986.9	1,011.0	239.4	230.2
Germany, West	169.0	1,693.6	367.6	5,548.9	2,099.5	553.2	1,219.7
Italy	8.4	132.0	88.7	617.4	210.4	98.9	226.6
Netherlands	.2	364.3	36.2	1,676.1	847.2	87.0	44.7
Subtotal	368.2	4,434.8	976.5	19,478.3	5,246.1	1,374.5	1,807.2
European Free Trade Association:							
Austria	13.6	17.3	15.6	821.1	267.0	34.9	311.7
Denmark	--	--	.5	102.7	134.4	5.9	1.4
Norway	.1	2.2	3.2	122.7	306.5	32.6	2.0
Portugal	--	3.3	(6)	2.1	6.2	6.5	--
Sweden	15.9	78.4	26.6	458.0	593.1	121.7	91.7
Switzerland [7]	1.5	10.7	.9	56.3	31.0	4.3	.7
United Kingdom	138.0	786.6	259.2	515.6	577.5	599.0	94.3
Subtotal	169.1	898.5	306.0	2,078.5	1,915.7	804.9	501.8
Other non-Communist Europe:							
Finland	.1	3.0	1.3	69.2	164.9	1.4	.4
Greece	--	5.3	(6)	19.6	12.6	22.6	113.0
Spain	(6)	11.1	38.3	61.2	39.4	1.7	9.3
Subtotal	.1	19.4	39.6	150.0	216.9	25.7	122.7
European Communist Countries:							
Bulgaria	--	--	6.2	172.7	78.0	10.0	238.6
Czechoslovakia	101.6	23.8	7.2	584.7	397.4	83.3	962.1
Germany, East [8]	--	2.0	--	8.8	11.4	12.3	70.6
Hungary	--	--	(6)	186.4	163.5	43.0	243.7
Poland	11.9	125.8	139.7	127.3	121.4	22.1	777.4
Romania	--	--	7.5	205.6	9.3	5.0	621.7
U.S.S.R.	11.3	--	190.3	57.6	134.4	243.8	5,549.9
Yugoslavia	--	2.6	7.9	87.1	9.1	10.4	157.4

Subtotal	124.8	154.2	358.8	1,430.2	924.5	429.9	8,621.4
Total	662.2	5,506.9	1,680.9	23,137.0	8,303.2	2,635.0	11,053.1
Africa: South Africa, Republic of	2.3	42.1	39.0	45.6	18.6	44.9	--
South Asia and Far East:							
India [9]	.1	45.2	.3	9.8	21.9	8.5	186.1
Japan	400.0	5,272.0	1,445.0	1,037.0	139.0	542.0	407.0
Total	400.1	5,317.2	1,445.3	1,046.8	160.9	550.5	593.1
Oceania: Australia	17.4	132.4	9.8	6.6	125.2	52.9	--
Grand total	2,001.1	11,475.1	4,287.9	25,329.1	8,999.8	3,720.7	11,757.4

Exporting country and area	Destinations [1]							
	Africa	Near East [4]	South Asia and Far East			Oceania	Unallocated	Total
			Japan	Other non-Communist	Communist [5]			
North America:								
Canada	1.0	10.8	10.2	1.6	--	10.5	--	589.6
United States	90.5	56.0	7.0	616.6	--	17.2	--	4,773.9
Total	91.5	66.8	17.2	618.2	--	27.7	--	5,363.5
Europe:								
European Economic Community:								
Belgium-Luxembourg	307.0	221.0	--	110.0	9.0	8.0	--	12,582.0
France	604.4	196.2	0.1	51.3	39.4	22.0	0.2	6,582.6
Germany, West	347.0	277.9	2.9	444.4	1.5	10.6	--	12,735.8
Italy	180.9	172.5	--	52.7	59.8	21.2	10.3	1,879.8
Netherlands	132.0	27.2	.3	15.7	.1	.3	--	3,231.3
Subtotal	1,571.3	894.8	3.3	674.1	109.8	62.1	10.5	37,011.5
European Free Trade Association:								
Austria	7.5	28.9	.4	3.7	4.9	2.3	3.1	1,532.0
Denmark	.4	.9	(6)	.1	--	(6)	--	246.3
Norway	1.4	2.1	.4	1.2	--	--	--	474.4
Portugal	42.0	.7	--	.1	--	--	--	60.9
Sweden	13.0	8.2	2.7	8.7	8.8	6.1	--	1,432.9
Switzerland [7]	.8	1.3	--	.1	--	.2	4.9	112.7
United Kingdom	241.0	262.1	.7	324.8	37.0	139.4	.1	3,975.3
Subtotal	306.1	304.2	4.2	338.7	50.7	148.0	8.1	7,834.5
Other non-Communist Europe:								
Finland	--	2.2	--	2.1	--	--	--	244.6
Greece	7.7	4.1	--	--	--	--	.1	185.0
Spain	7.1	1.1	--	.1	--	.4	--	169.7
Subtotal	14.8	7.4	--	2.2	--	.4	.1	599.3

See footnotes at end of table.

Table 52.—Major world trade in steel ingots and semimanufactures in 1969, by areas—Continued

(Thousand metric tons)

Exporting country and area	Destinations[1]							
	Africa	Near East[4]	South Asia and Far East			Oceania	Unallocated	Total
			Japan	Other non-Communist	Communist[5]			
European Communist Countries:								
Bulgaria	7.2	58.2	18.2	.3	3.0	--	--	592.4
Czechoslovakia	25.5	204.6	--	22.8	41.8	--	--	2,454.8
Germany, East[8]	--	--	--	--	--	--	--	105.1
Hungary	26.5	158.5	--	32.8	7.0	--	--	861.4
Poland	46.0	24.6	--	17.5	23.9	--	--	1,437.6
Romania	.1	70.3	--	4.7	18.8	--	--	943.0
U.S.S.R.	136.9	401.9	--	149.5	73.9	--	36.1	6,985.6
Yugoslavia	2.6	12.7	--	1.1	1.5	--	--	292.4
Subtotal	244.8	930.8	18.2	228.7	169.9	--	36.1	13,672.3
Total	2,137.0	2,137.2	25.7	1,243.7	330.4	210.5	54.8	59,117.6
Africa: South Africa, Republic of	--	--	6.8	5.6	--	.6	215.9	421.4
South Asia and Far East:								
India[9]	55.2	320.2	12.1	181.3	--	12.1	.2	853.0
Japan	528.0	651.0	XX	3,455.0	1,255.0	417.0	--	15,548.0
Subtotal	583.2	971.2	12.1	3,636.3	1,255.0	429.1	.2	16,401.0
Oceania: Australia	21.2	5.7	98.2	405.1	.4	246.2	6.9	1,128.0
Grand total	2,832.9	3,180.9	160.0	5,908.9	1,585.8	914.1	277.8	82,431.5

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 United States and Canada.
[3] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, U.S.S.R., and Yugoslavia.
[4] Bahrain, Cyprus, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Muscat and Oman, Qatar, Saudi Arabia, Southern Yemen (formerly Aden), Syria, Trucial States, Turkey, and Yemen.
[5] Consists of China (mainland), North Korea, and North Vietnam; Mongolia is included under other non-Communist South Asia and Far East, owing to its inseparability from this group in source.
[6] Less than 50 tons.
[7] Source: Statistical Office of the United Nations. 1969 World Trade Annual. V. III, Walker and Co., New York, 1971, 494 pp.
[8] Partial figure derived from import data of partner countries. Source: Statistical Office of the United Nations. 1969 Supplement to the World Trade Annual. V. I. Walker and Co., New York, 1970, p. 263.
[9] Year beginning April 1, 1969 and ending March 31, 1970.
Source: Except where otherwise noted: United Nations Economic Commission for Europe. Statistics of World Trade in Steel. 1969, 59 pp.

Table 53.—World trade of lead ores and concentrates [1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1969									
United States	44.0	36.3	--	--	0.3	--	18.4	--	99.0
Western Europe:									
Belgium-Luxembourg [5]	23.0	32.3	14.7	--	--	--	--	14.6	84.6
France	--	9.9	33.3	--	25.0	--	3.5	--	71.7
Germany, West [6]	20.7	21.0	61.9	4.6	7.6	0.5	2.9	--	119.2
United Kingdom	7.0	5.6	9.2	--	1.8	--	17.8	12.2	53.6
Other [7]	--	5.9	10.5	--	10.4	--	--	--	26.8
Total	50.7	74.7	129.6	4.6	44.8	.5	24.2	26.8	355.9
Japan	36.0	38.1	--	--	.8	14.4	29.0	1.1	119.4
Grand total	130.7	149.1	129.6	4.6	45.9	14.9	71.6	27.9	574.3
1970									
United States	37.3	37.9	--	--	(8)	--	26.6	--	101.8
Western Europe:									
Belgium-Luxembourg [9]	--	32.5	41.0	--	--	--	--	37.3	110.8
France [10]	--	4.8	35.0	--	30.8	--	6.9	--	77.5
Germany, West	41.6	28.9	63.2	8.7	11.0	1.2	5.7	--	160.3
United Kingdom	2.6	14.6	4.7	--	4.4	--	9.2	--	35.5
Other [11]	9.4	--	12.2	--	5.8	--	--	2.1	29.5
Total	53.6	80.8	156.1	8.7	52.0	1.2	21.8	39.4	413.6
Japan	78.8	21.5	--	--	1.1	17.1	16.8	1.3	136.6
Grand total	169.7	140.2	156.1	8.7	53.1	18.3	65.2	40.7	652.0

[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 U.S.S.R.
[5] Data are for gross weight of ore, January through October.
[6] January through November.
[8] Less than 50 tons.
[9] Gross weight of ore, January through September.
[10] January through October.
[11] Includes Italy gross weight of ore, January through September and Austria for January through September.

Source: Monthly Bulletin of Statistics of the International Lead and Zinc Study Group. Lead and Zinc Statistics. April 1970, v. 10, No. 4, p. 24; April 1971, v. 11, No. 4, p. 24.

Table 54.—Major world trade in lead bullion and refined lead [1]

(Thousand metric tons)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total [5]
1969									
United States	42.1	104.0	40.9	--	11.4	--	55.1	0.9	254.4
Western Europe:									
Belgium-Luxembourg [6]	(7)	.3	6.8	1.6	--	0.5	--	1.8	11.0
France [8]	--	1.5	26.7	1.0	27.6	--	--	--	56.8
Germany, West	12.0	1.8	65.7	1.7	2.0	10.9	14.3	.8	109.2
Italy [6]	--	7.0	5.6	5.8	14.3	--	--	14.8	47.5
Netherlands	--	7.8	22.1	7.2	1.1	.2	1.1	.1	39.6
Switzerland	2.5	3.1	16.0	.8	.5	2.6	.5	(7)	26.0
United Kingdom	43.4	--	.7	.2	12.7	--	172.1	.1	229.2
Other [9]	3.8	5.2	26.1	7.5	5.4	--	--	.8	48.8
Total	61.7	26.7	169.7	25.8	63.6	14.2	188.0	18.4	568.1
Japan	1.3	--	--	--	2.6	1.1	1.5	1.8	8.3
Grand total	105.1	130.7	210.6	25.8	77.6	15.3	244.6	21.1	830.8
1970									
United States	57.9	82.6	22.1	--	11.9	--	46.9	.7	222.1
Western Europe:									
Belgium-Luxembourg [6]	.3	1.4	9.4	--	--	--	--	1.6	12.7
France	--	.5	24.0	.6	22.6	--	--	--	47.7
Germany, West	4.3	2.2	80.6	.7	.6	17.3	16.5	.4	122.6
Italy	.2	24.5	36.6	9.1	33.4	--	--	16.8	120.6
Netherlands	.1	9.2	27.4	1.9	.8	.3	10.5	1.0	51.2
Switzerland	3.4	2.3	18.7	.1	.3	--	1.2	--	26.0
United Kingdom	41.2	--	.3	--	7.7	--	206.0	.2	255.4
Other [10]	.7	4.6	35.7	7.8	6.4	--	--	.2	55.4
Total	50.2	44.7	232.7	20.2	71.8	17.6	234.2	20.2	691.6
Japan	.2	--	--	--	.2	.6	--	.6	1.6
Grand total	108.3	127.3	254.8	20.2	83.9	18.2	281.1	21.5	915.3

[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 totals 70,000 tons or more per year.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and U.S.S.R.
[5] Reported totals.
[6] January through September.
[7] Less than 50 tons.
[8] January through November.
[9] Includes Austria, January through September, Ireland, January through November; and Denmark, Finland, Norway, and Sweden, January through December.
[10] Includes Austria, January through September; Norway, January through November; and Denmark, Finland, Ireland, and Sweden, January through December.
Source: Monthly Bulletin of the International Lead and Zinc Statistics. May 1970, v. 10, No. 4, pp. 24–25; May 1971, v. 11, No. 4, pp. 24–25.

Table 55.—World trade of zinc ores and concentrates [1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1969									
United States	333.4	198.5	--	--	11.3	--	2.7	0.4	546.3
Western Europe:									
Belgium-Luxembourg [5]	219.3	--	106.0	--	47.5	--	--	52.9	425.7
France	56.6	42.2	79.8	--	41.3	0.2	--	7.7	227.8
Germany, West [6]	90.2	1.8	49.2	--	5.2	1.0	9.8	--	157.2
United Kingdom	19.2	3.7	15.8	--	--	--	95.7	30.4	164.8
Other [7]	29.9	.8	74.1	--	--	--	8.1	--	112.9
Total	415.2	48.5	324.9	--	94.0	1.2	113.6	91.0	1,088.4
Japan	39.2	247.3	--	--	--	36.2	70.1	42.1	434.9
Grand total	787.8	494.3	324.9	--	105.3	37.4	186.4	133.5	2,069.6
1970									
United States	288.5	181.8	--	--	4.6	--	2.1	(8)	477.0
Western Europe:									
Belgium-Luxembourg [5]	290.8	--	19.3	--	33.9	--	--	98.6	442.6
France [6]	52.8	41.6	80.5	--	16.1	.8	--	--	191.8
Germany, West	94.3	8.3	54.0	4.8	5.3	3.7	6.8	--	177.2
United Kingdom	26.2	6.4	12.5	--	--	--	103.3	5.9	154.3
Other [9]	33.4	.3	69.7	--	1.7	--	14.8	--	119.9
Total	497.5	56.6	236.0	4.8	57.0	4.5	124.9	104.5	1,085.8
Japan	126.4	164.5	.5	--	2.0	73.5	87.9	2.3	457.1
Grand total	912.4	402.9	236.5	4.8	63.6	78.0	214.9	106.8	2,019.9

[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 U.S.S.R.
[5] Data are for gross weight of ore, January through September.
[6] January through October.
[7] Includes the Netherlands and Norway, January through December; and Austria, January through September.
[8] Less than 50 tons.
[9] Includes Austria, January through September; Norway, January through November; and the Netherlands, January through December.

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics. April 1970, v. 11, No. 4, p. 24.

Table 56.—Major world trade in refined zinc [1]

(Thousand metric tons)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total [5]
1969									
United States	134.9	38.4	21.4	8.6	9.3	--	31.1	50.8	294.5
Western Europe:									
Belgium-Luxembourg [6]	--	--	1.3	--	15.1	5.5	4.3	6.6	32.8
France [7]	.7	.1	15.0	4.4	2.8	.1	--	.5	23.6
Germany, West	11.6	2.4	120.5	14.0	21.2	--	5.4	--	175.1
Italy [7]	2.3	1.0	15.9	2.6	3.1	--	2.0	2.9	29.8
Netherlands	--	--	4.5	3.0	2.2	5.8	.9	--	16.4
Sweden	4.8	.1	24.5	9.7	--	--	--	--	39.1
Switzerland	.3	.1	17.2	2.9	3.9	4.9	1.8	(8)	31.1
United Kingdom	99.2	2.4	17.5	20.9	3.3	2.3	16.5	1.2	163.3
Other [9]	--	.2	23.0	5.1	2.5	.1	--	.3	31.3
Total	118.9	6.3	239.4	62.6	54.1	18.7	30.9	11.5	542.5
Hong Kong	1.7	--	.3	--	--	1.1	2.2	1.3	6.6
Japan	2.2	.1	--	--	.1	4.0	--	.7	7.1
Grand total	257.7	44.8	261.1	71.2	63.5	23.8	64.2	64.3	850.7
1970									
United States	109.4	35.7	27.1	7.0	9.2	--	27.5	29.6	245.5
Western Europe:									
Belgium-Luxembourg [6]	1.7	--	1.7	--	9.6	1.9	4.2	3.8	22.9
France	4.3	--	14.7	5.1	1.8	--	--	--	25.9
Germany, West	10.1	7.1	110.8	7.3	8.5	.9	1.1	--	145.8
Italy	6.0	--	23.5	4.6	6.3	--	.9	2.7	44.0
Netherlands	--	.1	5.1	5.7	--	3.1	.1	--	14.1
Sweden	--	--	23.6	5.1	--	5.3	--	--	34.0
Switzerland	.5	.1	20.7	1.7	2.4	1.4	.5	(8)	27.3
United Kingdom	101.0	5.3	15.6	17.0	.3	2.3	18.5	.7	160.7
Other [10]	.4	.2	16.0	5.0	2.1	--	--	.5	24.2
Total	124.0	12.8	231.7	51.5	31.0	14.9	25.3	7.7	498.9
Hong Kong [7]	2.9	--	.3	--	--	.3	3.1	1.3	7.9
Japan	7.9	1.5	--	.6	.8	6.8	4.8	--	21.6
Grand total	244.2	50.0	259.1	59.1	41.0	22.0	60.7	38.6	773.9

[1] Imports of countries other than those listed are generally less than those of listed countries individually, except for the following countries (total 1969 imports of each given parenthetically, in thousand tons): India (30.9); Brazil (55.7); Republic of South Africa (8.5); U.S.S.R. (50.1); Hungary (20.2); Philippines (21.4); Thailand (18.1); and Taiwan (10.7). The aggregate tonnage of imports for nations not listed in body of table nor in the foregoing list is estimated to be about 100,000 metric tons.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Romania, and U.S.S.R.
[5] Reported totals; detail may not add horizontally owing to rounding.
[6] January through September.
[7] January through November.
[8] Less than 50 tons.
[9] Includes Austria, January through September; Ireland, January through November; Denmark and Finland, January through December.
[10] Includes Austria, January through September; and Denmark, Finland, and Ireland, January through December.

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics. May 1970, v. 10, No. 5, pp. 26–27; May 1971, v. 11, No. 5, pp. 26–27.

Table 57.—World movement of solid fuels in 1969 [1]

(Thousand metric tons, standard coal equivalent)

Source area	Destinations: North America [2]	Caribbean America [3]	Other America [4]	Western Europe [5]	Africa	Near East	Far East	Oceania	Other countries [6]	Destination unspecified [7]	World [8]
North America [2]	16,230	790	2,730	13,940	--	--	20,480	5	250	30	54,450
Western Europe [5]	65	100	110	38,590	315	10	20	10	1,290	120	40,630
Africa	--	--	--	560	1,570	--	350	10	10	100	2,585
Far East	--	--	--	--	--	--	660	--	--	--	660
Oceania	--	--	70	80	--	--	15,900	290	--	10	16,360
Other countries [6]	--	140	170	25,160	670	--	5,675	--	33,900	510	66,190
Total [8]	16,295	1,040	3,035	78,410	2,550	20	43,140	320	35,450	770	181,030

[1] Data based on the general trade system; lignite briquets are reduced to standard coal equivalent 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 and Yugoslavia.
[6] Chiefly the Communist nations of Europe and Asia, but apparently including some other countries not identified separately.
[7] As reported in source.
[8] 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.

Source: Statistical Office of the United Nations. World Energy Supplies 1966–69. Series J, No. 14, New York, 1971, pp. 38–43.

Table 58.—World movement of crude petroleum in 1969 [1]

(Thousand metric tons)

Source area [2]	Destinations: North America	Caribbean America	Other America	Western Europe	Africa	Near East	Far East	Oceania	Other countries	Destination unspecified	World [3]
North America	26,670	30	--	60	--	--	100	--	--	--	26,860
Caribbean America	37,470	66,540	6,960	24,645	250	--	500	--	--	40	136,405
Other America	920	100	550	160	--	--	20	--	--	--	1,750
Western Europe	90	--	--	1,920	--	--	--	--	--	--	2,010
Africa	13,230	7,930	3,670	202,070	2,940	680	1,110	350	3,360	1,200	236,540
Near East	15,830	3,160	10,510	274,410	14,130	22,660	174,950	15,620	1,120	6,960	539,350
Far East	4,460	--	--	130	--	--	24,625	5,700	--	--	35,220
Other Countries	--	4,300	180	23,840	1,960	--	550	--	32,625	--	63,995
Total [3]	98,680	82,350	21,870	527,230	19,280	23,340	201,855	21,670	37,105	8,545	1,042,140

[1] Data are based on the general trade system.
[2] For details on countries included in each area, see footnotes to table 52.
[3] Reported totals; detail may not add to totals shown because of: (1) inclusion in totals of quantities shipped to or received from not listed separately or not identified in original sources and (2) rounding.

Source: Statistical Office of the United Nations. World Energy Supplies 1966–69. Series J, No. 14, New York, 1971, pp. 78–84.

Table 59.—Refined petroleum fuel trade, by continental areas [1]

(Million metric tons)

Continental area [2]	Exports		Imports		Bunkers	
	1968	1969	1968	1969	1968	1969
North America	6.96	7.26	87.23	96.48	20.12	20.36
Caribbean America	112.52	118.04	13.55	13.78	14.00	13.86
Other America	1.09	0.28	5.11	4.79	1.33	1.29
Western Europe	78.30	89.49	103.60	106.79	41.92	45.53
Eastern Europe	36.37	35.54	7.01	6.32	NA	NA
Africa	4.75	4.26	12.42	13.36	8.01	7.56
Near East	50.44	55.98	2.69	3.74	17.49	17.49
Far East	20.17	19.74	40.65	42.72	22.40	23.61
Oceania	1.15	.86	3.69	4.42	4.21	3.69
Not specified [3]	--	--	1.32	1.34	.05	.05
Total	311.75	331.45	277.27	293.74	129.53	133.44

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 52 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.

Source: Statistical Office of the United Nations. World Energy Supplies 1966–69. Series J, No. 14, New York, 1971, pp. 56–77.

The Mineral Industry of Algeria

By Roman V. Sondermayer [1]

During 1970 Algeria remained a significant producer and exporter of crude oil and natural gas. As in the past, natural gas was exported as liquefied natural gas (LNG) from installations at Arzew. Although the Government attempted to increase the development of other mineral resources of the country, crude oil and natural gas dominate the industrial economy and account for about 60 percent of the country's exports by value. Estimated Algerian Government income generated by gas and oil amounted to $255 million [2] in 1970. The country's output of iron ore, lead, zinc, copper, pyrites, phosphate rock, and cement was of domestic importance. Political difficulties with France and other western nations assisted the economic penetration of some Communist countries. Romania, Bulgaria, and the U.S.S.R. were the most active and at yearend were involved in financing different industrial projects and helping train Algerian nationals in mineral exploration, production, and processing.

The Algerian state-owned company Société Nationa pour la Recherche, la Production, la Transport, la Tranformation et la Commercialisation des Hydrocarbures (SONATRACH), after a governmental action, assumed control of all non-French foreign petroleum and natural gas properties except those of Getty Oil Company. Compensation arrangements were being negotiated at the yearend. Two contracts were concluded in 1970 calling for the delivery of Algerian LNG to the United States. The two agreements involve deliveries of up to 1,542 million cubic feet daily of natural gas equivalent. Implementation of these agreements was pending approval by the U.S. Federal Power Commission. The Algerian-owned Société Nationale de Recherche et d'Exploitation Minière (SONAREM) contracted with the Litton Industries Aero Service for an aerial survey of certain parts of the country. In addition SONAREM specialists were involved in exploration for lead, zinc, copper, mercury and other nonferrous metals and in supervising the construction of a 40,000-ton-per-year electrolytic zinc plant at Ghazaouet. Construction of two new cement plants and the expansion of an existing one should raise Algeria's cement producing capacities from the present 0.9 million tons to 2.6 million tons by 1973. Both are being built by Société Nationale des Matériaux de Construction (SNMC).

PRODUCTION

According to preliminary data there were no pronounced changes in mineral production during the year. Iron mining continued to improve technologically, but production results were not spectacular. Output of lead and zinc ores, declined slightly, because technicians lacked experience to use the equipment. Output data on several nonmetallics were not available.

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[1] Petroleum engineer, Division of Fossil Fuels.
[2] Where necessary, values have been converted from Algerian Dinars (AD) to U.S. dollars at the rate of AD 4.937 = US$1.00.

Table 1.—Algeria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Antimony concentrates:			
Gross weight	195	[e] 223	[e] 200
Metal content	54	[e] 60	[e] 155
Copper concentrates:			
Gross weight	3,424	2,363	2,406
Metal content	789	550	574
Iron and steel:			
Iron ore .... thousand tons	3,079	2,969	2,863
Pig iron and blast furnace ferroalloys [e] .... do	10	60	70
Crude steel .... do	28	18	[e] 20
Semimanufactures .... do	46	[e] 50	[e] 50
Lead concentrates:			
Gross weight	[r] 9,780	11,460	9,439
Metal content	[r] 5,200	7,947	6,523
Silver [e] .... thousand troy ounces	100	100	100
Zinc concentrates:			
Gross weight	35,177	40,769	30,556
Metal content	19,178	20,887	16,974
NONMETALS			
Barite [2]	[r] 44,986	51,710	51,643
Cement .... thousand tons	866	950	[e] 1,000
Clays, bentonitic	19,295	12,580	--
Diatomite	21,367	10,545	--
Fertilizer materials:			
Phosphate rock .... thousand tons	366	420	492
Superphosphate .... do	115	[e] 120	NA
Gypsum [e] .... do	175	175	175
Lime [e] .... do	20	20	20
Pyrite:			
Gross weight	46,175	41,759	32,504
Sulfur content	22,118	19,209	14,952
Salt .... thousand tons	[e] 120	150	100
Sulfur, elemental	21,712	[e] 22,000	[e] 22,000
MINERAL FUELS AND RELATED MATERIALS			
Coal .... thousand tons	(3)	19	13
Gas, natural:			
Gross production .... million cubic feet	[e] 340,000	350,000	[e] 340,000
Marketable production including liquefied .... do	[r] 93,654	105,520	102,377
Natural gas liquids (condensate) .... thousand 42-gallon barrels	6,300	7,905	NA
Petroleum:			
Crude .... do	[r] 330,922	345,436	371,767
Refinery products:			
Gasoline .... do	[r] 4,310	4,313	4,372
Kerosine and jet fuel .... do	[r] 2,069	1,620	1,579
Distillate fuel oil .... do	[r] 4,925	5,877	6,948
Residual fuel oil .... do	[r] 2,835	2,943	3,330
Lubricants .... do	--	1	--
Other .... do	[r] 1,181	1,243	1,250
Refinery fuel and losses .... do	471	342	907
Total .... do	15,791	16,339	18,386

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

[1] In addition to the commodities listed, secondary aluminum and lead may be produced in small quantities and a variety of crude construction materials (common clay, gravel, sand, and stone) undoubtedly are produced but output is not reported and available information is inadequate to make reliable estimates of output levels.

[2] Barite concentrates; total crude output reported as follows in metric tons: 1968—188,000; 1969—235,956; 1970—137,000 (estimate).

[3] Less than ½ unit.

TRADE

Tables 2 and 3 indicate foreign trade in minerals for 1968 and 1969, latest years for which complete information was available.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum including alloys, all forms	709	691	France 546; Italy 145.
Copper:			
Ore and concentrate	4,250	2,116	All to Japan.
Metal including alloys, scrap	1,590	--	
Iron and steel:			
Iron ore and concentrate [2] thousand tons	3,268	2,765	Italy 820; Poland 485; Belgium-Luxembourg 372; United Kingdom 206.
Scrap	1,765	12,238	All to Italy.
Pig iron and cast iron	--	65,564	Japan 61,078; Italy 4,486.
Lead:			
Ore and concentrate [2]	10,059	10,060	Greece 4,365; Morocco 3,142; Italy 1,867; Belgium-Luxembourg 686.
Metal including alloys, all forms	1,081	643	France 466; Italy 145.
Silver, argentiferous metallurgical residues value, thousands	--	$126	All to France.
Tungsten ore and concentrate	18	--	
Zinc:			
Ore and concentrate [2]	22,165	44,283	France 18,592; Italy 15,075; Netherlands 4,180.
Metal including alloys, all forms	NA	260	All to France.
Other, ores and concentrates n.e.s	18	1,329	Netherlands 1,227; Belgium-Luxembourg 102.
NONMETALS			
Barite	15,940	5,286	United States 4,289; Netherlands 997.
Cement	10,540	--	
Clays, crude n.e.s	5,128	1,384	All to United Kingdom.
Diatomite and other siliceous earths	9,740	4,365	Spain 3,846; United Kingdom 519.
Fertilizer materials, crude, phosphate rock	73,202	92,898	Yugoslavia 40,085; West Germany 25,546; France 13,432; Spain 11,409.
Salt	38,480	27,090	All to France.
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, liquefied million cubic feet	53,101	60,068	United Kingdom 40,025; France 20,043.
Petroleum: [3]			
Crude thousand 42-gallon barrels	285,480	327,015	France 195,135; West Germany 65,329; Italy 11,999.
Refinery products: [4]			
Gasoline do	1,514	1,178	NA.
Kerosine and jet fuel do	477	294	NA.
Distillate fuel oil do	928	765	NA.
Residual fuel oil do	1,221	1,206	NA.
Other do	271	42	NA.
Total do	4,411	3,485	NA.

NA Not available.

[1] Except where otherwise noted, compiled from import data of the following countries: Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the U.S.S.R., the United Kingdom, the United States, and Yugoslavia.

[2] Source: Bureau de Documentation Minière (of France). Annales des Mines, September 1970, pp. 65–66.

[3] Source: U.S. Bureau of Mines. International Petroleum Annual, 1968 and 1969.

[4] Excludes bunkers, reported for 1968 as 1,099,000 barrels of residual fuel oil and 939,000 barrels of other products (chiefly distillate fuel oils, but including aviation gasoline, jet fuel, and lubricants). Corresponding 1969 data are not available.

Source: Except where otherwise noted, Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 754–759; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 536–539.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	331	--
Metal including alloys, all forms	2,470	3,495
Copper including alloys, all forms	2,719	2,877
Iron and steel:		
Pig iron and ferroalloys	498	538
Steel, primary forms	17,090	31,083
Steel semimanufactures:		
Pipes and tubes	179,884	207,854
Other	147,971	221,855
Lead:		
Oxide	216	350
Metal including alloys, all forms	1,522	1,674
Nickel including alloys, all forms	--	5
Platinum group ... value, thousands	$1	$228
Silver, all forms ... do	$39	$74
Tin including alloys, all forms ... long tons	54	71
Titanium oxide	266	327
Zinc:		
Oxide and peroxide	173	351
Metal including alloys, all forms	655	1,270
Other:		
Scrap n.e.s	44	33
Unwrought and semimanufactures	NA	33
NONMETALS		
Abrasives:		
Natural, except diamond	22,409	28,112
Grinding stones	116	95
Asbestos, crude	1,690	2,412
Cement, hydraulic	15,192	30,734
Chalk	5,649	6,853
Clays and products:		
Crude	1,083	657
Products:		
Refractory	6,947	4,510
Nonrefractory	1,537	2,090
Fertilizers manufactured:		
Nitrogenous	84,392	94,024
Phosphatic	58,730	59,476
Potassic	31,564	46,733
Lime	2,730	4,408
Pigments, mineral, iron oxide	NA	832
Sodium and potassium compounds, n.e.s	6,920	2,957
Stone, sand and gravel:		
Dimension stone, marble	982	1,847
Gravel and crushed stone	3,213	6,469
Sulfur, elemental	30,626	10,501
Talc and related materials	1,960	1,883
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	1,272	1,459
Coal, all grades	22,030	66,914
Coke, all grades	9,147	124,248
Petroleum refinery products: [2]		
Gasoline:		
Aviation ... thousand 42-gallon barrels	75	70
Other ... do	--	86
Distillate fuel oil ... do	148	--
Lubricants ... do	252	217
Other ... do	821	948
Total ... do	1,296	1,321
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	1,202	1,865

NA Not available.
[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, U.S.S.R., the United Kingdom, the United States, and Yugoslavia.
[2] Data from Foreign Service despatches.

Source: Except as noted, for the U.S.S.R.: Official trade returns of that country; for all other countries: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 760–782; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 540–556.

COMMODITY REVIEW

METALS

As a part of an effort by the Algerian Government to develop the mineral resources of the country, the Litton Industries Aero Service, under contract with SONAREM, will conduct a aerial survey covering about 919,353 square miles. Results of the survey should be delivered in about 3 years.

Aluminum.—The Algerian state-owned Société Nationale de Sidérurgie (SNS) has engaged British Smelter Constructions, Ltd., to prepare a feasibility study on the construction of a 60,000-ton-per-year primary aluminum smelter in western Algeria near Mostagnem. According to reports alumina for the plant will come from Sardinia's large bauxite processing installations. Total costs for the smelter were set at $70 million. In addition Davy-United of Sheffield was instructed to prepare a study on aluminum fabricating facilities in Algeria. Progress on both projects has not been reported.

Iron and Steel.—The principal iron ore producer was Quenza-Boukhadra mine, which accounted for two-thirds of the country's output. This property was recently equipped with new mining and transportation facilities. Other mines, Zaccara, Timezit, Beni Saf, and Khanguet, were responsible for the remaining output.

Exploration of the Gara Djebilet iron ore deposits, located approximately 1,000 miles inland from Algiers continued during 1970. SONAREM carried out exploration over an area covering 50 square miles. The Gara Djebilet deposit has two zones of mineralization; Gara-West and Gara-Center. The two deposits reportedly contain 900 million tons of ore with an average iron content of about 58 percent, a SiO_2 content of 4.8 percent, and a relatively high 0.8 percent phosphorus. The work on steel facilities of El Hadjar plant near Annaba continued. Demag of West Germany has received the contract for a continuous pickling line for wide strip and a degreasing line for cold-rolled strip. Annual capacity for the pickling plant will initially be 250,000 tons and for the degreasing line 140,000 tons. Also, Innocenti S.A., an Italian firm, plans to build a seamless tube plant having an annual capacity of 160,000 tons of pipe. The plant is scheduled to start up in 1974. Construction progress at the El Hadjar steel plant was delayed during 1970 because of a cement shortage and delays in equipment deliveries. The U.S.S.R. is financing the project and providing construction supervision.

Lead and Zinc.—Algerian authorities increased their efforts to produce lead and zinc during 1970. A significant part of the Grande Kabylie was under exploration. Preliminary results showed existence of "good" but widely scattered lead and zinc deposits. The rugged Kabylie terrain presents difficulties for construction of adequate ore beneficiation facilities and transportation networks. The most important were at Ichmoul and Kerzet-Oncef. The construction of the El Abed lead and zinc beneficiation plant scheduled to have an annual capacity of 70,000 tons of zinc and 15,000 tons of lead concentrates continued. Furthermore, construction of the concentrator at Kerzet-Oncef continued and construction of a 40,000-ton-per-year zinc electrolytic plant at Ghazaouet began. No startup date was announced for all these projects. In addition several closed mines were examined for possible reopening.

Other Metals.—Production of copper was modest during 1970 and amounted to several thousand tons. Plans were made to reopen the Kef-Oum-Theboul mine and to build a copper-zinc-pyrites beneficiation plant. Exploration for gold, platinum, tin, tungsten, and uranium continued in the Hoggar Mountains. Seven Soviet and Algerian geological teams were active in the area. Construction of the Ismail mercury distillation plant at Azzaba in the province of Constantine continued; initial capacity of the project was reported at 9,000 76-pound flasks of mercury per year.

NONMETALS

Cement.—During 1970 domestic consumption exceeded production, and imports were essential for adequate supply. Production of cement is under the direction of the state-owned corporation SNMC. This company operates cement plants at Point Pescade, Meftah, and Zahna having a total capacity of 950,000 tons per year. To improve the supply position, the management of SNMC pursued several projects during 1970. Construction of two new cement plants and expansion of one now in operation should bring Algeria's total yearly cement output to 2.6 million tons by 1973. The construction of 500,000-ton-per-year cement plant at Hadjar near Annaba continued during 1970. Apparently production should start in 1972, indicating a postponement of operations by 1 year of the previously announced date. The construction of the Meftha plant with an annual capacity of 1 million tons of cement per year started under the supervision of the Canadian engineering firm of Surveyor, Meninger and Chenevet. The Meftha plant will be one of the largest and most up-to-date plants in Africa. The Algerian technicians for this plant will be trained in Canada. Plans for expanding the Zahana cement plant capacity by 200,000 tons by adding two furnaces, did not as yet materialize but all preliminary work was completed by yearend.

Clays.—*Kaolin.*—Development of the kaolin mine at Djebel Debagh was completed and the mine was in trial production at yearend 1970. Reportedly, the annual capacity of this mine is 4,000 tons of raw kaolin.

Fertilizer Materials.—The development of new phosphate-rock-producing facilities continued during 1970. The management of Société du Djebel Onk was directing work on expanding the mine and treatment plant at Bir-El-Ater near the Tunisian border. The expanded facilities will permit annual output of phosphate rock to reach 0.8 million tons which later may be expanded to 1.4 million tons. A French company, Société Gexa will carry the project on in association with the Algerian company Altra. Dorr-Olliver Inc. will supply the fluidized bed dryer for the project. Société du Djebel Onk, controlled by SONAREM, produced about 438,000 tons of phosphate rock in 1970.[3]

The Annaba phosphate fertilizer plant was under construction during 1970. Raw material for this operation will come from the Djebel Onk facilities. As reported in the 4-year plan (1970–74), the Annaba installation will also include a unit to produce tripolyphosphate. The capacity of the unit is not known. Société Krebs will be the contractor for the tripolyphosphate plant.

Other Nonmetallics.—Barite production was nearly 52,000 tons in 1970. Keddar and Bou Mahni mines were the principal producers. In order to satisfy barite demand created by drilling activities for gas and oil, SONAREM experts were examining the possibilities of reopening mines at Ichmoul and Mizab.

Construction continued on the marble cutting and polishing plant at Skikda. When completed early in 1971 the plant is expected to have a capacity of 150,000 square meters of processed marble per year.

MINERAL FUELS

Petroleum and natural gas were the principal energy sources in Algeria with coal a minor contributor.

Coal.—The small coal output came mostly from the Kenadza mines near Bechar. The thermal electric plant at Bechar was the major consumer of Kenadza coal. During 1970 Algerian Authorities awarded a contract to an institute from East Germany to study the feasibility of coking Behar coal.

Petroleum and Natural Gas.—During 1970 the Algerian Government strongly enforced its policy toward increasing state control of oil and gas production. Early in the year the tax-reference prices for oil produced by French companies were increased unilaterally by the Algerian Goverment. Retroactive to January 1, 1969, the Government increased the tax reference price on Algerian crude oil from $2.08 to $2.85. The tax reference price is used by Algeria to determine the level of taxes and royalties paid by producing companies. French sources estimate the move will cost French companies about $100 million per year. In addition, the Algerians requested all companies to retain in Algeria at least $1.80 per barrel of crude oil exported. At yearend negotiations between the French and Algerians were suspended. All indications were that a general realignment of the ownership of joint Algerian-French exploration and production companies was underway. Nationalization, total or partial, of French interests was mentioned as a possibility. The compensation for interests nationalized in 1969 and earlier have not been settled. However, SONATRACH indicated that compensation should be paid in cash over a period of

[3] Phosphorous & Potassium (London). New Plants and Projects. Africa—Algeria. No. 50, November–December 1970, p. 19.

years and that for both Atlantic Richfield Oil Co. and Mobil Oil Corp. the compensation will be about $5 million similar to that paid to Phillips Oil Co. The Royal Dutch/Shell Group compensation is to be $10 million.

During the year, Algeria signed a pact with Libya and Iraq concerning the coordination of the action of the three governments regarding oil matters. Moreover, SONATRACH signed a new cooperation contract with the U.S.S.R. through the Soviet firm Technoexport, providing for the supply of 15 drilling rigs and technicians and for training Algerian drilling personnel. Additional contracts for technical assistance in reservoir engineering and development of existing oilfields and gasfields were also signed with the U.S.S.R.

Total surface covered by exploration rights in Algeria on July 1, 1970, covered an area of 265,198 square kilometers, of which SONATRACH held about 91,057 square kilometers. Exploitation concessions covered an additional 20,527 square kilometers.

Most of the exploration consisted of seismographic surveying work. In addition, a modest number of geological surveys were performed.

Exploration drilling activities were centered in Sahara and Polignac Basin. Some wells were drilled in Northern Algeria and in the Colomb Bechar areas. Four important new discoveries were made during the year. One discovery well, located 20 kilometers south of the Tin Fouye Tabankort oilfield, tested about 2,800 barrels of oil per day. Another, Rhourde Nouss A.1, in the Gothland area, tested 3,000 barrels of oil per day. Results of two discoveries in the Polignac basin were not released. Total footage drilled in Algeria during 1970 was estimated at about 800,000 feet of which 60 percent was developmental drilling and the remainder exploratory drilling.

Production of crude oil increased during 1970 by about 7,214 barrels per day compared with 1969 production. Slightly more than one-half of the production came from Hassi Messaoud oilfields. During the year studies were initiated for introducing a water injection program. Soviet experts believe that an output of 40 million tons per year can be attained if 1 million cubic meters of water can be injected per year. As a conservation measure the Government reduced the production from certain fields during 1970. There were two refineries operating in 1970. The largest, a 42,000-barrel-per-day plant at El Harch is operated by the Société de la Raffinerie d'Algerè (SRA). A smaller one, located at Hassi Messaoud, is operated by Société Nationale de Recherche et d'Exploration des Pétroles en Algérie (SNREPAL) and has a capacity of 4,400-barrel-per-day. The Japan Gasoline Company was building a 50,000-barrel per-day refinery (2.5 million tons per year) at Arzew for SONATRACH. The completion date is scheduled for late in 1971. Most of the marketed natural gas production of Algeria comes from the Hassi R'Mel gasfield. Plans call for Hassi R'Mel gasfield to produce 26,000 million cubic meters of gas per year (about 920,000 million cubic feet). The large associated gas reserves were not used and most of the produced gas was reinjected into the formation of flared. Two plants for recovery of condensate were under construction during 1970 at Hassi Messaoud. Aggregate capacity was reported at 950,000 metric tons per year or about 30,000 barrels per day. Completion date was set for the end of 1972. The recovered liquids will be shipped through a 12-inch pipeline from Hassi Messaoud to Hassi R'Mel and from there by 16-inch pipeline to the Arzew area. The expansion of Arzew LNG plant was underway and when completed in 1974 the facility will have a capacity of 17,000 million cubic meters per year or 600,346 million cubic feet per year. The construction of a new LNG plant at Skikda continued and startup of single-stream capacity of 88,000 cubic feet per year was scheduled for the end of 1971. By 1974 it should have a three stream capacity of 177,000 million cubic feet. Plans for up to six streams with capacity of 340,000 million cubic feet per year were reported. However, the latest figure was only mentioned as a possibility but at yearend no firm commitments were made for building anything above the three stream capacity.

During 1970, two subsidiaries of El Paso Natural Gas Co. of El Paso, Tex.—El Paso Atlantic Richfield Co. of Houston, Texas and El Paso Algeria Corporation concluded arrangements to purchase LNG from Algeria. El Paso Algeria Corporation will purchase natural gas from SONATRACH, importing up to 1,500 million cubic feet daily of gas equivalent for a 25-year period.

Distrigas Corporation of Boston, Mass, intends to import an equivalent of 42 million cubic feet of LNG per day. The LNG will be purchased from Alocean Ltd., a Bermuda corporation organized jointly by Gasocean International S.A. and SONATRACH. The LNG will be derived from Algerian natural gas processed at Arzew and a plant now under construction at Skikda. At yearend both plans were awaiting permits from the U.S. Federal Power Commission. Investments of up to 1 billion dollars will be required to make the imports of LNG from Algeria possible.

The Mineral Industry of Angola, Mozambique, and Portuguese Guinea

By Henry E. Stipp [1]

ANGOLA

Mineral industry activity in Angola was centered around exploration for mainly crude oil, diamond, gold, copper, phosphate rock, and sulfur. The development of iron ore, gold, and copper deposits proceeded steadily. The Government of Angola conducted a geological survey of an area of 3,860 square miles near Novo Redondo that revealed occurrences of copper, nickel, ilmenite (titanium), zircon, kyanite, olivine, and corundum.[2]

A subsidiary of Pickands Mather & Co. and Portuguese interests explored for phosphate rock in the Cabinda enclave. The Angolan subsidiary of Tenneco Inc., a U.S. firm, explored for sulfur on its concession area near Benguela. Consolidated Investments, a South African firm, was granted a concession in the same general area.

Société Française d'Études Minières, (Sofremines) studied gold deposits at M'popo, Chipindo, and Gove, copper deposits near Calumbumbolo and Chuchi, tungsten and molybdenum in the Calai River and Bailundu areas, and sulfide deposits at Lubangué, Sulima, and Longonjo. Reportedly Companhia Mineira do Lobito, Sofremines, and the Angolan Mines Bureau will prepare a geological map of the various concession areas.[3]

Urangesellschaft, a West German firm, and the Portuguese Atomic Energy Board explored for uranium.

PRODUCTION AND TRADE

The principal mineral commodities produced in 1970 consisted of diamond, iron ore, and crude oil. Output of diamond by Companhia de Diamantes de Angola (DIAMANG), Angola's only producer, rose 18 percent to 2.4 million carats compared with 2.0 million carats in 1969. Production of crude oil increased sharply (109 percent) from 17.5 million barrels in 1969 to 36.5 million barrels in 1970. The greater part of crude production came from the new offshore field of Cabinda Gulf Oil Co. Iron ore output increased 11 percent, to 6.1 million tons, compared with 5.5 million tons in 1969. Production of other mineral commodities such as manganese ore, gypsum, copper concentrate, and asphalt rock decreased from 1969 output. The total value of mineral commodity production in 1970 was about $178 million,[4] compared with approximately $167 million in 1969.

Shipments of iron ore from the port of Moçâmedes totaled 6.3 million tons in 1970, up 31 percent from the 4.8 million tons of 1969. West Germany, Japan, France, and the United Kingdom were the principal destinations of iron ore exports. Exports of diamond rose to 2.5 million carats, compared with 2.0 million carats in 1969, while crude oil shipments increased to 30.6 million barrels, up sharply from the 10.8 million barrels exported in 1969.

COMMODITY REVIEW

Metals.—*Copper.*—Nippon Mining Co. Ltd. and Empresa do Cobre de Angola reportedly will spend $18 million to develop

[1] Physical scientist, Division of Ferrous Metals.
[2] The Provincial Inspector of Mines. Report on the Mining Industry in Angola. Bureau of Mines of Angola, Luanda, Mar. 6, 1971, 5 pp.
[3] World Mining. Angola. V. 7, No. 1, January 1971, p. 51
[4] Where necessary, values have been converted at the rate of 1 escudo (Esc.) = US$0.035.

Table 1.—Angola: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Copper mine output, metal content	--	201	12
Gold mine output, metal content ... troy ounces	9	12	--
Iron ore and concentrate, gross weight ... thousand tons	3,218	5,478	6,091
Manganese ore and concentrate, gross weight ... do	9,150	29,070	23,000
NONMETALS			
Cement, hydraulic ... do	312	383	450
Clays, kaolin	9,150	1,310	2,032
Diamond:			
Gem ... thousand carats	1,316	1,617	1,917
Industrial ... do	351	405	479
Total ... do	1,667	2,022	2,396
Gypsum	12,987	16,397	13,769
Salt, marine	72,496	80,181	87,743
Stone:			
Granite ... cubic meters	1,243	7,130	3,628
Marble, blocks ... do	696	1,044	761
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	30,603	39,283	36,956
Natural gas:			
Gross production ... million cubic feet	[e] 4,000	[e] 14,000	28,749
Marketable production ... do	185	766	[e] 1,500
Petroleum:			
Crude oil ... thousand 42-gallon barrels	5,401	17,456	36,499
Refinery products:			
Gasoline ... do	560	524	477
Jet fuel ... do	375	375	587
Kerosine ... do	64	58	137
Distillate fuel oil ... do	1,010	734	734
Residual fuel oil ... do	2,361	[r] 2,324	2,609
Other ... do	177	144	175
Refinery fuel and losses ... do	854	320	NA
Total ... do	5,401	4,479	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, a variety of crude nonmetals such as clays, and sand and gravel are presumably produced for local consumption, but information is inadequate to make reliable estimates of output levels.

a mine in the northern part of the Mavoio area.[5]

Sociedade de Investigações Mineiras (SIMEIRA) Lda., a joint subsidiary of the Portuguese Companhia União Fabril and Société Anonyme du Chrome of Switzerland, explored near the old Mavoio-Tetelo copper mines in northern Angola, near Maquela do Zombo. Sociedade Mineira do Cubango S.A.R.L. conducted a survey for copper minerals east of Serpa Pinto, in the interior of Angola. The two firms planned to spend a total of $210,000 per year for exploration.[6]

Gold.—Companhia Mineira do Lobito (CML) was developing a mine, in the M'popo area, south of Tchamutete.[7] The mine was scheduled to begin production in 1971. Value of the gold deposit at M'popo was estimated at $20 million. In 3 years of prospecting, the company has located several gold deposits in the area. Development work is expected to begin on a second gold mine in the next 2 years. Geologists prospecting for DIAMANG reportedly found traces of alluvial gold in the vicinity of Nova Lisboa.

Iron Ore.—Owing to improvements in the railroad from the mines to the port of Saco (Salazar), CML, which is owned (85 percent) by the Portuguese Government, sharply increased shipments from its Cassinga mines. In addition, various improvements to mining facilities, such as workshops, a warehouse, fuel storage depots, a water pumping station, a powerplant, and the installation of a 7-mile belt conveyor system, helped to expand output. In late 1969 an alluvial ore beneficiating plant with a capacity of 1.2 million tons per year and a massive ore beneficiating plant

[5] World Mining. What's Going On in World Mining. V. 26, No. 6, June 1970, p. 36.
[6] U.S. Embassy, Luanda, Angola. State Department Airgram A-25, May 7, 1971, pp. 5–6.
[7] World Mining. Angola. V. 6, No. 3, March 1970, p. 25.

Table 2.—Angola: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum metal including alloys, scrap	96	410	France 210; Republic of South Africa 76; Belgium-Luxembourg 69.
Beryl ore and concentrate	--	23	United States 15.
Copper ore and concentrate	--	100	All to Japan.
Iron and steel:			
Ore and concentrate	2,451,422	4,810,586	Japan 2,007,405; West Germany 1,844,231; United Kingdom 366,403.
Metal:			
Scrap	r 428	315	Belgium-Luxembourg 202; France 50; West Germany 31.
Semimanufactures	r 808	1,877	Mozambique 920; Nigeria 802.
Lead:			
Metal including alloys:			
Scrap	500	384	Republic of South Africa 279; Belgium-Luxembourg 50; France 38.
Semimanufactures	6	1	All to Italy.
Manganese ore and concentrate	37,907	27,477	Japan 20,636; Spain 5,180; West Germany 1,000.
Platinum ... value	--	$5,347	All to Belgium-Luxembourg.
Tin including alloys, all forms ... long tons	--	8	All to Republic of South Africa.
Zinc including alloys, all forms	8	16	All to Netherlands.
Other base metals including alloys, all forms n.e.s	--	5	All to Mozambique.
NONMETALS			
Cement	12,873	55,384	Republic of South Africa 12,850; Brazil 12,500; Nigeria 11,910.
Diamond ... thousand carats	1,505	1,960	All to Portugal.
Fertilizer materials, mineral	1,561	3,012	Portugal 1,941; West Germany 623; Netherlands 248.
Gypsum and anhydrite	7,388	7,039	All to Mozambique.
Salt	19,551	20,625	Congo (Kinshasa) 16,378; St. Thomas and Principe Islands 1,653; Mozambique 826.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous (marble)	234	141	West Germany 88; Mozambique 52.
Other (granite)	1,593	6,578	West Germany 4,034; Portugal 1,413; Italy 508.
Worked	36	15	Republic of South Africa 12; St. Thomas and Principe Islands 2.
Quartz and quartzite	--	2	All to Republic of South Africa.
Sand excluding metal bearing	(1)	2	All to Portugal.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	215	128	St. Thomas and Principe Islands 124.
Carbon black and gas carbon	1	(1)	
Coal and coke including briquets	7	80	Portugal 20.
Petroleum:			
Crude and partly refined ... thousand 42-gallon barrels	121	10,826	Netherlands 4,941; Denmark 2,781; Spain 1,445.
Refinery products:			
Gasoline ... do	(1)	4	St. Thomas and Principe Islands 4.
Kerosine and jet fuel ... do	351	347	Bunkers 345.
Distillate fuel oil ... do	204	221	Bunkers 213; St. Thomas and Principe Islands 6.
Residual fuel oil ... do	1,712	1,670	Bunkers 991; Portugal 443; Greece 235.
Lubricants ... do	2	4	St. Thomas and Principe Islands 2; bunkers 2.
Total ... do	2,269	2,246	

r Revised.
1 Less than ½ unit.

Table 3.—Angola: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	r 923	1,104
Beryl ore and concentrate	2	--
Copper:		
Matte	28	37
Copper sulfate	17	49
Metal including alloys, all forms	566	597
Iron and steel:		
Oxide and hydroxide	132	144
Metal:		
Scrap	39	70
Pig iron including cast iron	507	2,163
Sponge iron, powder and shot	32	49
Ferroalloys	515	1,180
Steel primary forms	12,444	9,447
Semimanufactures	r 101,837	83,912
Lead:		
Oxide	54	66
Metal including alloys, all forms	r 289	357
Mercury 76-pound flasks	15	4
Nickel including alloys, all forms	6	2
Silver including alloys troy ounces	6,238	6,338
Tin including alloys, all forms long tons	r 42	80
Titanium oxides	237	242
Zinc:		
Oxide	108	101
Metal including alloys, all forms	403	590
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	19	19
Grinding and polishing wheels and stones	78	74
Asbestos	558	404
Barite and witherite	1	10
Boron materials:		
Crude natural borates	2	(1)
Oxide and acid	3	2
Cement	6,588	3,519
Chalk	573	393
Clays and products (including all refractory brick):		
Crude n.e.s	3,848	1,939
Products:		
Refractory (including nonclay bricks)	850	530
Nonrefractory	1,066	1,963
Diatomite and other infusorial earths	155	340
Feldspar	20	60
Fertilizer materials:		
Crude:		
Phosphatic	69	50
Other	6	10
Manufactured:		
Nitrogenous	10,037	14,547
Phosphatic:		
Thomas (basic) slag	59	79
Other	4,627	6,008
Potassic	1,237	2,979
Other, including mixed	10,277	20,511
Ammonia	125	132
Graphite, natural	6	3
Gypsum and plasters	62	67
Lime and limestone	93	69
Magnesite	6	10
Mica, all forms	r 11	129
Pigments, mineral	66	580
Precious and semiprecious stones, except diamond carats	15	--
Salt and brines	43	795
Sodium and potassium compounds, n.e.s	2,780	2,559
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	485	486
Worked	370	607
Dolomite, chiefly refractory grade	51	88
Gravel and crushed rock	156	194
Quartz and quartzite	5	--
Sand excluding metal bearing	28	56
Sulfur:		
Elemental, all forms	527	633
Sulfur dioxide	17	11
Sulfuric acid	2,166	1,389
Talc, steatite, soapstone and pyrophyllite	r 123	141
Other n.e.s	282	19

See footnotes at end of table.

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

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	1,016	237
Carbon black and gas carbon	530	507
Coal and coke, including briquets	r 38,264	34,776
Gas, hydrocarbon	1	(1)
Hydrogen, helium and rare gases	7	4
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	418	553
Refinery products:		
Gasoline do	r 69	79
Kerosine and jet fuel do	r 85	258
Distillate fuel oil do	1,096	1,248
Lubricants do	r 108	107
Liquefied petroleum gas do	18	78
Mineral jelly and wax do	3	2
Other do	r 2	3
Total do	r 1,381	1,775
Mineral tar and other coal, petroleum, or gas derived crude chemicals	206	875

r Revised.
1 Less than ½ unit.

with a capacity of 400,000 tons per year were started up at Cassinga South.[8]

At Port Salazar, a rotary dumper with a capacity of 1,650 tons per hour and a 1.7-million-ton storage area with two stacking and reclaiming units has been installed. Ships of 120,000 tons deadweight were loaded at a rate of 3,000 to 5,000 tons per hour by a traveling shiploader. CML, with the help of Kaiser Steel Corp., reportedly plans to install a pelletizing plant at the Cassinga-Sul mines to utilize an estimated 3 billion tons of low-grade ore (32 to 45 percent). Pelletizing facilities with a capacity of 1.8 million tons per year also were planned for construction at the Cassala-Quitungo deposits of Companhia do Manganês de Angola near Salazar. The plant will use low-grade taconite ore. Production of ore from the Cassala mines decreased sharply from 300,000 tons in 1969 to 140,000 tons in 1970, owing to exhaustion of high-grade ore.

Uranium.—The Portuguese Government Junta de Energia Nuclear reported that prospecting in Angola and Mozambique had resulted in the discovery of significant deposits. Geologists from the West German firm Urangesellschaft carried out exploration work in the Dondo and Malange areas and in the Moxico District near the Congolese border.[9]

Nonmetals.—*Diamond.*—DIAMANG prospected extensively in its concession before releasing about 80 percent of the area by midyear 1971. Reportedly DIAMANG has discovered several promising deposits and has proved large reserves of diamond bearing gravels.[10] DIAMANG and DeBeers Consolidated Mines Ltd. of South Africa were organizing a joint company to develop diamond concessions in Angola.[11]

Companhia Nacional de Diamantes S.A.R.L. (DINACO) prospected for diamond in the coastal area south of Luanda. Companhia Ultramarina de Diamantes S.A.R.L. (DIAMUL) explored for diamond south of Gabela. Companhia de Diamantes do Oeste de Angola (OESTEDIAM), a subsidiary of Diamond Distributors Inc., a U.S. firm, planned to spend about $500,000 on prospecting in its concession.

Phosphate Rock.—Companhia dos Fosfatos de Angola S.A.R.L. (COFAN) proved reserves of high-grade phosphate rock in the Cabinda enclave totaling over 100 million tons.[12]

Sulfur.—Tenneco Angola, Inc., reportedly discovered very promising traces of sulfur in a gypsum strata near Benguela.

The Portuguese Minister for the Overseas Provinces was authorized to negotiate a contract with a South African concern for prospecting rights to sulfur and gyp-

8 Skillings' Mining Review. Cassinga Iron Ore Project. V. 59, No. 29, July 18, 1970, p. 5.
9 Work cited in footnote 6.
10 Work cited in footnote 2.
11 World Mining. Angola. V. 7, No. 1, January 1971, p. 51.
12 Work cited in footnote 6.

sum in an area between Benguela and Novo Redondo.[13]

Mineral Fuels.—*Petroleum.*—Cabinda Gulf Oil Co. discovered an oil pool beneath its shallow zone field about 10 miles offshore from the enclave of Cabinda.[14] Petroleum was found at an undisclosed depth in the Toca Carbonate, a thick limestone strata. The discovery well flowed at 5,000 barrels per day of 32 gravity oil on a production test. The size of the pool was being evaluated at yearend.

Angola's Government granted permission to Sociedade Portuguesa de Exploração de Petróleos (ANGOL) to build a 40,000-barrel-per-day refinery at Lobito.[15] The new refinery will have a throughput capacity of 2 million tons of crude oil. The cost of the refinery was estimated at $12 million. Companhia de Petróleos de Angola (PETRANGOL) owns the only operating refinery at Luanda, where capacity was being increased from 11,000 to 20,000 barrels per day.

Exploration activity continued in four concession areas in northwestern Angola.[16] ANGOL and Total Exploration (Pty.) Ltd., a subsidiary of Compagnie Française des Pétroles, were working in the East Cuanza and Ambriz areas. ANGOL, PETRANGOL, and Texaco Petróleos Angola also shared onshore and offshore areas near the Congo (Kinshasa) border. Although no major finds were reported, PETRANGOL drilled several onshore wells that may be exploitable. Texaco has drilled two dry wells offshore.

Several firms applied for petroleum exploration permits. Shell Petroleum Corp. applied for offshore exploration rights in early 1970. At midyear the Portuguese firm Rimalpi applied for exploration permits on behalf of five U.S. concerns to search for petroleum in an area extending south from Novo Redondo to the border of South-West Africa and from 12 miles inland to a depth of about 660 feet offshore.[17] The U.S. firms include the Oil Organization Co., the Monsanto Chemical Co., the Kewanee Oil Co., the Equity Funding Corp. of America, and Pennzoil United Inc. Mobil Oil Corp. also applied for exploration rights offshore from Novo Redondo south to the South-West African border.[18]

MOZAMBIQUE

Although mineral production continued to play a minor role in the economy of Mozambique, exploration for mineral deposits, including mineral fuels, expanded significantly. The Government of Mozambique reportedly was enlarging its geological and mining staffs and offering special inducements to invest in mining. A 5-year contract for minerals exploration in Tete Province was signed by the Government and an organization which included a South African mining firm.[19] The contract covered prospecting for all minerals, except petroleum, natural gas, diamond, and ferrous minerals, in an area bounded by the Zambezi River and the Zambia and Malawi borders.

The Government of Mozambique contracted with a French company for geological mapping of a 42,460-square-mile area in the Zambezi, Mozambique, Cabo Delgodo, and Niassa Districts.[20]

In March the Portuguese Atomic Energy Board signed an agreement with the West German firm Urangesellschaft to prospect for uranium in large areas of Mozambique.

PRODUCTION AND TRADE

Mineral commodity production (excluding petroleum products) rose 15 percent in value to an estimated $15 million[21] in 1970 compared with an estimated $13 million in 1969. The principal commodities produced were petroleum products, cement, and coal.

Mineral commodity exports were valued at $14.7 million in 1969. They consisted mainly of 95,000 tons of coal valued at $780,000, 29,000 tons of cement valued at

[13] Standard Bank Review (London). Angola. October 1970, p. 41.

[14] Petroleum Intelligence Weekly. Angola. V. 9, No. 19, May 11, 1970, p. 7.

[15] Petroleum Press Service. News in Brief. V. 37, No. 6, June 1970, p. 229.

[16] Work cited in footnote 6.

[17] Petroleum Legislation Report. Angola. No. 73, June 1–Dec. 31, 1970, p. 23.

[18] Petroleum Legislation Report. Angola. No. 65, Jan. 1–Feb. 21, 1970, p. 14.

[19] Barclay's Overseas Review (London). Mozambique. February 1970, p. 45.

[20] Barclays Overseas Review (London). June 1970, p. 44.

[21] Where necessary, values have been converted at the rate of 1 escudo (Esc.) = US$0.035.

Table 4.—Mozambique: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS			
Aluminum, bauxite, gross weight	3,275	4,393	7,146
Beryllium, beryl concentrate, gross weight	r 96	122	151
Bismuth mine output, metal content	2	3	1
Cesium mineral, pollucite, gross weight	--	200	100
Columbium and tantalum, ore and concentrate, gross weight:			
Columbite-tantalite	62	p 64	97
Microlite	90	82	e 64
Copper ore and concentrate:			
Gross weight	--	--	602
Metal content e	--	--	130
Gold mine output troy ounces	6	21	35
Rare earth minerals, monazite, gross weight kilograms	350	--	2,100
Tin ore and concentrate:			
Gross weight long tons	--	(2)	--
Metal content do	--	(2)	--
NONMETALS			
Abrasives, natural, garnet kilograms	9,012	NA	2,300
Asbestos	120	787	228
Cement, hydraulic thousand tons	288	306	385
Clays:			
Bentonite (including montmorillonite)	3,818	4,432	6,483
Kaolin (including china)	r 522	1,270	1,477
Diatomite	209	120	NA
Feldspar	100	81	e 100
Gem stones, tourmaline kilograms	r 865	1,340	6,209
Lithium minerals:			
Amblygonite	r 5	1	13
Lepidolite	r 600	391	24
Mica, mainly scrap	r 291	350	253
Quartz:			
Quartz crystal kilograms	2,628	160,000	NA
Other do	800,000		
Salt, marine	r 3 30,629	9,545	28,742
Stone:			
Limestone thousand tons	688	595	674
Marble	NA	415	NA
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous thousand tons	314	277	351
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	r 1,182	1,214	1,137
Distillate fuel oils do	r 1,844	1,634	1,431
Residual fuel oils do	r 2,378	2,349	2,208
Other do	139	271	324
Refinery fuel and losses do	441	758	476
Total do	r 5,984	6,226	5,576

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

[1] In addition to the commodities listed, lime is produced in unreported quantities, and there may be additional quantities of crude construction materials produced for local use, but information is inadequate to make reliable estimates of output levels.

[2] Less than ½ unit.

[3] Includes 20 tons of rock salt.

$427,000, and 3.6 million barrels of petroleum products valued at $11.1 million. Imports of mineral commodities were valued at $37.3 million in 1969. The principal mineral imports were 837,000 barrels of crude petroleum valued at $13.2 million and 68,000 tons of iron and steel semimanufactured products valued at $11.9 million. As in previous years, Mozambique earned much foreign exchange by the transit of mineral commodities from neighboring countries to ports on the Indian Ocean. Table 4 shows data on mineral production and trade.

COMMODITY REVIEW

Metals.—*Columbite-Tantalite.*—Ore is mined principally in the Zambezia district near Ile, Alto Molocué, Maganja da Costa, Mocuba, and in the border regions of the adjacent Moçambique District. The main producers and exporters of columbite-tantalite ore and concentrate are Sociedade Mineira do Marropino, Lda., Pebane; Empresa Mineira do Alto Ligonha S.A.R.L., Lourenço Marques; Sociedade Mineira da Zambézia, Lda., Mocuba; Mrs. Alice A. Campos Costa, Quelimane; and Sociedade Mineira de Mocubela Lda., Vila da

Table 5.—Mozambique: Exports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal and alloys, all forms [1]	73	101
Columbite-tantalite concentrates, gross weight	173	78
Copper metal and alloys, all forms [1]	538	493
Iron and steel scrap	5,593	9,010
Lead metal and alloys, all forms [1]	274	249
Nickel metal and alloys, all forms [1]	1	--
Tin metal and alloys, all forms [1] long tons	2	1
Zinc metal and alloys, all forms [1]	6	10
Other:		
Ores and concentrates n.e.s	67	90
Metal, all forms [1]	3	4
NONMETALS		
Asbestos	624	841
Cement, hydraulic	19,694	29,056
Clays, crude, bentonite	2,586	2,790
Salt	3,233	5,698
MINERAL FUELS AND RELATED MATERIALS		
Coal	67,508	94,914
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	773	752
Jet fuel do	55	62
Distillate fuel oil do	r 837	721
Residual fuel oil do	r 2,406	1,880
Other do	51	135
Total do	4,122	3,550

r Revised.
1 Includes unspecified quantities of manufactures.

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

Commodity	1968	1969
METALS		
Aluminum metal and alloys, all forms [1]	781	861
Copper metal and alloys, all forms	331	367
Iron and steel semimanufactures	66,492	67,912
Lead metal and alloys, all forms [1]	229	198
Nickel metal and alloys, all forms [1]	1	3
Tin metal and alloys, all forms [1] long tons	80	25
Zinc metal and alloys, all forms [1]	64	92
Other:		
Ores and metal bearing residues	17,455	4,397
Metals, all forms n.e.s	9	7
NONMETALS		
Fertilizer materials, crude and manufactured	26,002	20,922
Others not further described	24,886	27,386
MINERAL FUELS AND RELATED MATERIALS		
Coal	309,839	435,895
Coke and briquets	1,979	2,244
Petroleum:		
Crude thousand 42-gallon barrels	804,533	837,024
Refinery products:		
Gasoline do	r 267	238
Kerosine do	161	167
Fuel oil, distillate and residual do	663	636
Lubricants do	73	90

r Revised.
1 Includes unknown quantities of manufactures.

Maganja.[22] Tantalite concentrate imported into the United States from Mozambique in 1969 averaged 64 percent Cb_2O_5 and 10 percent Ta_2O_5.

Copper.—Edmundian Investments (Pty) Ltd. registered a claim located near Mount Isitaca about 130 miles northwest of Beira.[23] Copper deposits reportedly occur in the Fingoé Series of Tete District.[24]

[22] U.S. Embassy, Lourenço Marques, Mozambique. State Department Airgram A-43, May 23, 1969, 3 pp.
[23] World Mining. V. 6, No. 10, September 1970, p. 60.
[24] Mining Journal. Mining Annual Review (London). 1970, p. 337.

The General Mining & Finance Corp., Ltd., was negotiating with Complexo Mineiro do Norte Limitada for a joint venture to develop copper, iron, and nickel deposits.[25] Complexo markets the minerals mined in Mozambique.

Gold.—Prospecting in the Vila de Manica area, 300 miles west of Beira, by Monarch Mines Ltd. has revealed good indications of gold, which may stimulate the establishment of a new mining area.[26]

Ten claims were registered for gold and manganese in the Manica and Sofala districts.[27]

Iron Ore.—Sumitomo Metal Mining Co. was arranging $50 million to finance the development of a 5-million-ton-per-year open pit mine to be located near Namapa, Moçambique District.[28] Deposits located in the area around Namapa reportedly had estimated reserves of 360 million tons of high-quality ore.[29] The Sumitomo group of Japan contracted with the concession holder to exploit the deposit on a royalty basis. Sumitomo planned to build a railway from Namapa to the port of Nacala. The Japanese group also will oversee improvements to the port, which include installing modern ore-loading equipment and docking facilities for 100,000-ton-deadweight ore ships.

Several claims located in the Mavita area were registered by Companhia do Cimentos de Moçambique.[30] Five deposits located in the Barué area were being surveyed to determine their size.[31] Magnetite-titanium deposits containing an estimated 100 million tons of iron ore have been located in the Tete District by Companhia de Uranio de Moçambique.[32] Deposits in the Beira area were scheduled for development by Companhia de Uranio when the company can obtain electric power from the Cabora Bassa Dam.[33] The firm also was prospecting in the Tete area.

Rutile.—Ilmenite.—Workable deposits occur along the coastal beaches north of latitude 16°30″ S., and a small deposit is located near Vila Luisa, about 25 miles north of Lourenço Marques. The concessions are owned by Minerais de Marracuene, Ltd., Lorenço Marques; Geotécnica e Minas, Lda., Lourenço Marques; and Minerais Básicos de Moçambique Lda., Pebane. Studies by concessionaires indicate that the Pebane deposit contains reserves of 215,000 tons averaging 70-percent TiO_2 content, 75,000 tons averaging 30-percent TiO_2 content, and 10 million tons averaging 5-percent TiO_2 content. Deposits located between Moebase and the Milôcué River were assessed at 18 million tons of ilmenite averaging 12-percent TiO_2 content. In addition to rutile, the deposits contain workable quantities of ilmenite, zircon, and monazite.[34]

Uranium.—A prospecting agreement for a 4-year period was signed between the Portuguese Nuclear Energy Board and Urangesellschaft, a West German firm.[35] All uranium found will be divided between participants based upon the amount of each partner's investment. A quasi-public corporation will be established to participate in joint venture agreements for mining and processing radioactive minerals in Portugal and overseas territories. Later, the Portuguese Government reported that prospecting in Mozambique and Angola had located significant deposits.

Nonmetals.—*Asbestos.*—Fifteen claims located in the Manica district, near Movita, were registered.[36] Asbestos deposits also occur in the Atchiza region.

Clays.—A deposit of bentonite in the Boane region southwest of Lourenço Marques is reportedly one of the largest in the world. It has potential for supplying world markets.[37]

Diamond.—An occurrence of diamond was discovered in Tete District, and a company was formed with the United States and Luxembourg financing to exploit the deposit.[38] Gamor, a local company, contracted with the South African Federale Volksbeleggings Beperk for the exploitation of diamond, manganese, and

[25] World Mining. V. 6, No. 3, March 1970, p. 57.
[26] World Mining. V. 26, No. 6, June 1970, p. 35.
[27] Work cited in footnote 23.
[28] Engineering and Mining Journal. V. 171, No. 2, February 1970, p. 78.
[29] Chamber of Mines Journal (Salisbury). Mining Spotlight Focused on Moçambique. V. 12, No. 2, February 1970, p. 30.
[30] Work cited in footnote 23.
[31] Barclays Overseas Survey (London). 1970, p. 40.
[32] Work cited in footnote 24.
[33] World Mining. What's Going On In World Mining. V. 6, No. 11, October 1970, p. 66.
[34] U.S. Embassy, Lourenço Marques, Mozambique. State Department Airgram A–90, June 30, 1970, 2 pp.
[35] U.S. Embassy, Lisbon, Portugal. State Department Airgram A–48, March 12, 1970, p. 1.
[36] Barclays Overseas Review (London). June 1970, p. 44.
[37] Work cited in footnote 24.
[38] Work cited in footnote 29.

asbestos deposits in the Catuane region near the Swaziland border.

Fluorite.—The Canxixe mine about 60 miles south of Sena was being developed by the Mozambique firm Interminas Ltd. A U.S. company reportedly has a 26.5-percent interest in the mine. Canxixe yields an acid-grade material of which about 1,000 tons was shipped to West Germany in 1970. If the mine is profitable a flotation plant will be built near the mine site. Employment at the mine totaled 80 men. The Maringue mine, also about 60 miles south of Sena, was scheduled for development. Numerous firms have applied to the Government to exploit the Djanguire and Monte Domba deposits.[39]

The Anglo-American Corp. of South Africa, Ltd. was given a concession to explore fluorite occurrences at Canxixe and other areas.[40] The inaccessibility of the Canxixe area and the long distance to the port of Beira have been obstacles to the development of the deposits. The building of a mill to produce acid-grade concentrates for export, based upon cheap electric power from the Cabora Bassa Dam, would help to overcome these problems.

Mineral Fuels.—*Petroleum.*—Tenneco Mozambique Oil Co. applied to the Government for an oil-prospecting concession area located onshore east of the South African, Swazi, and Rhodesian borders, and west and north of Lourenço Marques.[41]

Sunray Mocambique Oil Co., operator for a group including Skelly Oil Co. and Clark Oil and Refining Co., completed a sixth well offshore between Bartolo-Diaz and the southern border without finding oil or gas. Sunray was negotiating with the Government for other exploration acreage at yearend.[42]

Mozambique Gulf Oil Co. planned to prospect for oil offshore.[43] Studies of seismographic soundings indicate that important deposits could be found. Prospecting was scheduled to begin by October 1969.

The capacity of the Sociedade Nacional de Refinacao de Petroleos (SONAREP) refinery at Matola was increased by 900,000 tons per year to a total 1.5 million tons per year by mid-1970. The company was scheduled to reach a total planned capacity of 2.4 million tons per year by yearend.[44]

PORTUGUESE GUINEA

Esso Exploration Guinea Inc. drilled several dry holes, completing the last in June 1969.[45] The company was inactive in 1970. Trade was the only activity involving mineral commodities reported in 1970; however, small quantities of stone, sand and gravel probably were produced for local consumption.

In the first 8 months of 1969, imports of mineral commodities consisted mainly of 35,819 barrels of motor gasoline valued at $387,905; 6,936 barrels of kerosine valued at $70,490; and 13,885 barrels of aviation gasoline and jet fuel valued at $143,395. Other mineral product imports included 421 tons of cold rolled iron and steel valued at $95,200 and 5,751 tons of cement valued at $125,335. Imports of motor gasoline in 1970 totaled 31,748 barrels valued at $370,030; kerosine imports totaled 15,663 barrels valued at $178,185; aviation gasoline and jet fuel imports totaled 19,093 barrels valued at $181,566; and lubricating oil imports totaled 3,811 barrels valued at $123,452.

OTHER PORTUGUESE POSSESSIONS

Ball and Collins Ltd. of the United Kingdom signed an agreement with the Government of Portugal in May 1970 for oil and gas exploration rights on 1,057 square miles off the islands of São Tomé and Principe, in the Gulf of Guinea.[46] The concessions cover a period of 3½ years and are renewable for periods of 3 and 2 years. Exploitation rights can be extended for a 30-year period. An $11 million exploration program was planned for the next 18 months.

[39] Work cited in footnote 24.

[40] Industrial Minerals (London). World of Minerals. No. 31, April 1970, p. 43.

[41] U.S. Embassy, Lourenço Marques, Mozambique. State Department Airgram A–114, Aug. 14, 1970, p. 1, encl. 2.

[42] Petroleum Press Service. News In Brief. V. 37, No. 9, September 1970, p. 349.

[43] U.S. Embassy, Lisbon, Portugal. State Department Airgram A–228, Aug. 12, 1969, p. 1.

[44] Petroleum Press Service. Refinery Construction Boom. V. 37, No. 9, September 1970, p. 349.

[45] World Petroleum Report. Portuguese Guinea. V. 17, 1971, p. 61.

[46] Petroleum Press Service. V. 37, No. 8, August 1970, p. 309.

The Mineral Industry of Argentina

By Gordon W. Koelling [1]

Although the value of Argentina's crude minerals output increased approximately 10 percent during 1970, its share of the country's gross domestic product (GDP) was only about 2 percent. Mineral industry exports were insignificant, but imports of mineral commodities accounted for more than one-fourth of the total value of goods entering the country.

It has been estimated that 74 percent of Argentina's territory has mineral potential. However, as of 1970, only 22 percent of the potential mineralized area had been intensively explored and/or was involved in mineral production or had been subjected to only preliminary exploration. Consequently, the Government announced a 5-year exploration and mining plan that was to begin in 1971. This plan has as its principal goals (1) the increased production of minerals in order to lower imports, promote exports, assist in the expansion of basic industries, and increase the growth of the GDP; (2) assistance in the expansion and strengthening of the competitive position of the country's mining organizations; (3) the facilitation of regional vertical integration of the industries derived from, and connected with, the mining sector; and (4) improvement of mining methods and utilization of labor in order to reduce costs.

The Government continued studies to revise the 1887 Mining Code, which fails to furnish the necessary incentives for investment of risk capital in large-scale mining ventures.

PRODUCTION

Most segments of the mineral industry registered production gains in 1970. Some of the most important increases were shown by crude oil, natural gas, total refinery products, coal, columbite-tantalite, zinc, and salt. Major declines were registered by manganese, silver, and gypsum.

[1] Geographer, Division of Fossil Fuels.

Table 1.—Argentina: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Antimony mine output, metal content ... kilograms	------	------	380
Beryl concentrate, gross weight	r 594	518	302
Bismuth mine output, metal content ... kilograms	3,125	875	------
Chromium, chromite, gross weight	100	NA	NA
Columbite-tantalite, gross weight ... kilograms	r 1,820	1,615	4,490
Copper mine output, metal content	r 420	456	471
Gold mine output, metal content ... troy ounces	14	16	------
Iron and steel:			
Iron ore and concentrate ... thousand tons	277	299	239
Pig iron ... do	574	583	815
Ferroalloys, electric furnace ... do	25	24	e 24
Crude steel (ingots and castings) ... do	r 1,552	1,697	1,825
Semimanufactures ... do	1,537	1,870	2,500
Lead:			
Mine output, metal content	r 26,671	38,692	35,203
Smelter	25,038	22,000	e 38,000
Manganese ore and concentrate, gross weight:			
30 to 40 percent manganese	r 23,545	21,859	24,063
Less than 30 percent manganese	r 10,170	14,652	
Silver mine output, metal content ... thousand troy ounces	r 2,470	3,109	2,051
Tin mine output, metal content ... long tons	701	855	1,150
Tungsten mine output, metal content	r 185	146	e 120
Uranium mine output, U_3O_8 content ... kilograms	42,688	49,000	49,000
Zinc:			
Mine output, metal content	26,323	31,685	38,984
Smelter	20,938	24,598	32,000
NONMETALS			
Abrasives, natural, n.e.s.:			
Corundum	6	------	------
Garnet	65	100	60
Asbestos	346	326	e 320
Barite	r 24,195	26,990	24,850
Boron minerals, crude	r 25,855	31,788	43,313
Cement, hydraulic ... thousand tons	r 4,175	4,306	4,743
Chalk	r 59,001	54,475	61,126
Clays:			
Bentonite	r 54,168	62,139	55,500
Decolorizing (fuller's earth)	r 9,237	12,164	3,281
Foundry earth	2,110	(2)	2,024
Kaolin	r 73,706	80,905	65,184
Refractory	r 116,113	134,706	135,566
Other ... thousand tons	r 882	[2] 2,100	2,081
Diatomite	r 8,473	10,339	8,800
Feldspar	r 18,332	21,836	26,232
Fertilizer materials, crude natural phosphates (guano)	294	491	317
Fluorspar	r 21,508	29,377	24,000
Graphite	110	243	76
Gypsum, crude	r 434,076	535,306	465,797
Lithium minerals	127	352	295
Mica:			
Sheet	r 97	119	77
Waste and scrap	r 802	573	664
Pigments, natural mineral, ocher	r 100	310	220
Pumice and related volcanic materials	12,419	29,892	32,617
Rhodochrosite	r 177	119	164
Salt:			
Rock	1,786	471,834	1,102
Solar	736,815		911,789
Sand and gravel:			
Sand:			
Construction ... thousand tons	r 8,479	9,101	8,690
Silica sand (glass sand) ... do	r 194	271	228
Gravel ... do	r 5,806	7,175	6,890
Stone:			
Dimension:			
Alabaster	45	976	NA
Flagstone	r 47,101	69,913	46,610
Granite	r 13,160	18,255	13,530
Marble and other calcareous, n.e.s	r 20,370	26,002	24,837
Sandstone	r 12,372	6,636	16,796
Crushed, broken and unspecified:			
Basalt ... thousand tons	729	2,147	1,800
Calcite, nonoptical	r 6,223	10,023	10,448
Dolomite ... thousand tons	r 128	162	170

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
NONMETALS—Continued			
Stone—Continued			
Crushed, broken and unspecified—Continued			
Granite, crushed ... thousand tons	r 4,571	8,050	6,000
Limestone ... do	r 11,477	15,352	16,000
Marble chips ... do	64	70	68
Quartz ... do	r 51	48	52
Quartzite ... do	r 923	1,135	1,373
Serpentine	26,343	25,750	26,350
Shell, marl	109,039	e 105,000	103,687
Strontium minerals, celestite	r 165	13	406
Sulfur, elemental refined	r 33,637	34,579	37,500
Sulfates, natural:			
Aluminum (alum)	r 2,369	6,242	7,774
Iron (melanterite)	8	165	50
Magnesium (epsomite)	r 2,005	1,317	1,172
Sodium (mirabilite)	r 19,919	26,980	31,866
Talc and related materials:			
Pyrophyllite	r 6,298	6,432	6,860
Steatite	r 2,608	4,528	5,338
Talc	r 21,266	21,713	16,176
Vermiculite	r 4,324	4,557	3,553
Zeolite	52	48	75
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	r 1,976	3,485	NA
Carbon black	21,974	24,000	e 25,000
Coal, bituminous ... thousand tons	r 472	522	616
Coke, all types, including breeze ... do	365	361	e 360
Gas, natural:			
Gross production ... million cubic feet	249,486	247,294	270,683
Marketed ... do	188,806	188,133	212,452
Natural gas liquids:			
Natural gasoline [3] ... thousand 42-gallon barrels	r 423	458	645
Liquefied petroleum gas ... do	r 1,310	1,312	NA
Peat, agricultural	1,771	536	3,407
Petroleum:			
Crude oil ... thousand 42-gallon barrels	r 125,492	130,086	143,428
Refinery products:			
Aviation gasoline ... do	r 470	419	377
Motor gasoline ... do	r 29,392	33,164	33,559
Jet fuel ... do	1,708	2,212	2,341
Kerosine ... do	r 6,275	6,427	6,880
Distillate fuel oil ... do	r 28,914	31,757	34,915
Residual fuel oil ... do	r 56,576	55,235	59,609
Lubricants ... do	961	1,036	1,084
Other:			
Naphtha ... do	r 677	654	e 700
Liquefied petroleum gas ... do	r 3,527	4,156	e 4,200
Petroleum coke ... do	2,398	2,908	3,645
Asphalt ... do	3,702	4,803	4,205
Solvents ... do	391	395	410
Other ... do	234	222	350
Refinery fuel and losses ... do	r 2,089	1,735	e 1,830
Total ... do	137,314	145,123	154,105

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

[1] In addition to the commodities listed, cadmium metal, lime, perlite, and both Thomas slag and urea for fertilizer use are also produced but output is unreported and available information is inadequate to make reliable estimates of output levels.

[2] Foundry earth included with "Other" clays.

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

TRADE

During 1970, Argentina's mineral industry continued to experience a serious unfavorable balance of trade, with the value of imports exceeding that of exports by a factor of 26 to 1. Petroleum refinery products accounted for 48 percent of the total value of mineral exports with most of the remainder consisting of borates; salt; and tungsten, silver, lead, tin, and copper concentrates. Semifinished iron and steel accounted for approximately 60 percent of mineral imports by value. Other items contributing significantly to the total value of mineral imports included semifinished aluminum and copper, crude oil, and refinery products.

The value of mineral exports and imports in 1970 were 5 percent higher and 3 percent lower, respectively, than during 1969, the latest year for which detailed foreign trade product breakdown data were available.

Table 2.—Argentina: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	68	282
Beryllium, beryl ore and concentrate	570	527
Cadmium	24	------
Copper:		
Ore and concentrate [1]	282	826
Metal including alloys, all forms	421	274
Iron and steel:		
Ingots and other primary forms	------	1
Semimanufactures:		
Bars and rods:		
Wire rods	39,198	92,513
Other	112,316	8,170
Angles, shapes, sections	24,711	30,587
Universals, plates, sheets	2,116	2,804
Wire	5,743	4,424
Tubes, pipes, fittings	55,992	59,905
Other	82	83
Lead:		
Ore and concentrate	633	4,113
Metal including alloys, all forms	6	1
Manganese ore and concentrate	------	21
Silver thousand troy ounces	540	18
Tantalite kilograms	1,802	------
Tin:		
Ore and concentrate long tons	4,648	5,627
Metal including alloys do	3	(2)
Tungsten ore and concentrate	307	193
Zinc including alloys, all forms	1,854	2,550
Other:		
Ores and concentrate	------	32
Ash and residues containing nonferrous metal	1,446	1,232
Metals including all forms, n.e.s	29	32
NONMETALS		
Asbestos	------	6
Barite	1,263	100
Boron materials, crude natural borates	200	232
Cement	35,798	34,628
Chalk	25	13
Clays and clay products (including all refractory brick):		
Bentonite	10,471	7,765
Kaolin	22	73
Other	3	18
Diatomite and other infusorial earths	6	24
Fluorspar	981	499
Gypsum and plasters	15,037	9,792
Lime	205	108
Mica, all forms	524	330
Onyx	108	15
Quartz	60	3
Rhodochrosite, ornamental kilograms	9,805	21,388
Salt	47,995	62,691
Stone, sand and gravel:		
Dimension	5,720	8,473
Dolomite	1,520	2,730
Other	51	95
Talc, steatite, soapstone, pyrophyllite	60	330
Other nonmetals	2,024	632
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	4,316	2,071
Carbon black	5,294	3,096
Coal and coke, all grades	2,164	25,329
Gas, hydrocarbon, liquefied or not	995	105
Petroleum:		
Crude thousand 42-gallon barrels	1,410	455
Refinery products:		
Gasoline do	5	12
Kerosine do	(2)	5
Distillate fuel oil do	1	24
Residual fuel oil do	r 6,168	639
Lubricants do	r 16	39
Other do	r 381	987
Mineral tar and crude chemicals from coal, petroleum, natural gas	301	2,023

r Revised.
[1] Including concentrates containing significant amounts of silver.
[2] Less than ½ unit.

Source: Instituto Nacional de Estadística y Censos. Comercio Exterior, Part II, 1968 and 1969.

Table 3.—Argentina: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	37,528	29,917
Oxide (alumina) and hydroxide	6,816	9,156
Metal including alloys, all forms	41,550	53,710
Antimony ore and concentrate	283	369
Arsenic, trioxide	433	468
Bismuth	17	22
Cobalt:		
Oxide and hydroxide	10	15
Metal	71	79
Chromium, chromite	310	4,744
Copper including alloys, all forms	20,104	29,132
Iron and steel:		
Ore and concentrate ... thousand tons	616	467
Metal:		
Scrap ... do	185	199
Pig iron, including spiegeleisen ... do	280	362
Ferroalloys	2,808	3,266
Ingots and other primary forms ... thousand tons	343	781
Semimanufactures:		
Bars and rods ... do	20	27
Angles, shapes, sections ... do	22	31
Universals, plates, sheets:		
Tinned plates and sheets ... do	117	133
Other coated plates and sheets ... do	2	7
Other (uncoated) ... do	190	295
Hoop and strip ... do	13	12
Rails and accessories ... do	(1)	13
Wire ... do	2	2
Tubes, pipes, fittings ... do	7	39
Other, n.e.s ... do	1	1
Lead including alloys, all forms	1,870	1,208
Magnesium	249	675
Manganese:		
Ore and concentrate	54,396	20,168
Oxides	4,321	3,702
Metals	38	58
Mercury ... 76-pound flasks	165	552
Nickel including alloys, all forms	572	573
Precious metal and alloys, unwrought and semimanufactures ... troy ounces	95,230	84,653
Rare-earth metals and compounds	10	16
Selenium, elemental	9	11
Tin:		
Oxides ... long tons	1	------
Metal including alloys, all forms ... do	1,079	1,292
Titanium:		
Ore and concentrate	794	1,245
Oxides	1,100	964
Zinc including alloys, all forms	4,480	5,079
Zirconium ore and concentrate	844	1,079
Other:		
Ore and concentrate	r 2	(1)
Metals including alloys, all forms	r 20	32
NONMETALS		
Abrasives, natural, n.e.s	620	372
Asbestos	16,629	16,451
Barite	70	119
Bromine	75	117
Cement	r 1,605	345,406
Chalk	82	337
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Fire	268	222
Kaolin	13,818	15,579
Other	23	7
Products:		
Refractory (including nonclay brick and cement)	17,911	14,201
Nonrefractory	456	2,551
Diamond: [2]		
Gem ... value	$21,433	$51,615
Industrial ... do	$97,102	$115,866
Powder ... do	$43,742	$37,594
Diatomite and other infusorial earths	2,174	1,988

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Fertilizer materials:		
Nitrogenous:		
Natural	7,738	10,640
Manufactured	36,125	30,219
Phosphatic	7,741	9,756
Potassic	10,909	8,539
Mixed and nonspecified fertilizers	37,905	38,830
Graphite, natural	372	347
Gypsum	------	41
Iodine	26	56
Kyanite, andalusite, sillimanite	202	331
Lime	60	(1)
Lithium and lithium compounds	40	82
Magnesite	4,560	13,880
Mica	20	22
Pigments, mineral	75	74
Quartz	241	1,137
Sodium and potassium compounds excluding salt:		
Caustic soda	5,594	14,785
Caustic potash	755	783
Sodium carbonate	143,096	149,245
Stone, sand and gravel:		
Dimension	8,710	11,182
Dolomite	12,271	24,124
Gravel and crushed rock ... thousand tons	244	202
Sand ... do	922	1,038
Sulfur, elemental, all forms	22,468	44,715
Talc, steatite, soapstone, pyrophyllite	143	236
Other nonmetals, n.e.s	487	614
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	192	249
Carbon black	1,478	2,373
Coal ... thousand tons	521	457
Coke ... do	31	46
Gas, hydrocarbon, liquefied or not ... thousand 42-gallon barrels	3,712	1,931
Petroleum:		
Crude ... do	13,133	16,227
Refinery products:		
Gasoline ... do	523	3
Kerosine ... do	(1)	(1)
Distillate fuel oil ... do	2,823	5,893
Residual fuel oil ... do	------	4,926
Lubricants ... do	65	3
Other ... do	6	------
Mineral tar and crude chemicals from coal, petroleum, natural gas	36,692	54,748

r Revised.
1 Less than ½ unit.
2 Data on quantity incomplete, or not reported.

Source: Instituto Nacional de Estadistíca y Censos. Comercio Exterior, Part III, 1968 and 1969.

COMMODITY REVIEW

METALS

Aluminum.—Bids were received during 1970 from three groups—a British, an Italian, and a U.S.-French-Canadian consortium—for participation in a planned 140,000- to 150,000-ton-per-year aluminum reduction plant at Puerto Madryn. This plant, scheduled for completion in 1974, will use imported alumina as a feedstock and is to obtain its electric power from the planned Futaleufu hydroelectric project more than 500 kilometers to the west.

Copper.—The Government, through Fabricaciones Militares (FM), continued its efforts to interest foreign firms in the development of the 54 copper prospects discovered in the Provinces of Mendoza, Neuquén, and San Juan under the joint United Nations-FM Plan Cordillerano survey. Bids for development of one or more of these prospects were received from five international companies during 1970. One of the companies was Compañía Minera Aguilar, S.A., a subsidiary of St. Joe Minerals Corp. of the United States; another was Falconbridge Nickel Mines, Ltd., of Canada; and two of the remaining three were United Kingdom firms.

Iron and Steel.—The Government continued to push ahead with its plans to mine and beneficiate 2 million tons per year of high-phosphorous iron ore at Sierra Grande and to pelletize the beneficiated ore at a plant to be constructed at Punta Colorado on the Golfo San Matías. To this end, Hierro Patagonica de Sierra Grande, S.A., a company with majority interest assigned to the Government-owned FM, was formed in February 1970 to operate the project.

A contract was then signed between Hierro Patagonica de Sierra Grande, S.A., and Widmark & Platzer, A.B., of Sweden, calling for the latter to provide technical and engineering services and mine management at Sierra Grande. The Swedish company will also be in charge of underground installations and will construct the primary grinding and preconcentration plants. A 30-kilometer iron ore slurry pipeline from Sierra Grande to Punta Colorado is to be constructed, under contract, by the Bechtel Corp. of the United States. Another firm, Soros Associates of New York, was awarded a contract covering the planning of necessary marine loading facilities at Punta Colorado. Contracts for construction of the concentration plant at Sierra Grande and the pelletizing plant at Punta Colorado had not been awarded as of yearend 1970.

Pig iron production increased almost 40 percent in 1970, largely as a result of the repair and improvement of existing facilities at the Government-owned Sociedad Mixta Siderúrgia Argentina (SOMISA) plant. During the same year, crude steel output rose 8 percent owing to the operation of new furnaces and technical improvements.

Work continued in 1970 on expansion and modernization of the SOMISA steel mill. Construction was underway on batteries 3 and 4 of the coke plant and on the initial billet-soaking pit for the billet-rolling plant. Progress was also made on installation of a new soaking pit for the flat rolling plant. The foundation was completed, and other site work was in progress for a 2,000-ton-per-day sintering plant.

During 1970, the capacity of the Establecimientos Metalúrgicas Santa Rosa, S.A., steel mill was increased 8,000 tons per year, as a result of stack changes and the installation of an electromagnetic agitator and an additional transformer at one of the electric furnace units. Plans for further expansion of the mill were submitted to the Government for approval.

Uranium.—The Comisión Nacional de Energía Atómica (CNEA), which is responsible for all uranium exploration and production but contracts a major portion of its work to private firms, announced near yearend 1970 that private firms under its direction had discovered a major uranium deposit. This discovery is located in the vicinity of Bola Hill, 25 kilometers west of San Rafael in southern Mendoza Province. CNEA described it as the richest uranium deposit discovered in Argentina to date; reserves were estimated in excess of 10,000 tons of U_3O_8 content. The deposit was described as extending 2,600 feet along a strike, with depths exceeding 650 feet in some places. Average U_3O_8 content of the ore was reported at approximately 0.1 percent.

Construction continued on Argentina's first nuclear power station at Atucha. The reactor was expected to be in operation by mid-1972 and the commercial production of electric power was scheduled to begin during 1973.

NONMETALS

Cement.—The rated installed capacity of Argentina's cement industry totalled 5,131,000 tons at the beginning of 1970. Approximately 65 percent of this total was accounted for by five plants located in the Province of Buenos Aires. Rated capacity by province was as follows in thousand tons per year:

Province	Capacity
Buenos Aires	3,319
Córdoba	627
Chubut	168
Entre Ríos	146
Mendoza	368
Salta	234
San Juan	125
Santiago del Estero	144
Total	5,131

Fertilizer Materials.—Decree 1641 of May 22, 1970, suspended, until the end of the same year, the importation of all synthetic fertilizers. This move was designed to protect the petrochemical fertilizer plant of Petrosur, S.A.I. y C. This company's nitrogenous fertilizer plant, placed on stream at Campana during 1968, was reported to have a daily capacity of 200 tons of ammonia, 147 tons of ammonium sulfate, and 160 tons of urea.

Sulfuric Acid.—Although installed capacity for the production of sulfuric acid was more than adequate to meet demand at the beginning of 1970, plant capacity was expanded 21 percent during the year, and considerable price competition occurred in the domestic market. Operators of active sulfuric acid plants and the capacities of their facilities at yearend were as follows, in tons per year:

Operator	Capacity
Compañía Química	14,000
Fabricaciones Militares (FM)	36,200
Industrias Quimicas Argentinas Duperial	75,000
National Atomic Energy Commission	5,000
National Waterworks	12,000
Petrosur, S.A.I. y C.	39,500
Sulfacid	43,000
Zárate Sulfúrico	18,000
Total	242,700

Two plants, one owned by SOMISA and the other by Grassi, S.A., were not in operation.

Most of the feedstock for sulfuric acid plants was of domestic origin although some elemental sulfur was imported. All of the sulfuric acid produced by Petrosur was used by that company in its fertilizer plant.

MINERAL FUELS

Coal and Coke.—Work was in progress during 1970 on a project to expand the coal-washing facilities at the Río Turbio mine of Yacimientos Carboníferos Fiscales (YCF), the Government coal entity, located in extreme southwestern Argentina in the Province of Santa Cruz. West's (Manchester), Ltd., a United Kingdom firm, held the contract for the design, manufacture, and shipment of equipment necessary to increase the coal washing capacity from 250 tons per hour to 520 tons. YCF was responsible for erection of the equipment, with technical assistance to be provided by West's (Manchester), Ltd. The project was scheduled for completion in 1971.

A Belgian company and a West German firm reportedly signed an agreement during the early part of 1970 with an Argentine steel manufacturer for the installation of a coke and coke byproducts plant. This plant would have 80 ovens and an ultimate capacity of 847,000 tons of coke per year. Completion time was estimated at 29 months.

Petroleum and Natural Gas.—Argentina's output of crude oil increased 10 percent, to 392,943 barrels per day during 1970. The most important gains were from fields in the provinces of Río Negro, Mendoza, Neuquén, and Jujuy. Yacimientos Petrolíferos Fiscales (YPF), the Government oil entity, was responsible for 67 percent of total output and private companies, the most important of which were U.S.-owned, holding contracts with YPF under terms of the Hydrocarbons Law 17,319 of 1967, accounted for 32 percent. The remaining 1 percent of production was from private firms operating under earlier agreements.

In 1970, natural gas production rose about 9 percent, to 742 million cubic feet per day. YPF accounted for almost 94 percent of total output, private companies operating under the Hydrocarbons Law of 1967 were responsible for 5 percent, and other private firms produced 1 percent.

According to figures published by YPF, the country's total proved reserves of crude oil were almost 2.5 billion barrels at yearend 1970. 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:

	1968	1969	1970
Geologic and geophysical surveying:			
Geologic---party-months	84.0	100.0	112.0
Gravimetric---do	12.0	12.0	14.0
Magnetic---do	0.9	1.3	----
Seismic---do	294.0	287.1	341.9
Total---do	390.9	400.4	467.9
Drilling: Wells drilled:			
Exploratory:			
Oil---number	13	16	14
Gas---do	9	4	10
Dry---do	63	66	89
Subtotal---do	85	86	113
Development:			
Oil---do	294	228	334
Gas---do	30	20	38
Dry---do	91	88	94
Subtotal---do	415	336	466
Total---do	500	422	579

Source: American Association of Petroleum Geologists. Bulletin. August 1969, August 1970, and September 1971.

A total of 20 exploration wells were drilled offshore, 12 in the Bahía Blanca area and eight in the Golfo San Jorge. Of the exploratory wells drilled in Bahía Blanca, where the Phillips Petroleum Co. Argentina-Agip Argentina combine and the Hunt International Petroleum Co. were active; all were dry holes. Two of the eight wells drilled in the Golfo San Jorge by the Phillips Petroleum Co. Argentina-Agip Argentina-Tennessee Argentina, S.A., consortium produced 260 and 500 barrels of crude oil, respectively, on test, but it was doubtful that they would prove to be commercial discoveries because of their distance from shore and the frequent rough water conditions in the area.

One major new exploration permit area was opened for bids by the Government under the terms of Hydrocarbon Law 17,319. This was the Zona Magallanica, a 1.8-million acre area in the southwestern part of Santa Cruz Province adjacent to the Chilean border. During September 1970, this block was awarded to a combine comprised of Amoco Argentina Oil Co. and South American Development Co., a subsidiary of Signal Companies, Inc. This group was later joined by Superior Oil International, Inc. Amoco Argentina Oil Co. was named operator for the group; surface geologic exploration was initiated late in the year, and a contract was awarded for a seismic survey to begin early in 1971.

YPF continued its pilot water injection program during 1970 in the Cañadón field in the Province of Santa Cruz, the Barrancas Sur field in Mendoza, and the El Sauce and Cerro Bandera fields in Neuquén.

The programs in the latter two fields are to be expanded to full-scale pressure maintenance operations by private capital under a service contract arrangement.

During the first half of 1970, YPF announced plans for three additional pilot water injection projects and a full-scale water injection program. The necessary facilities will be installed and operated by a consortium of private companies under a service contract recently signed with YPF. Texas International Petroleum Corp. will be the operator for the consortium, which also includes Sunset International Petroleum of Dallas, Tex., and Argentina's Compañía Naviera Pérez, Petrolera Argentina San Jorge, and Burguardt and Cia.

Initial work under terms of the service contract will involve a full-scale water-injection, pressure-maintenance program at the Catriel Oeste field in Neuquén Province, two pilot water floods at the El Condón field in Santa Cruz, and one pilot injection project at the El Trébol field in Chubut.

The modernization and expansion of Argentina's petroleum refining facilities continued during 1970. Work was in progress on the expansion of YPF's Luján de Cuyo refinery from a capacity of 44,000 barrels per day to 100,000 barrels; construction of the company's 94,000-barrel-per-day plant at Bahía Blanca was under way. The 86,000-barrel-per-day Buenos Aires refinery of Shell Cía. Argentina de Petróleo, S.A., was in the process of being expanded to a capacity of 116,000 barrels per day. La Iseura, S.A., a private Argentine company, was doubling the size of its small refinery at Bahía Blanca.

At yearend 1970, YPF announced plans for additional expansion of its refining facilities. The most ambitious of these plans called for raising the throughput capacity of the La Plata refinery to 205,000 barrels per day by the addition of a 75,000-barrel-per-day atmosphere distillation unit. Another project in the planning stage was the enlargement of the 5,000-barrel-per-day Plaza Huincul plant to 22,000 barrels per day. Other announced plans included expansion of the Campo Durán refinery's capacity by 4,000 barrels per day, construction of a 6,300-barrel-per-day plant at Río Gallegos, and the installation of an asphalt unit at the San Lorenzo refinery.

Argentina's principal trunk crude oil and products pipelines transported almost 78 million barrels of petroleum during 1970, an increase of 54 percent over that of 1969. Quantities carried by individual lines during both years were as follows, in thousand barrels:

Pipeline	Quantity transported	
	1969	1970
Crude oil: Challacó-Puerto Rosales	25,295	33,302
Products:		
Campo Durán-Aguaray	156	140
Campo Durán-San Lorenzo	8,318	15,878
La Plata-Dársena de Inflamables	9,312	11,173
Do	5,963	9,794
Luján de Cuyo-Monte Cristo	1,514	7,411
Subtotal	25,263	44,396
Total	50,558	77,698

Source: Secretaría de Estado de Energía, Dirección General de Asumtos Tecnicos y Economics, Departmento de Estadística. 1971.

Extensive pipeline construction was in progress during 1970. A 32-inch crude oil line with a capacity of 200,000 barrels per day was being built to link the marine terminal under construction at Cabo San Antonio with refineries in La Plata and Buenos Aires. This 270-kilometer line was scheduled for completion during 1971.

A 14-inch refined products pipeline was under construction from Mercedes, on the Luján de Cuyo-Córdoba line, to Buenos Aires. This 660-kilometer pipeline was to have a capacity of 50,000 barrels per day. Completion was scheduled for 1972.

At the end of 1970, two large natural gas pipelines were being constructed for Gas del Estada, the Government-owned gas distribution company. One of these, scheduled for completion during 1971, was to extend 570 kilometers from Neuquén to Bahía Blanca. It was to have a diameter of 24 inches and a capacity of 130 million cubic feet per day. The other line, scheduled for completion during 1972, will link the El Cóndor and Cerro Redondo fields, located in extreme southern Argentina, with the southern terminus of the existing natural gas pipeline from Pico Truncado to Buenos Aires. Capacity of the 665-kilometer, 30-inch Cóndor-Pico Truncado line will be 300 million cubic feet per day.

Construction was intiated in December 1970 on the La Plata petrochemicals plant of Petroquimica General Mosconi, a firm owned jointly by FM and YPF. This project is scheduled for completion by the end of 1974. It is being designed to utilize raw materials from YPF's La Plata refinery for the production of the following petrochemicals, in tons per year:

Product	Capacity
Benzene	28,000
Toluene	5,000
Cyclohexane	40,000
Orthoxylene	15,000
Paraxylene	33,000
Aromatic mixtures	17,000

As of yearend 1970, negotiations between The Dow Chemical Co. and FM had failed to resolve the disagreement concerning the former's degree of participation in the planned Bahía Blanca petrochemicals complex, and it appeared unlikely that Dow would make a substantial investment in the project.

The Mineral Industry of Australia

By J. Patrick Ryan [1]

In 1970, Australia's mineral industry continued its high rate of growth in production and exports. According to preliminary data, the value of Australia's mineral production reached a new record of $1,596 million,[2] an increase of nearly 25 percent over the previous high of $1,277 million established in 1969. The most significant production gain was in iron ore, which increased from 39 million tons in 1969 to 51 million tons in 1970. Crude oil production more than quadrupled, to 65 million barrels; natural gas output increased almost sixfold, to 53 million cubic feet; nickel concentrates more than doubled, to 230,000 tons; and bauxite output was up 19 percent, to 9.4 million tons. Appreciable production gains were also recorded for ilmenite and zircon concentrate. Mine production of lead increased slightly but zinc output was lower than that of 1969; copper output increased 16 percent.

The value of mineral exports exceeded $1,000 million for the first time, establishing a new record of $1,282 million, an increase of 29 percent over 1969. Most of the increase came from iron ore and pellets, alumina and aluminum, coal, copper, lead and zinc, mineral sands, and tin and tungsten. In contrast, the value of mineral imports dropped nearly 16 percent, to $286 million. The sharp reduction in imported crude oil, resulting from increased domestic production, was the major factor in the decline. The drop in imports of phosphate rock and sulfur for the fertilizer and chemical industries also contributed to the decrease in value of mineral imports. Nickel and asbestos were the only mineral imports that increased significantly. The gain in nickel import value reflected increased price, as well as quantity; the 40-percent gain in value of asbestos imports was attributed to expansion in the building industry.

The search for minerals continued to surge upward as exploration activities expanded in many parts of the Commonwealth. State mining departments have been swamped with applications for exploration and prospecting licenses. The exploration and development of the vast iron ore, bauxite, and nickel deposits of Western Australia accelerated and international mining companies acquired new mineral tracts for intensive exploration. In the Northern Territory, discoveries of lead-zinc and uranium were reported, and potential areas for petroleum discovery have been delineated. A significant lead-zinc-copper ore discovery in New South Wales was announced by St. Joe Minerals Corp. and Phelps Dodge Corp.

PRODUCTION

Production gains were recorded for most metals and nonmetals produced in Australia in 1970. The most significant increases were in the metals and fuels groups although appreciable gains also occurred in most nonmetals.

[1] Mining engineer, Division of Nonferrous Metals.

[2] Unless otherwise indicated, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$1 = US$1.12.

Table 1.—Australia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite thousand tons	r 4,955	7,921	9,389
Alumina do	1,309	1,931	2,138
Metal, refined do	97	126	204
Antimony mine output (content of antimony and lead concentrates)	r 856	925	922
Beryllium, beryl, gross weight	15	7	18
Bismuth mine output (content of ore) kilograms	r 182,888	200,127	201,066
Cadmium:			
Mine output, metal content	1,381	1,687	1,621
Smelter output (refined)	472	571	598
Chromium, chromite, gross weight	87	--	--
Cobalt mine output (content of zinc and nickel concentrates)	r 239	244	463
Columbium-tantalum concentrates, gross weight	108	155	55
Copper:			
Mine output, metal content	r 109,638	131,056	151,956
Blister:			
Primary	93,938	116,184	110,877
Secondary	9,277	8,242	NA
Refined:			
Primary	85,622	100,854	103,743
Secondary	17,416	19,552	NA
Gold mine output, metal content troy ounces	r 781,782	701,918	620,305
Iron and steel:			
Iron ore, gross weight thousand tons	r 26,625	39,094	51,102
Pig iron do	r 5,637	6,186	6,148
Ferroalloys:[1]			
Ferrochromium, high carbon	2,512	2,447	NA
Ferromanganese	36,900	50,249	NA
Ferrosilicon	10,213	9,533	NA
Silicomanganese	15,109	13,293	NA
Ferronickel	--	19	NA
Crude steel thousand tons	6,502	7,017	6,822
Steel semimanufactures [1] do	6,349	6,317	NA
Lead:			
Mine output, metal content	r 388,813	r 452,040	457,366
Metal:			
Primary:			
Bullion for export	117,997	155,592	172,384
Refined	178,045	188,756	180,078
Total	296,042	344,348	352,462
Secondary (excluding remelt)	24,800	26,100	NA
Manganese ore, gross weight	r 743,613	889,289	751,522
Mercury 76-pound flasks	54	48	37
Molybdenum mine output, metal content	5	47	e 45
Monazite concentrate, gross weight	r 2,088	3,855	4,560
Nickel:			
Mine output, metal content	r 4,677	11,181	28,905
Metal, refined	--	--	e 9,000
Platinum group:			
Osmiridium troy ounces	12	--	NA
Palladium [2] do	NA	321	NA
Platinum [2] do	NA	473	NA
Selenium (in refinery slime) e kilograms	2,500	3,000	3,300
Silver:			
Mine output, metal content thousand troy ounces	r 21,394	24,457	25,995
Refined do	9,613	10,389	9,303
Tin:			
Mine output, metal content long tons	r 6,537	8,173	8,919
Smelter output do	3,692	4,156	5,129
Titanium concentrates:			
Ilmenite (including leucoxene)	r 561,985	720,524	875,887
Rutile	r 292,233	362,058	367,552
Tungsten mine output, metal content	1,156	1,250	1,244
Uranium oxide (U_3O_8) e	300	300	300
Zinc:			
Mine output, metal content	r 422,394	509,903	489,061
Smelter output	208,282	246,323	260,594
Zirconium concentrates, gross weight	r 298,917	375,223	385,466
NONMETALS			
Abrasives, natural:			
Beach pebbles	1,342	1,062	NA
Garnet (sales)	102	83	NA
Asbestos	r 813	748	816
Barite	r 39,783	40,197	42,813
Cement, hydraulic thousand tons	3,928	4,310	4,600

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
NONMETALS—Continued			
Clays:			
Bentonite and bentonitic	308	463	e 450
Brick and shale thousand tons	r 6,525	7,927	6,978
Cement and shale do	r 255	277	e 270
Damourite	r 493	593	e 500
Fire thousand tons	300	325	e 300
Kaolin and ball	60,295	65,484	e 65,000
Other thousand tons	793	628	NA
Diatomite	6,833	2,412	2,282
Feldspar	4,916	5,016	3,381
Fertilizer materials, crude, phosphate rock	5,836	18,551	14,489
Fluorspar	--	--	e 2,000
Fuller's earth	76	30	NA
Gem stones e value, thousands	$7,365	$13,900	NA
Gypsum	r 857,286	912,113	837,625
Kyanite and sillimanite, sillimanite	2,149	1,701	e 1,200
Lime [3]	214,819	e 210,000	e 210,000
Lithium minerals, petalite, gross weight	750	721	783
Magnesite	23,517	23,525	22,663
Perlite, crude	1,066	1,132	NA
Pigments, natural mineral, ocher	535	678	NA
Pyrite including cupreous:			
Gross weight	167,918	160,931	e 157,000
Sulfur content	72,944	71,789	e 65,000
Salt thousand tons	r 914	1,680	3,116
Sand and gravel:			
Sand:			
Construction do	14,637	18,199	NA
Glass including quartzite do	551	652	NA
Gravel do	8,473	10,501	NA
Stone:			
Dolomite do	322	297	318
Limestone for cement do	5,880	6,500	NA
Limestone for other uses do	2,728	3,108	NA
Other:			
Crushed and broken [4] do	45,087	47,829	NA
Dimension [4] do	280	269	NA
Unspecified [5] do	27,008	24,695	NA
Sulfur, byproduct [6] do	122	135	NA
Talc and soapstone	r 38,894	52,614	130,934
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous [7] thousand tons	40,829	46,082	49,547
Lignite do	23,340	23,274	24,203
Total do	64,169	69,356	73,750
Coke:			
Metallurgical do	3,955	4,451	4,878
Gas house do	635	391	390
Fuel briquets do	1,578	1,487	1,449
Natural gas, marketed production million cubic feet	216	9,375	53,061
Petroleum:			
Crude thousand 42-gallon barrels	13,877	15,805	65,149
Refinery products:			
Gasoline:			
Aviation do	312	219	246
Other do	56,085	58,721	62,255
Jet fuel do	6,374	6,764	8,753
Kerosine do	1,874	1,710	1,676
Distillate fuel oil do	28,850	31,831	34,043
Residual fuel oil do	44,728	38,913	41,734
Lubricants do	2,402	2,258	2,576
Other do	6,676	10,181	12,844
Refinery fuel and losses do	16,288	15,320	15,333
Total do	163,589	165,917	179,460

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

[1] Year ended November 30 of that stated.

[2] Partial data; palladium and platinum 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 these metals reportedly are not recovered.

[3] Year ended June 30 of that stated.

[4] Excludes quartzite (see under sand and gravel), and all production from Northern Territory and Australia Capital Territory.

[5] Excludes quartzite (see under sand and gravel), and all production from Northern Territory, Australian Capital Territory, South Australia and West Australia.

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

[7] Includes semianthracite and subbituminous.

TRADE

The following trade data, provided by the Commonwealth Bureau of Census and Statistics, 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	1967–68	1968–69	Principal destinations, 1968–69
METALS			
Aluminum:			
Alumina [2] value, thousands	$67,704	$81,150	NA.
Scrap	1,205	3,219	Japan 2,684; Netherlands 207.
Unwrought	7,047	8,522	Hong Kong 3,144; New Zealand 1,646; Philippines 1,595; Japan 1,093.
Semimanufactures	5,399	3,729	Canada 1,861; New Zealand 590; Malaysia 305.
Beryllium ore and concentrate	66	129	All to United States.
Cadmium, refined [3]	16	128	United Kingdom 56; United States 49; Netherlands 14.
Copper:			
Ore and concentrate, gross weight	48,014	41,732	Japan 39,778; Belgium-Luxembourg 1,439.
Blister, cement, etc	6,638	7,936	All to Japan.
Scrap	513	362	NA.
Ingots, blocks, billets	12,685	26,476	United Kingdom 6,252; United States 5,589; Italy 4,660.
Semimanufactures	6,124	9,348	New Zealand 6,406; Japan 1,928; Malaysia 784.
Pipe, tubes, wire	870	942	New Zealand 708; Singapore 105.
Gold:			
Ore and concentrate, content [2] troy ounces	116,575	424,666	NA.
Crude bullion, content do	15,831	--	
Mint bullion do	60,839	50,869	Hong Kong 31,198; United Kingdom 19,219.
Sheet, strip, dust do	424,641	644,307	Hong Kong 630,328; New Zealand 8,635.
Iron and steel:			
Iron ore and concentrates thousand tons	12,524	20,394	Japan 17,471; West Germany 738; Italy 681.
Scrap	429,940	489,718	Japan 468,894; West Germany 10,587.
Pig iron	185,865	351,739	Japan 309,606; Philippines 14,729.
Steel ingots, blooms, slabs, etc	348,986	431,655	Philippines 185,265; Japan 98,050; Spain 34,617.
Steel semimanufactures	594,295	699,314	New Zealand 215,102; United States 132,343; United Kingdom 95,582; Philippines 47,747.
Lead:			
Ore and concentrate, gross weight	115,320	115,162	United States 43,330; Japan 30,914; United Kingdom 19,169.
Refined, unwrought	153,465	117,267	United Kingdom 48,704; United States 37,166; India 13,278.
Bullion, lead and silver-lead	108,473	128,375	United Kingdom 111,245; Belgium-Luxembourg 6,602; Netherlands 6,174.
Semimanufactures	3,994	6,616	New Zealand 1,886; United Kingdom 1,694; Philippines 958.
Manganese ore	400,044	639,635	Japan 376,660; United States 140,982.
Platinum [4] troy ounces	3,671	8,486	Hong Kong 5,340; United Kingdom 1,253; New Zealand 1,032.
Silver:			
In lead bullion and concentrates, content [2] thousand troy ounces	11,272	13,125	Mainly in lead bullion to United Kingdom.
Mint bullion do	10,320	10,718	United Kingdom 8,537; Japan 2,180.
Sheet, strip, dust do	1,036	948	United States 266; Japan 197; West Germany 192.
Tantalite-columbite concentrate	55	1,092	United States 1,071.
Tin:			
Ore and concentrate, gross weight long tons	3,886	6,387	Netherlands 2,388; United Kingdom 1,404; Spain 891; West Germany 663.
Unwrought do	193	434	United States 225; New Zealand 85; Italy 50.
Titanium concentrates:			
Ilmenite, minimum 45 percent TiO_2	413,482	503,179	United Kingdom 193,963; France 131,259; Japan 93,103.
Rutile, minimum 90 percent TiO_2	267,131	290,672	United States 143,370; Japan 26,192; Netherlands 24,438.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal destinations, 1968–69
METALS—Continued			
Tungsten concentrates:			
Scheelite	1,268	1,799	United Kingdom 761; West Germany 515; Netherlands 249.
Wolframite	368	690	West Germany 449; Netherlands 120.
Zinc:			
Ore and concentrate, gross weight	316,436	337,958	United Kingdom 150,316; Japan 108,634; Belgium-Luxembourg 22,433.
Ingots, blocks, slabs, etc	90,566	117,416	United States 26,175; United Kingdom 12,732; Thailand 11,765.
Semimanufactures	828	1,321	United States 508; New Zealand 352; Iran 124.
Other forms	3,317	2,739	Japan 1,155; United Kingdom 455; West Germany 355.
Zircon concentrate, minimum 30 percent $ZrSiO_4$	254,933	300,740	United States 74,775; Japan 58,170; United Kingdom 42,264.
NONMETALS			
Abrasives:			
Industrial diamond [4] carats	40,512	76,219	United States 62,131; Philippines 4,000.
Other natural abrasives value, thousands	$81	$17	NA.
Asbestos, crude and fiber [5]	722	410	Malaysia 200; Indonesia 118; New Zealand 92.
Cement, construction types [4]	16,745	1,638	Nauru 1,083.
Clays, fire, sillimanite, others	4,177	5,266	Japan 2,215; United Kingdom 1,337; New Zealand 832.
Gem stones:			
Diamond [4] carats	1,623	1,711	Belgium-Luxembourg 537; New Zealand 371; United Kingdom 350.
Opal value, thousands	$7,503	$9,561	Japan $3,796; Hong Kong $3,571; United States $1,051.
Other, cameo, intaglio do	$2,407	$3,748	United States $1,599; Japan $787; United Kingdom $466.
Gypsum	214,574	267,889	New Zealand 95,668; Taiwan 51,032; Philippines 35,583.
Magnesite	1,781	2,006	United States 1,348; New Zealand 535.
Monazite concentrate [2]	2,616	2,695	United States 2,238.
Salt [4]	168,825	300,689	Japan 289,266; New Zealand 5,829.
Talc and steatite [4]	17,558	21,013	Netherlands 19,121.
MINERAL FUELS AND RELATED MATERIALS			
Coal thousand tons	10,363	14,021	Japan 13,648.
Coke and semicoke	289,714	149,342	Japan 64,984; New Caledonia 56,428; Portugal 23,377.
Petroleum refinery products:			
Gasoline, total [4] thousand 42-gallon barrels	2,004	1,728	Singapore 1,203; New Zealand 478.
Kerosine and jet fuel [4] do	974	559	New Zealand 459; Fiji 72.
Distillate fuel oil do	r 1,535	1,380	New Zealand 901; Fiji 154.
Residual fuel oil [4] do	3,213	2,020	Japan 702; New Caledonia 533; Singapore 448.
Lubricants [4] do	676	720	New Zealand 257; Republic of South Africa 256; Kenya 63.
Other products [4] do	226	262	New Zealand 202; Netherlands 15; New Caledonia 15.

r Revised. NA Not available.
[1] Periods shown are fiscal years July 1 to June 30.
[2] Data given are for 1968 and 1969 calendar years, respectively.
[3] Data not available on quantities of cadmium exported in lead and zinc concentrates.
[4] Includes reexports.
[5] Mostly crocidolite.

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

(Metric tons unless otherwise specified)

Commodity	1967-68	1968-69	Principal sources, 1968-69
METALS			
Aluminum:			
Scrap	1,202	845	New Zealand 616; Canada 61.
Pigs, ingots, blocks, etc	1,362	11,847	Canada 3,845; Hungary 2,000; Yugoslavia 2,000.
Semimanufactures	2,034	3,872	United States 2,172; United Kingdom 746; West Germany 524.
Pipes, tubes, powder, wire	706	587	United Kingdom 154; United States 130; Canada 87; Belgium-Luxembourg 79.
Antimony	2	30	Mainland China 24; United Kingdom 6.
Arsenic trioxide	1,893	1,022	Sweden 558; France 279; mainland China 135.
Bismuth	12	10	United Kingdom 8; Republic of Korea 2.
Chrome ore and concentrate	15,257	18,771	Philippines 9,070; Iran 8,535.
Cobalt and cobalt base alloys	72	123	Zambia 45; Congo (Brazzaville) 22; United States 17.
Copper:			
Ore and concentrate	40	(2)	NA.
Scrap	1,023	1,242	New Zealand 1,027.
Ingots, blocks, and billets	325	105	Republic of South Africa 51; United States 27; New Zealand 16.
Semimanufactures	371	420	United Kingdom 333; Canada 29.
Pipe, tubes, powder, wire	1,321	1,476	United Kingdom 661; Japan 582.
Gold:			
Crude bullion, gold content troy ounces	140,560	109,108	Fiji 85,489; Papua and New Guinea 23,541.
Refined bullion do	5,168	4,211	Papua and New Guinea 3,480; West Germany 455.
Iron and steel:			
Ore and concentrate, includes pyrite materials	170,930	117,940	New Caledonia 117,891.
Scrap	114	138	New Zealand 119.
Ferroalloys:			
Ferrochromium	4,865	3,553	Republic of South Africa 2,939; Japan 475.
Ferromanganese	10,627	10,159	Republic of South Africa 5,816; Japan 2,833; France 761.
Ferromolybdenum	185	87	United Kingdom 42; United States 30; Sweden 13.
Ferrosilicon	6,933	6,871	Republic of South Africa 5,299; Norway 978.
Ferronickel	3,583	518	All from New Caledonia.
Other	2,175	2,116	United Kingdom 1,244; Republic of South Africa 504; Japan 124.
Ingots, blooms, etc	14,688	11,794	Japan 11,516.
Semimanufactures	241,963	239,649	Japan 166,272; United Kingdom 34,254.
Pipes, tubes, castings, and forgings	99,309	198,235	Japan 124,538; Italy 27,249; United Kingdom 22,482.
Lead and lead alloys	513	127	New Zealand 92; United Kingdom 17.
Magnesium and magnesium base alloys	613	1,025	Norway 528; U.S.S.R. 325; United States 90.
Manganese ore:			
Battery-grade	1,592	635	All from Ghana.
Metallurgical-grade	6,800	6,324	Fiji 2,815; mainland China 1,887; Republic of South Africa 1,070.
Mercury 76-pound flasks	1,491	1,013	Italy 710; Spain 85.
Nickel:			
Matte and other crude forms	273	594	All from Canada.
Pigs, ingots, granulated	1,628	1,668	Canada 1,326; United Kingdom 200.
Bars, rods, anodes, powder	414	346	Canada 154; United Kingdom 116; United States 64.
Platinum group troy ounces	14,564	25,999	United Kingdom 22,327; United States 3,123.
Silicon value, thousands	$486	$700	Sweden $196; France $148; Italy $113.
Silver:			
Crude bullion, silver content [3] troy ounces	73,948	113,118	Fiji 46,084; New Zealand 40,241; Papua and New Guinea 12,564.
Refined bullion do	3,930	--	
Tin and tin base alloys long tons	137	145	Mainly from Malaysia.
Tungsten and tungsten base alloys	12	13	United Kingdom 6; West Germany 3.
Zinc:			
Ore and concentrate	--	3,303	All from United States.
Zinc and zinc base alloys	32	24	NA.
NONMETALS			
Abrasives:			
Industrial diamond carats	541,389	702,830	Republic of South Africa 388,173; Netherlands 114,393; United States 103,705.
Pumice and tripoli [4]	951	1,555	United States 817; Italy 175; Greece 141.
Garnet	88		

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal sources, 1968–69
NONMETALS—Continued			
Asbestos:			
Chrysotile	41,843	42,995	Canada 42,628.
Amosite	10,305	8,557	Republic of South Africa 8,471.
Other	3,107	2,845	Canada 2,578.
Barium minerals, natural and ground	1,720	2,119	Mainland China 1,900.
Boron minerals, crude and concentrate	1,985	1,428	Mainly from United States.
Cement, construction types	52,777	77,527	Japan 33,913; Okinawa 16,967; United Kingdom 13,668.
Clays:			
China, kaolin, pottery	22,635	25,910	United Kingdom 20,527; United States 5,247.
Fire and ball	16,927	24,416	United Kingdom 12,615; Republic of South Africa 4,841; United States 4,419.
Bentonite	33,618	53,753	United States 52,386.
Other	14,372	10,767	United States 9,014; Republic of South Africa 1,262.
Cryolite, natural and synthetic	289	225	Mainly from Denmark.
Diatomite and other earths	4,809	6,192	United States 5,449.
Fertilizer materials:			
Nitrogenous:			
Sodium nitrate, natural	5,654	3,907	Chile 3,886.
Manufactured nitrogenous fertilizers	150,917	113,431	West Germany 35,038; United States 26,327; Japan 19,287.
Phosphatic:			
Phosphate rock...thousand tons	3,349	3,228	Nauru 1,550; Christmas Island 857; United States 386.
Other manufactured phosphatic materials	31	14,246	United States 8,200; Israel 5,807.
Potassic manufactured materials	132,213	137,098	United States 87,023; West Germany 26,842; Canada 14,828.
Other and mixed fertilizers	42,944	66,485	United States 33,161; West Germany 14,087; Italy 13,002.
Fluorspar	21,131	20,992	Mexico 8,636; United Kingdom 7,904; Republic of South Africa 3,236.
Gem stones:			
Gem diamond...carats	27,016	35,526	Belgium-Luxembourg 11,502; Israel 10,163; Republic of South Africa 7,335.
Pearls and other precious and semiprecious stones...value, thousands	$1,589	$2,550	Japan $398; Papua and New Guinea $364; India $242.
Gypsum, crude and calcined	685	1,072	United Kingdom 450; United States 421.
Graphite:			
Colloidal	24	23	United Kingdom 18.
Crystalline, flake	432	446	Malagasy Republic 202; mainland China 115.
Amorphous	863	1,323	Ceylon 460; Republic of Korea 381; mainland China 295.
Iron oxide pigments	8,232	8,447	West Germany 5,021; Spain 1,588; United Kingdom 765.
Kyanite	1,163	2,151	India 1,304; United States 828.
Limestone	312,516	522,612	Mainly from Japan.
Lithopone	1,098	1,061	West Germany 452; mainland China 398; United Kingdom 116.
Magnesite, crude, calcined and fused	26,723	20,607	Japan 15,620; Republic of Korea 2,615.
Mica:			
Block or sheet	18	12	Mainly from India.
Splittings	90	95	India 94.
Ground and scrap	965	745	Republic of South Africa 410; United States 22.
Phosphorus	620	556	West Germany 401; United Kingdom 132.
Quartz and quartzite	438	624	Sweden 444.
Salt	8,934	7,503	United Kingdom 6,969.
Sillimanite	748	709	Republic of South Africa 707.
Stone, construction...value, thousands	$456	$380	Italy $278; Republic of South Africa $21; Finland $18.
Sulfur, elemental	586,749	401,326	Canada 222,967; United States 84,177; Mexico 59,960.
Talc, steatite, and chalk	9,720	10,489	France 5,523; mainland China 2,192; United Kingdom 1,898.
Vermiculite	3,336	3,598	Republic of South Africa 3,582.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, bitumen, and pitch:			
Natural minerals	1,085	658	United States 398.
Petroleum bitumen	208	5,133	Singapore 4,616; United Kingdom 263.
Coal tar and coal tar pitch	5,788	676	United States 593.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal sources, 1968–69
MINERAL FUELS AND RELATED MATERIALS—Continued			
Carbon and carbon black	3,373	3,501	United States 2,995; United Kingdom 381.
Coal, all types including briquets	8,663	19,931	Republic of South Africa 16,186; United States 3,679.
Coke and semicoke	40,537	72,573	Mainly from United States.
Peat	3,232	3,175	West Germany 1,796; Ireland 1,155.
Petroleum:			
Crude____thousand 42-gallon barrels	144,010	147,762	Indonesia 36,758; Kuwait 32,968; Saudi Arabia 28,137.
Refinery products:			
Liquefied petroleum gas 42-gallon barrels	3,277	1,926	United States 1,578.
Gasoline thousand 42-gallon barrels	3,239	2,496	Southern Yemen 1,120; Iran 422; Singapore 401.
Kerosine and jet fuel____do	824	837	Singapore 465; Southern Yemen 280.
Distillate fuel oil____do	760	1,555	Singapore 984; Saudi Arabia 404.
Residual fuel oil____do	604	3,927	Singapore 937; Bahrain 772; Iran 750.
Lubricants____do	404	396	United States 173; Netherlands Antilles 88; United Kingdom 52.
Petroleum turpentine____do	39	35	Iran 24; United States 11.
Other products____do	1,416	1,932	Bahrain 1,703.

NA Not available.
[1] Periods shown are fiscal year, July 1 to June 30.
[2] Less than ½ unit.
[3] Includes refined bullion in 1968–69.
[4] Includes emery and natural corundum in 1968–69.

COMMODITY REVIEW

METALS

Aluminum.—The Australian aluminum industry continued to expand as substantial export markets were developed for bauxite, alumina, aluminum metal, and fabricated products. Production of refined aluminum reached a new record in 1970, exceeding output in 1969 by 62 percent. The sharp gain in production reflected increased capacity of the Alcoa of Australia Pty. Ltd. smelter at Point Henry, Victoria, and greater output at the new Alcan Australia Ltd. smelter at Kurri Kurri, New South Wales. Alumina production also was at a record high level largely because of progressive expansion of facilities at Kwinana, Western Australia. Nearly 8 million tons of bauxite, about 85 percent of the total bauxite output was produced from mines in Queensland and Western Australia. Expansion of currently productive facilities in Queensland and completion of new facilities at mines under development in Western Australia are expected to increase total productive capacity to 20 million tons of bauxite per year. Australian bauxite resources are estimated to be about 3,000 million tons. About 2,500 million tons of proven and potential ore are in a 310-square-mile area in Queensland.

Expansion of current alumina refinery facilities at Gladstone, Queensland, and completion of other plants either planned or under construction at Pinjarra and Port Warrender, Western Australia, Weipa, Queensland, and Gove Peninsula, Northern Territory, will raise the Commonwealth's productive capacity to approximately 7.5 million tons of alumina per year.

Comalco Industry Pty. Ltd. reported shipments of 5.2 million tons of bauxite during 1970, 6 percent more than the tonnage shipped in 1969. Of the 1970 shipments, 2.1 million tons went to the Gladstone, Queensland, and Bell Bay Tasmania alumina plants, 1.2 million tons went to Japan, and 1.9 million tons went to West European and other countries. The grade of ore being exported averages about 58 percent Al_2O_3 and 4.75 percent SiO_2. The company continued its development program to increase productive capacity of its bauxite beneficiation plant at Weipa to 10 million metric tons per year by mid-1972; the capacity of the Bell Bay aluminum smelter was to have been expanded from 73,000 to 94,000 tons per year early in 1971. Construction of the new aluminum smelter and metal casting facilities at Bluff, New Zealand, by New Zealand Aluminum Smelters Ltd. (50-percent owned by Comalco) proceeded on schedule, and production of aluminum metal was expected to commence in July 1971 at an initial rated capacity of 66,000 tons of primary aluminum, this is to be increased to 100,000 tons by mid-1972. The total capacity of the three operating smelters at Bell Bay, Point Henry, and Kurri Kurri has reached 204,000 metric tons per year. Queensland Alumina Ltd. made substantial progress in expanding its Gladstone alumina plant capacity from 900,000 tons to 1.27 million metric tons per year and ultimately to 2.0 million tons of alumina by mid-1972. Alcan Australia increased the annual capacity of its Kurri Kurri aluminum reduction plant from 30,000 to 50,000 tons and plans to continue expanding production capacity to 100,000 tons of aluminum per year by adding a second potline. Kobe Steel Ltd. of Japan has agreed to purchase 500,000 tons of aluminum over a 10-year period. The Alcoa alumina refinery at Kwinana reached full capacity of 1.25 million tons of alumina per year; the company's second plant under construction at Pinjarra will have an initial annual capacity of about 500,000 metric tons and was to be in operation by 1972. Completion of the Pinjarra plant will augment the company's total alumina production capacity in Western Australia to 1.67 million metric tons per year.

Swiss Aluminum Australia Pty. Ltd. reported substantial progress in its Gove Peninsula bauxite-alumina project, jointly owned with Gove Alumina Ltd. Bauxite production began in late 1970; exports were scheduled to begin in mid-1971. Alumina production was scheduled to commence at an initial annual rate of 500,000 tons by mid-1972, which will be expanded to 1 million tons annually by mid-1973.

Copper.—In 1970, production of copper in ore and concentrate rose to a new record, about 16 percent more than that of 1969. Likewise, output of refined copper reached a record, a 3 percent increase compared with that of 1969. The gain in copper output was largely due to the increased ore tonnage treated by Mount Isa Mines Ltd., which accounted for about 75 percent of the total Australian copper output. Apparent consumption for the year was estimated at 85,000 tons, about 3,400 tons more than in 1969. Exports of ore and concentrates more than doubled those in 1969, but exports of blister copper declined. The gain in concentrate exports chiefly reflected shipments from Mount Lyell and smaller shipments from the Mammouth and Mount Oxide mines in Queensland.

In the year ending June 28, 1970, Mount Isa treated 3.6 million tons of copper ore yielding 84,229 tons of copper, an increase of 14 percent over output in the corresponding period in 1969. Primary ore reserves at the Mount Isa mine were increased by 45 million tons, to 120 million tons averaging 3.0 percent copper. The blister copper produced at Mount Isa is refined at the company's refinery in Townsville. Mount Isa has begun an expansion program to increase its annual output of copper from about 110,000 tons to approximately 170,000 tons.

Cobar Mines Pty. Ltd. operating the CSA mine at Cobar, New South Wales, treated 302,547 metric tons of copper ore averaging 2.0 percent copper and 344,075 tons of copper-zinc ore averaging 1.5 percent copper, 1.1 percent lead, and 3.0 percent zinc. Concentrates were shipped to Port Kembla, New South Wales, for smelting and refining.

Mount Lyell Mining and Railway Co. Ltd. milled 2.2 million tons of ore, produced 71,847 tons of copper concentrate, and began shipments under an agreement to supply 20,000 tons of concentrates from its mine in western Tasmania for smelting at Port Kembla, New South Wales. The remainder of its production was shipped to Japan for smelting and refining under a 10-year contract. As of June 30, 1970, ore reserves were reported to be 38.9 million metric tons with an average content of 1.42 percent copper. The company reported substantial progress on its expansion program, which included a changeover from opencut to underground mining, rebuilding part of the railway system, and the installation of new storage and handling facilities.

The Mount Gunson mine, controlled by C.S.R. Co. Ltd., began metal production operations in May at its concentrator, which has a capacity of 1,250 tons of ore per day. Output of copper in concentrates is expected to be about 3,000 tons per year. Ore reserves were estimated at 3.3 million tons averaging 1.04 percent copper. Based on the results of a diamond drilling program, Peko-Wallsend Ltd. announced that it will mine the Gecko ore body in

Table 4.—Australia: Major copper industry facilities

Facility	Production (metric tons of copper [1]) 1967	1968	1969
Mines:			
Mount Isa Mines Ltd	44,475	60,729	78,229
Mount Morgan Ltd	6,874	8,070	8,139
Broken Hill field	3,583	3,346	3,752
Cobar Mines Pty. Ltd	7,781	8,953	11,351
Mount Lyell Mining and Railway Co. Ltd	16,133	16,371	16,615
Electrolytic Zinc Co. of Australasia Ltd	1,615	1,743	1,790
Ravensthorpe Copper Mines, N.L	721	749	786
Tennant Creek field	8,031	7,749	6,608
Rum Jungle field	716	189	140
Smelters:			
Mount Isa Mines Ltd	44,406	62,943	80,490
Mount Morgan Ltd	6,759	7,301	8,132
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd.[2]	5,497	10,213	13,689
Mount Lyell Mining and Railway Co. Ltd	15,301	13,481	13,872
Refineries:			
Mount Isa Mines Ltd	45,979	64,519	77,380
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd	21,174	21,102	23,474

[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.

the Tennant Creek district, Northern Territory; ore reserves were estimated at 500,000 tons averaging 3.5 percent copper. Peko-Wallsend also is developing the Warrengo mine for production and is constructing a concentrator scheduled for completion in 1972, which will treat 500,000 tons of ore per year. The company also announced plans to construct a copper smelter near the Warrengo mine, which will treat concentrates from the Warrengo and other mines in the Tennant Creek district.

Several significant exploration and development projects in various parts of the Commonwealth were proceeding at a relatively rapid pace during the year. Pacific Copper Exploration Ltd. continued developing its copper ore body at Cadia, New South Wales, and carried out metallurgical tests. The project, scheduled for production in 1972, will have a capacity of 4,000 tons of ore per day. Ore reserves are estimated at 15.0 million tons averaging 0.81 percent copper. The Kanmantoo opencut copper mining project in South Australia, controlled by Broken Hill South Ltd., was scheduled to go on stream in 1971, the rate of output was to be 750,000 tons per year of 1-percent copper ore. United Uranium N.L. announced in April that it would begin mining operations at its copper mine at Mount Diamond, Northern Territory. Ore reserves were estimated at 211,400 tons averaging 5.6 percent copper and 3.4 ounces silver per ton. Ore milling was scheduled to begin early in 1971 at a rate of 40,000 tons per year.

Gold.—Mine production of gold continued to decline in 1970, dropping 12 percent below 1969 output; this was the lowest level since World War II. Based on production data for 1969, Western Australia accounted for 63 percent of the total; Northern Territory, 18 percent; Queensland, 10 percent; the remaining 9 percent came from the four remaining States. The Golden Plateau mine in Queensland was the only gold mine that increased gold production in 1970. Lakeview and Star Ltd. and North Kalgurli (1912) Ltd. ceased development work but will continue mining present reserves at their Fimiston mines until depleted.

In 1969, the most recent year for which details are available, gold mines accounted for 79 percent of Australia's total gold production. Approximately 3 percent was recovered in bismuth concentrates at the Juno mine, and 18 percent was recovered as a byproduct of base metal operations. The principal gold producers and quantities recovered during 1969 were as follows:

Company	Gold produced (troy ounces)
Central Norseman Gold Corp. N.L	70,067
Gold Mines of Kalgoorlie (Australia) Ltd	135,824
Great Boulder Gold Mines Ltd	22,398
Hill 50 Gold Mine N.L	26,878
Lakeview and Star Ltd	108,741
North Kalgurli (1912) Ltd	62,696
Orlando Mines N.L	89,678

The Royal Mint at Perth, New South Wales, refines all bullion production from

Western Australia; Englehard Industries Pty. Ltd. in Melbourne, Victoria, and Matthey Garret Pty. Ltd. in Sydney, New South Wales, also refine gold and other gold-bearing material. Broken Hill Associated Smelters Pty. Ltd. at Port Pirie, South Australia, refines byproduct gold from lead smelting; and Electrolytic Refining and Smelting Co. of Australia Pty. Ltd., Port Kembla, refines gold contained in copper refinery slimes.

The Commonwealth Government extended the Gold Mining Industry Assistance Act for an additional 3 years from June 30, 1970, but rejected proposed amendments to increase the maximum subsidy of $8.96 per ounce paid to gold producers. Subsequent submissions to the Prime Minister for subsidy increases were based on maintaining the work force in Kalgoorlie, Western Australia, until nickel mining becomes established and can provide alternative employment. This would prevent the early closure of gold mines because of the depletion of economically minable ore. The Gold Producers' Association sold all the gold produced by its members on the free market.

Australia's exports of refined gold dropped sharply in 1970 to about 188,440 ounces, less than one-third the quantity exported in 1969.

Iron and Steel.—*Iron Ore.*—The rapid growth in production of iron ore in recent years continued in 1970. Output of ore and pellets reached a record high of 51 million tons, about 31 percent more than in 1969. As in preceding years, mines in Western Australia provided the bulk of production and exports, accounting for nearly 80 percent of the total output in 1970. South Australia supplied 15 percent, mostly to the domestic iron and steel industry. Tasmania and the Northern Territory contributed the remaining 5 percent. Nearly 80 percent of the iron ore and pellet production was exported; most of the export was shipped to Japan.

Principal producers and quantities of products shipped during the year were as follows, in thousand metric tons.

Goldsworthy Mining Ltd., Western Australia (lump)	6,673
Hamersley Iron Pty. Ltd., Western Australia (lump, pellets)	17,031
Western Mining Corp. Ltd., (WMC), Western Australia (lump)	697
Broken Hill Pty. Co. Ltd., Western Australia (lump)	4,775
Broken Hill Pty. Co. Ltd., South Australia (lump, pellets)	7,823
Savage River Mines, Tasmania (pellets)	1,972
Frances Creek Iron Mining Corp. Ltd., Northern Territory (lump)	785
Mount Newman Iron Ore Co., Western Australia (lump)	11,815

The sharp gain in ore production resulted largely from expansion of major operations in the Pilbara region of Western Australia; this was particularly true of the Mount Newman consortium at Mount Whaleback, which reached a production rate of nearly 13 million tons per year, Hamersley Iron Pty. Ltd. at Mount Tom Price, which increased output by 3.7 million tons, and Goldsworthy Mining Pty. Ltd., which increased shipments by 31 percent.

Mount Newman Iron Ore Co. Ltd. produced 11.7 million metric tons from its Mount Whaleback mine during 1970, compared with 4.0 million tons in 1969, the initial year of operation. The company plans to increase its productive capacity to 25 million tons per year by 1972 and to 30 million tons by 1974. Development drilling at Mount Whaleback increased high-grade ore reserves to 660 million tons and indicated a potential of more than 1 billion tons. Ore shipments to Japan totaled more than 9 million tons; shipments also went to western European countries. Contracts with Japanese steel companies for future shipments totaled more than 219 million tons at yearend, long-term contracts also were made with western European countries.

In 1970, Hamersley Iron produced 17.0 million tons of ore from its Mount Tom Price mine, nearly 3.7 million tons more than in 1969. Shipments of ore and pellets to Japan increased about 33 percent, to 13.1 million tons; shipments to Europe and North America totaled 3.9 million tons, 16 percent more than in 1969. Hamersley planned to increase annual production by 5 million tons, to 22.5 million in 1971 and to 37.5 million tons by 1974, based on expansion of operations at Mount Tom Price and development of a new mine at Paraburdoo 35 miles south of Mount Tom Price. The company and associated interests plan to build a metallizing plant near Dampier using Paraburdoo ore. The plant, scheduled for production in 1973, will have a capacity of 1.4 million tons per year.

Ore and pellet production by Broken Hill Pty. Co. Ltd. (BHP) at Yampi Sound and Koolyanobbing in Western Australia and from its mines in South Australia was used largely in the company's four steel mills; part of the pellet production is exported.

The Robe River consortium, developing deposits at Robe River, Western Australia, planned to commence production by 1972 and increase annual output to 4.2 million tons of pellets and 6.1 million tons of sinter fines by 1975. The consortium is reported to be considering plans to double total shipments of pellets and fines to about 20 million tons by 1975.

Goldsworthy Mining Ltd., operating the Mount Goldsworthy mine, 70 miles east of Port Hedland, concluded new long-term contracts for shipment of 6 million tons of ore per year until April 1973, when the rate increases to 8 million tons per year for the following 7 years. To meet the expanding shipping schedule, additions were made to mining and ore-reduction facilities at Mount Goldsworthy and to shipping facilities at Port Hedland. In addition, Mount Goldsworthy started design of facilities for mining its ore deposits at Shay and Kennedy Gaps in anticipation of its 8 million-ton-per-year shipping rate in 1973. Additional reserves of about 44 million tons of high-grade ore were acquired near the deposits at Shay and Kennedy Gaps. Total reserves are estimated at 114 million tons. The Goldsworthy consortium has acquired substantial two new ore deposits in the Pilbara district. Known as McCamey's Monster and Western Ridge, the deposits are reported to have a potential of 10,000 million tons averaging 63 percent iron, which is about equal to that of Hamersley and Mount Newman. A 2-year exploration and feasibility study is planned.

Pig Iron and Steel.—BHP and its subsidiaries, which produce nearly all of Australia's primary iron and steel, reported a high level of domestic demand and near-capacity production of iron and steel during most of the year. Labor strikes reduced the quantity of raw steel produced by about 3 percent, to 6-8 million tons, and curtailed steel products available for export. The consolidated annual report of BHP and subsidiary iron and steel companies for the year ending May 31, 1970, summarizes output of various products as follows:

Commodity	Thousand metric tons	
	1969	1970
Pig iron	5,768	5,918
Steel ingots and billets	6,702	6,873
Blooms and slabs	5,835	5,883
Sheets, bars, billets, etc	2,958	2,875
Plate and strip	2,379	2,478
Merchant	1,518	1,595
Rod	515	533
Narrow cold-rolled strip	78	96
Tinplate	260	283

Steel output at the steelmaking plants was as follows: Newcastle, 2.1 million tons; Port Kembla, 3.6 million tons; and Whyalla, 1.1 million tons.

BHP reported that construction of the new No. 5 blast furnace and basic oxygen steelmaking plant was well advanced and that commissioning of those units and auxiliary facilities will augment raw steel production at Port Kembla to 6.0 million tons per year by 1973. The increase in plant capacity, which is estimated to cost $155 million, will result in a 30-percent increase in Australian steel production capacity.

The integrated steelworks under construction in Victoria is expected to start production of sheet steel and coil from Port Kembla semifinished products by 1973.

Lead and Zinc.—Production of lead in ores and concentrates increased slightly in 1969. Refined lead production was down about 5 percent. Output of zinc in ores and concentrates decreased 4 percent, but refinery production was 6 percent more than in 1969. About 62 percent of the total Australian lead production originates from mines at Broken Hill; 33 percent from Mount Isa, Queensland; and the remaining 5 percent from mines in Tasmania and the Northern Territory.

The Zinc Corporation Ltd., Broken Hill, milled 813,700 metric tons of lead-zinc-silver ore in 1970 and recovered 86,480 tons of lead and 70,770 tons of zinc in concentrates, compared with 793,700 tons of ore, 115,950 tons of lead, and 130,910 tons of zinc in 1969. The 2-percent gain in ore production in 1970 reflected less loss of working time owing to labor disputes than in 1969. Developed ore reserves at yearend were estimated at 5.5 million tons with an average grade of 11.8 percent lead, 9.8 percent zinc, and 2.5 ounces silver per ton, about the same quantity and grade as in the preceding year. New Broken Hill Consolidated Ltd. milled 991,510 tons of ore in 1970 and recovered in concentrates 96,830 tons of lead and 257,440 tons of zinc, compared with 1,002,690 tons of ore, 95,170 tons of lead, and 148,930 tons of zinc in 1969.

In 1970, Mount Isa Mines established new records in ore treated and metals recovered in 1970. The company treated 2.1 million metric tons of silver-lead-zinc ore in the year ending June 28, 1970, yielding 11.7 million ounces of silver, 152,744 tons of lead, and 92,785 tons of zinc, compared with 1.8 million tons, 10.0 million ounces silver, 119,188 tons lead, and 79,542 tons zinc in 1969. Ore reserves of silver-lead-zinc in the Mount Isa mine increased about 15 percent at mid-year to 53.4 million tons averaging nearly 5.0 ounces silver per ton, 7.0 percent lead and 5.9 percent zinc. At the Hilton mine, silver-lead-zinc ore reserves remained at 35.6 million tons grading 5.8 ounces of silver per ton, 7.7 percent lead, and 9.6 percent zinc. Exploration and development of the Hilton ore deposits continued in preparation for mining and contracts were let for sinking a 20-foot-diameter ore-production shaft and a 26-foot-diameter service shaft. Expansion of smelting and refining facilities was begun to provide the additional capacity required for treating the increased ore production expected from the Hilton mine.[3]

Electrolytic Zinc Co. of Australasia, Ltd. (EZ) reported that production of slab zinc for the year ending June 30, 1970, increased 11 percent to 170,924 metric tons, a new output record. Construction of additional facilities at the company's Risdon, Tasmania, plant continued during the year. By 1972 zinc production capacity was to be 200,000 tons per year. The plant expansion program includes extensive reconstruction of the wharf, provision for handling and storing bulk materials, and accommodation for larger ships. Ore milled at the Rosebery concentrator increased slightly in 1970; the tonnage of zinc and lead concentrates produced was down slightly from the preceding year. The average grade of ore milled in 1970 was 17.3 percent zinc, 5.3 percent lead, 0.7 percent copper, and 6.3 ounces silver per ton and 0.12 ounce gold per ton.[4]

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

Mine	1967		1968		1969	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
North Broken Hill Ltd	68,808	55,526	62,768	50,703	71,529	60,568
Broken Hill South Ltd	27,401	28,330	23,425	26,823	24,141	27,501
The Zinc Corp. Ltd	98,685	82,069	86,626	70,256	101,252	81,509
New Broken Hill Consolidated Ltd	88,565	131,973	76,369	127,754	84,671	170,403
Mount Isa Mines Ltd	78,240	51,848	118,552	85,411	150,090	105,682
Electrolytic Zinc Co. of Australasia Ltd. (Read-Rosebery)	15,377	49,634	15,150	49,521	15,144	51,010

Manganese.—The rapid growth of recent years in the production of metallurgical-grade manganese ore was interrupted in 1970 by industrial disputes including a 5-week strike at the Groote Eylandt Mining Co. Pty. Ltd. (a subsidiary of BHP) operations in the Northern Territory, which accounts for nearly 80 percent of total domestic production. Virtually all of the remaining ore was produced at two mines in Western Australia. Ore production and exports declined nearly 15 percent from the record levels of 1969. Exports to Japan increased, but exports to Europe and the United States declined, reflecting reduced demand and curtailed output. Shipments to Japan accounted for more than three-fourths of the total ore exports in 1970.

The $27.4 million expansion program begun in 1969 by Groote Eylandt, originally scheduled for completion in June 1971, was delayed by the strike and was rescheduled for completion by December 1971. The program included the installation of a new concentration plant, new ore stockpiling and handling facilities, a power-generating plant, and mobile equip-

[3] Mount Isa Mines Ltd. Annual Report. 1970, p. 5.
[4] EZ Industries. Annual Report. 1970, p. 7.

ment, which will increase production capacity for metallurgical-grade lump ore to 800,000 tons per year. Substantial tonnages of fine ore and other manganese products also will be produced. The installation of additional mining equipment will increase the production rate to about 1.3 million tons per year.

Longreach Manganese Pty. Ltd. expanded its mining operations at Woodie Woodie in the Pilbara region of Western Australia and continued exploration and development of manganese deposits at Ripon Hills. Proved ore reserves at Woodie Woodie were reported to be 500,000 tons, averaging more than 40 percent manganese. At Ripon Hills, reserves were estimated to exceed 60 million tons, averaging 17 percent manganese and 25 percent iron.

Although manganese ore imports have been declining in recent years because of increased domestic production, they were up 1,030 tons to about 6,620 tons in 1970.

Nickel.—The domestic nickel industry was characterized by rapid expansion and a high degree of exploration activity. Three companies were operating five mines and producing concentrates at two mills. The Kwinana nickel refinery commenced operations in April, and in May the first consignment of refined nickel was shipped to Commonwealth Steel Co. Ltd. in Newcastle. Most of the new nickel discoveries have been made in the region between Kalgoorlie and Norseman in Western Australia.

Production of nickel in ore and concentrates in 1970 was more than double the 1969 output. Western Mining Corp. Ltd. (WMC) at Kambalda treated 932,690 tons of ore, including 40,000 tons of ore from the Nepean and Scotia mines on behalf of Metals Exploration Pty. Ltd. N.L. and Great Boulder Gold Mines Ltd. WMC reported proved ore reserves on June 30, 1970, of 17.3 million metric tons, averaging 3.4 percent nickel.

Great Boulder Mines reported that a third ore body had been discovered at Carr Boyd Rocks, which resulted in increasing indicated ore reserves in this area to 1.8 million metric tons, with an average grade of 1.41 percent nickel and 0.43 percent copper. A program of shaft sinking and lateral development was well advanced at yearend; ore production from the Carr Boyd Rocks mine was expected to start early in 1971. It was anticipated that ore from the combined Scotia-Carr Boyd Rocks operations would be between 400,000 and 500,000 tons per year by yearend 1971.

BHP, in association with The International Nickel Co. of Canada Ltd., is conducting shaft sinking and drilling exploration of the nickel sulfide ore bodies at Widgiemooltha in the Kalgoorlie district. The companies also carried out metallurgical tests to determine the economic and technologic feasibility of mining the Rockhampton lateritic nickel deposits.

Poseidon N.L. reported reserves of 29 million tons, averaging 1.5 percent nickel, at the Windarra mine. The company plans to commence underground development of the ore bodies and begin ore production at a rate of 2.1 million tons per year. Metals Exploration and Freeport Sulphur Co. continued exploration of the Mount Keith deposit north of Kalgoorlie; the companies have estimated reserves at 215 million tons, averaging 0.6 percent nickel. Based on the results of technical and economic studies by Freeport on the Greenvale, Queensland, lateritic ores, plans were being considered to begin construction of a treatment plant by mid-1971. The plant would use the ammonia leach process and would be producing nickel in 1974. Reserves at Greenvale were estimated at 45 million tons averaging 1.55 percent nickel. Sealcast Exploration announced plans to bring its Spargoville prospect into production within 2 years. Plans called for sinking a 1,250-foot shaft and lateral development leading to an ore output of 160,000 metric tons per year to provide about 3,100 tons of nickel in concentrates.

Silver.—In 1970, mine production of silver, recovered as a coproduct or byproduct of lead, copper, and zinc, increased 6 percent, a new record. Most of the production gain was again attributed to the expanded scale of operations at the Mount Isa mine in Queensland. According to data compiled for 1969, Queensland accounted for 46 percent of the total Australian output of silver, New South Wales contributed about 44 percent, Tasmania accounted for 8 percent, and three other States accounted for 2 percent of the national mine output of silver. About 88 percent of the silver output was recovered in lead-silver bullion from smelting lead concentrates. Zinc and copper concentrates contained 7 percent and 4 percent, respectively, and other mine products (including gold bullion) 1 percent of the total. Principal company sources of silver and quantities produced in 1968 and 1969 were as follows:

Company	Thousand troy ounces	
	1968	1969
North Broken Hill Ltd	3,520	4,063
Broken Hill South Ltd	1,515	1,631
Zinc Corp. Ltd	2,323	2,628
New Broken Hill Consolidated Ltd	1,814	1,910
Mount Isa Mines Ltd	9,566	11,465
Electrolytic Zinc Co. of Australasia Ltd	1,662	1,662

Australian refineries reported production of 9,303,000 ounces of silver in 1970, compared with 10,389,000 ounces in the preceding year. In 1969 Broken Hill Associates Smelters at Port Pirie recovered about 8.0 million ounces of silver from lead concentrates produced by Broken Hill mines. Electrolytic Refining and Smelting Co., Port Kembla recovered 1.3 million ounces from copper concentrates, blister copper, and copper slimes. The Royal Mint in Perth recovered about 250,000 ounces of silver from gold bullion produced by mines in Western Australia.

Exports of silver in bullion and concentrates and other products increased 16 percent in 1969, to 13.1 million ounces, attributed largely to the higher rate of ore extraction at Mount Isa mines. Domestic sales of refined silver were about 3.5 million ounces.

Tin.—The expansion in mine production of tin during the past decade continued in 1970 as output of tin-in-concentrates reached a record high of about 8,900 long tons, 9 percent more than in 1969. Domestic production of refined tin by Associated Tin Smelters, Pty. Ltd., increased 23 percent to about 5,100 tons after newly installed equipment to augment capacity became operational. About 60 percent of the tin-in-concentrates produced came from lode mining operations at Renison-Bell and Mount Cleveland in northwest Tasmania and at Ardlethan in southern New South Wales. Most of the Alluvial tin is recovered by dredging in Queensland, New South Wales, Tasmania, and Western Australia.

Principal producers of tin concentrates and quantities of contained tin produced in 1968 and 1969 were as follows:

Company	Long tons	
	1968	1969
Aberfoyle Tin Co. N.L	389	402
Ardlethan Tin N.L	647	805
Cleveland Tin N.L	683	1,510
Cooglegong Tin Pty. Ltd	77	66
Gibsonvale Alluvials N.L	192	360
Greenbushes Tin N.L	200	248
J. A. Johnston & Sons Pty. Ltd	86	61
Pilbara Tin Pty. Ltd	233	160
Ravenshoe Tin Dredging Ltd	496	404
Renison Ltd	1,782	2,641
Storeys Creek Tin Mining Co. N.L	100	38
Tableland Tin Dredging N.L	313	271
Tullabong Tin Ltd	272	103

Nearly 60 percent of 1969 mine production of tin-in-concentrates came from Tasmania, about 19 percent from New South Wales, 14 percent from Queensland, and most of the remainder from Western Australia.

Of the total consumption of 3,730 tons of primary refined tin in 1969, about one-half was used in the production of tinplate, one-third for solders, and the balance for tinning, bearing, and type metals, bronze and brass production, and miscellaneous uses. Exports of tin in that year comprised 3,488 tons in concentrates and residues, most of which was destined to the Netherlands, Spain, and the United Kingdom; 434 tons of refined tin was shipped chiefly to the United States and New Zealand; and 57,413 tons of tinplate went mainly to New Zealand, Hong Kong, Singapore, Thailand, and the Philippines.

Titanium Concentrates.—Australia provides more than 90 percent of the free world's production of rutile and zircon and appreciable proportions of ilmenite and monazite from beach sand mining operations.

In 1970 output of ilmenite concentrates increased about 22 percent, to a record level of 875,900 metric tons; output of rutile and zircon concentrate reached 368,000 tons and 385,500 tons, respectively, compared with that of 1969.

Western Titanium N.L., the leading producer of alluvial ilmenite, increased the annual capacity of its beneficiation plant at Capel, Western Australia, to 300,000 tons of ilmenite and has planned to change its mining method from sluicing to dry-mining. Expansion of productive facilities also was underway by Cabel Ltd., which will increase capacity from 140,000 to 170,000 tons per year. Western Mineral Sands Pty. Ltd. plans to increase capacity from 185,000 to 210,000 tons per year. In addition, Norseman Titanium N.L. plans to commission ilmenite production facilities in the Capel area at a rate of 75,000 tons per year by mid-1971. The increase is expected to bring total annual ilmenite production capacity in Western Australia to approximately 900,000 tons.

Increased demand and higher prices for ilmenite spurred exploration and development of potentially productive deposits in southwestern Australia, resulting in some new discoveries. Exports of ilmenite increased nearly 13 percent during the year. The United Kingdom, France, and Japan have been the principal destinations in recent years.

The rate of growth of mineral sands production on Australia's east coast began to level off and domestic output of rutile and zircon concentrates in 1970 showed relatively small increases over 1969 output; however, new production records were achieved for both minerals. Exports also reached new high levels both in quantity and value. Mineral sand producers formed a company, Australian Mineral Sands Export Service Ltd., to stabilize zircon export prices and establish a more orderly market for this mineral.

In 1969 nearly two-thirds of Australia's rutile production came from mining operations in New South Wales; most of the remaining one-third was from operations in Queensland. In recent years about one-half of the total exports of rutile went to the United States.

Associated Minerals Consolidated Ltd., Australia's leading producer of rutile and zircon through subsidiaries, was mining in six districts between Sydney and Brisbane on the east coast. The company completed mining operations on South Stradbroke Island near Brisbane in March and transferred its dredge-concentrator to North Stradbroke Island. The company's 600-ton-per-hour bucket-wheel excavator at Jerusalem Creek, New South Wales, became fully operational in April.

Domestic consumption of ilmenite by pigment manufacturers in 1969 was about 80,000 tons. Consumption of rutile, mainly for use in coating welding electrodes, was about 2,600 tons. Based on domestic sales mainly for high-quality ceramic ware, consumption of zircon sand and flour in 1969 was estimated at 4,500 tons.

NONMETALS

Gypsum.—Domestic production of gypsum in 1970, was estimated at 837,600 tons. About 80 percent of the total production came from South Australia in 1969. Two major plaster manufacturers—Australian Gypsum Industries Ltd. and Colonial Sugar Refining Co.—control a large part of the gypsum production.

Exports of gypsum in 1970, mainly to New Zealand, Taiwan, and the Philippines totaled 213,190 tons, down about 7 percent from those of 1969.

Apparent consumption of gypsum in 1969 was 712,650 tons, 19 percent more than in the preceding year. Increased use in manufacture of plaster of paris, plaster sheets, and portland cement more than offset a decline in use for acoustic tile. Plaster of paris and portland cement use accounted for about 72 percent of the total gypsum consumption in 1969. Data on consumption of agricultural gypsum were incomplete.

Salt.—Exports of common salt, largely from Western Australia, increased 200 percent in 1970, to 2.3 million tons valued at $9.3 million, nearly all of which was shipped to Japan. Of the 3.1 million tons produced in 1970, at least one-half of the total came from Western Australia. Salt production by the leading producer, Imperial Chemical Industries of Australia and New Zealand Ltd. (I.C.I.A.N.Z.) at its Dry Creek, South Australia, operation, amounted to 416,000 tons in 1969; at Whyalla, South Australia, BHP shipped 47,000 tons in 1969. Most of domestic requirements for industrial chemicals, table salt, and food processing were met by production from Queensland, Victoria, and South Australia. Apparent consumption of salt was 900,000 tons in 1969 and 720,000 tons in 1968.

The Leslie Salt Co., near Port Hedland, Western Australia, produced 288,000 tons in 1969 and increased its productive capacity to 1 million tons per year. Texada Mines Pty. Ltd. at Lake McLeod, Western Australia, exported 294,827 in 1969. Dampier Salt Ltd. completed the first stage of its solar salt works at Dampier, Western Australia, and planned to begin salt harvesting in 1971 at an initial rate of 850,000 tons per year of salt, increasing gradually to 1.2 million tons by 1974. Other salt plants under construction in Western Australia are on Exmouth Gulf by Exmouth Salt Pty. Ltd. and on Shark Bay by Shark Bay Gypsum Joint Ventures. Production by Exmouth was expected to begin in late 1971 at a rate of 1.5 million tons per year. Lefroy Salt Pty. began production at Lake Lefroy, Western Australia. The harvested salt is transported by rail to the coast and shipped through the port of Esperance. Initial shipments went to Japan in the first half of the year.

Sulfur.—Imports of elemental sulfur for the manufacture of sulfuric acid declined for the second consecutive year from the record high level of 557,340 tons in 1968 to about 320,000 tons in 1970. Although no deposits of elemental sulfur have been discovered in Australia, three oil companies have sulfur recovery units with a combined capacity of about 70 tons of elemental sulfur per day. Other domestic sources of sulfur used in production of sulfuric acid include pyrites and smelter gases.

Three companies produced pyrites in 1969 for use in the manufacture of sulfuric acid: Mount Lyell, Tasmania (byproduct of base metal operations), Nairne Pyrites (pyrites mining), and Gold Mines of Kalgoorlie (byproduct of gold mining). Electrolytic Zinc began production of pyrites in 1970 and supplied 150,000 tons for acid manufacture. Total production of pyrites in 1970 was about 157,000 tons.

A substantial quantity of sulfur contained in base metal concentrates, particularly zinc concentrates, is exported from Australia. In 1969 the sulfur content of zinc concentrates exported was 113,900 tons, about 91,000 tons of which was recoverable.

Canada was the chief source of supply of elemental sulfur in 1969, accounting for nearly 54 percent of total imports; Mexico supplied 28 percent the United States, 13 percent and other countries, the remaining 5 percent.

Domestic production of sulfuric acid in 1969 dropped slightly to about 1,840,000 tons. Of the total output, about 70 percent was made from elemental sulfur, 8 percent from pyrites, 21 percent from zinc and lead concentrates, and the remaining 1.0 percent from other materials.

Consumption of sulfuric acid in 1969 was 1,825,400 tons, of which 77 percent was used in the manufacture of superphosphate, 3 percent for ammonium sulfate, 18 percent for other chemicals, and 2 percent for mining and metallurgical uses.

MINERAL FUELS

Black Coal.—The coal industry maintained its impressive growth of recent years, and a substantial increase was reported in 1970. Output during the year was 49.5 million metric tons, 8 percent more than in 1969. Production in New South Wales was 35.9 million tons, representing an increase of nearly 6 percent over 1969 production. Queensland production was 10.3 million tons, nearly 20 percent more than that of 1969. The two States accounted for 92 percent of the total black coal production. About 8 percent of the New South Wales coal output was mined in opencuts; in Queensland opencut mining accounted for nearly 70 percent of the State's total output.

According to preliminary data, exports of black coal increased nearly 15 percent, to 18.4 million tons, in 1970 valued at $180.8 million. Nearly 90 percent of black coal exported went to Japan; most of the remainder went to West Germany, the Netherlands, Italy, and New Caledonia.

Following the removal of the United Kingdom's ban on imports of coal in December, the Central Electric Generating Board contracted for purchase of 500,000 tons of coal from New South Wales for winter delivery.

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

Industry	Thousand metric tons		
	1967	1968	1969
Iron and steel	7,245	7,612	7,782
Electricity	11,546	12,095	12,578
Railways	572	430	370
Town gas	1,096	925	702
Cement	811	864	899
Metallurgical coke	477	486	493
Other (including bunkers)	2,296	2,299	2,469
Total	24,043	24,711	25,293

In January BHP announced that it will develop the Leichhudt Colliery at Blackwater, Queensland, into a fully integrated operation that will produce 800,000 tons of coking coal per year. The Blackwater coal will be blended with coal from the Newcastle area of New South Wales for use at the Whyalla steelworks. Production was to begin in 1971 and gradually increase to planned capacity early in 1974.[5]

[5] Australian Mineral Industry. V. 23, No. 3, March 1971. p. 66.

Other new developments in the central Queensland field include the South Blackwater mine, which commenced production in 1970 and reached a planned rate of 20,000 tons per day. The coal is shipped through Gladstone to Japan; and this mine alone was expected to augment 1971 production by about 5 million tons. Utah Development Co. announced plans to step up production at the Goonyella, Peak Downs, and Blackwater mines to 13 million tons per year by mid-1973. This group, which includes Japanese, Australian, and American interests, will become the Commonwealth's largest single coal producer.

Table 5.—Production of black coal

(Thousand metric tons)

State	1967	1968	1969
Queensland	4,754	6,657	8,635
New South Wales	27,242	30,836	33,975
Victoria	33	27	--
Tasmania	78	92	118
South Australia	2,077	2,112	2,246
Western Australia	1,079	1,105	1,108
Total	35,263	40,829	46,082

Plans were proposed to develop the large reserves of coking and steaming coal that have been delineated in the Mount Tomah area of New South Wales and to produce coal for the European and Asian markets. Two mines under development at Gunnedah will have a combined annual productive capacity of 700,000 tons during 1971.

Total average employment in the black coal mines increased during 1969 to approximately 16,800 persons.

Brown Coal.—The major deposits in Victoria, from which more than 95 percent of the State's production is mined by the State Electricity Commission (SEC), are in the Latrobe Valley southeast of Melbourne. All of Australia's production of brown coal comes from Victoria. Annual output, fluctuating narrowly since 1966, was slightly higher in 1970 than in 1969. The SEC-operated Morwell and Yallourn North opencuts produced 22.2 million tons in 1969. Two bucket-wheel dredges having productive capacities of 1,600 tons and 2,400 tons of brown coal per hour commenced operation at Morwell. One dredge will excavate coal and the other will remove overburden. The increased production at Morwell will be required to supply the nearby Hazelwood Power Station.

Brown coal that cannot safely be stockpiled is used locally. Consumption of brown coal increased nearly 800,000 tons during the past fiscal year. The use pattern showed that 75 percent of the total was for power generation, 17 percent was for the manufacture of briquets (a portion of which was used in power generation), and nearly 4 percent was used for factory fuel, about the same distribution as in the preceding fiscal year.

Reserves of brown coal in Victoria were estimated in 1962 at 54,700 million tons measured and indicated and 43,000 million tons inferred. Of the total reserves, about 17,500 million tons could be excavated economically by opencut mining methods. At current rates of extraction, measured recoverable reserves would last over 700 years.[6]

The first two retorts at the char plant at Morwell, operated by Australian Char Pty. Ltd., were commissioned in June 1970. The plant, when operating at full capacity, will use about 140,000 tons of briquets to produce 60,000 tons of char per year. The major portion of output will be shipped to Japan.

Petroleum and Natural Gas.—Following the significant developments in the petroleum and natural gas industries during 1969, production of crude oil and natural gas increased sharply during 1970. Annual output of crude oil increased 300 percent, to about 65 million barrels, and natural gas production rose to 53,061 million cubic feet, a fivefold gain over that of 1969.

Most of Australia's crude production (74 percent) came from the Halibut, Barracouta, and Marlin offshore oilfields in Bass Strait. The Halibut field commenced production in March and by yearend was producing at a rate of 200,000 barrels of oil per day. In 1970, the Barrow Island field in Western Australia produced about 17 million barrels (14 percent) from 324 wells. The water-flooding secondary recovery project at Barrow was completed, and 169 water-injection wells became operational. During the year, production from the Moonie and Alton field in Queensland declined to about 1.5 million barrels.

Offshore exploration drilling increased during the year, particularly in the Gippsland Basin and Bass Strait, but also in parts of Western Australia and the Northern Territory.

[6] Work cited in footnote 5.

According to a statement by the Bureau of Mineral Resources, total oil reserves on June 30, 1970, were 1,793 million barrels, 1,565 million barrels of which are in the Gippsland Basin offshore area, including the fields in Bass Strait (Victoria), 162 million barrels at Barrow Island (Western Australia), 60 million barrels at Mereenie-Palm Valley (Northern Territory) and the remainder in southern Queensland. Although Australia has made a great gain in self-sufficiency of petroleum, it has been stated that additional major discoveries must be made by 1980 if even partial self-sufficiency is to be maintained. Prospecting and exploration activity was reduced, and many rigs were closed down at yearend. Wildcat footage drilled during 1970 totaled 670,700, about 45 percent of which was offshore; development footage totaled 604,800, of which 60 percent was offshore.

Under the terms of the Petroleum Search Subsidy Act, the Commonwealth paid $12.6 million in subsidies to petroleum exploration companies during 1970. At yearend, total expenditure by the Commonwealth in subsidies under the act totaled $114.7 million. The act, which is designed to encourage exploration by providing 30 percent of the cost of geophysical investigations and drilling, has been extended to June 30, 1974.

The successful development of the Dongara gasfield 200 miles north of Perth, Western Australia, demonstrated sufficient reserves to install a 14-inch pipeline to connect the field with Perth, Kwinana, and Pinjarra—a total distance of 253 miles. The pipeline could supply 70 to 80 million cubic feet per day; at this rate, reserves are sufficient for 15 years. Several significant discoveries of natural gas were made in the Cooper Basin in northeast South Australia, and in December it was announced that an 840-mile pipeline would be built to supply the Sydney-Newcastle-Wollogong region in New South Wales, providing that reserves were developed to assure a 20-year supply estimated at a minimum of 2 trillion cubic feet. The announcement stimulated a $4 million program of drilling to determine reserves in Cooper Basin fields not already developed. The total recoverable gas reserves of Australia as of June 30, 1970, were estimated to be about 14 trillion cubic feet.

Domestic consumption of petroleum products in 1969-70 was 153 million barrels, an increase of nearly 7 percent over that of the preceding year. About 34 percent of the total consumption was for gasoline, 34 percent for fuel oils, and 15 percent for diesel fuel and automotive distillate, and the remaining 17 percent was consumed in miscellaneous products.

Expansion of productive facilities at the Shell and Mobil-Esso refineries in Victoria augmented the aggregate capacity of the Commonwealth's 10 refineries to 647,000 barrels per day. Output in fiscal 1969–70 was about 480,000 barrels, of which 17 percent was domestic crude. In fiscal 1970–71 the proportion of refinery feedstock from domestic crude was expected to rise to 50 percent as imports declined. Ampol Refineries, Ltd. and H. C. Sleigh Ltd. have announced plans to build a new refinery at Westernport Bay, Victoria. In addition, Ampol is increasing capacity of its Brisbane refinery to 75,000 barrels per day and Shell is expanding facilities at its Clyde, New South Wales, refinery.

Exports of refinery products in 1969–70 aggregated about 8.4 million barrels, 25 percent more than in 1968–69. Exported products included shipments of liquefied petroleum gas to Japan. Singapore, New Zealand, Japan, and the Pacific Islands were the principal destinations of other refinery products. Imports of crude petroleum and other feedstocks totaling about 145 million barrels came from Indonesia, Kuwait, and Saudi Arabia. About 17.5 million barrels of refinery products were imported, largely from Southern Yemen, the United States, Singapore, and Bahrain.

The Mineral Industry of Austria

By Grace N. Broderick [1]

During 1970 Austria produced aluminum, coal, copper, lead and zinc, iron and steel, cement, graphite, kaolin, magnesite, salt, crude oil, natural gas, and other mineral commodities. Of these, graphite and magnesite are significant export items. To sustain its industrial economy, however, Austria relies on imports of raw minerals and fuels.

The Austrian economy in 1970 recorded a growth of 7.1 percent—highest growth rate in Austria in the past 10 years. The mineral economy contributed only a small part of the gross national product (GNP). Large contributors to the overall economic expansion were manufacturing, building, tourism, and retail trade.

Developments that took place during the year affecting the mineral industry included the completion of the Adriatic-Vienna pipeline, completion of the new extrusion plant at the Ranshofen aluminum works, and the increased capacity added to the petroleum refinery at Schwechat. Further expansions are planned at Ranshofen and at the Schwechat refinery.

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[1] Physical scientist, Division of Ferrous Metals.

Table 1.—Austria: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Alumina, gross weight	24,337	27,268	27,537
Metal:			
Primary	85,898	89,680	90,004
Secondary	24,258	34,719	32,202
Antimony:			
Mine output, metal content	703	623	610
Antimony sulfide	722	707	749
Cadmium	19	25	22
Copper:			
Mine output, metal content of ore	r 2,067	2,349	2,262
Metal refined, including secondary	18,110	19,325	22,504
Germanium, metal content of concentrates kilograms	e 7,400	7,000	6,800
Iron and steel:			
Iron ore and concentrates thousand tons	3,482	3,982	3,997
Pig iron do	2,474	2,816	2,964
Ferroalloys (electric furnace) do	r 6	6	6
Steel ingots and castings do	3,467	3,926	4,079
Steel semimanufactures and castings and forgings do	2,646	2,916	3,025
Lead:			
Mine output, metal content of ore	6,780	6,807	6,003
Metal:			
Primary	r 8,057	7,480	8,743
Secondary	r 5,994	7,244	6,858
Manganese, content of iron ore	67,911	77,834	81,074
Silver including secondary troy ounces	r 165,898	118,315	175,864
Tungsten, metal content of:			
Crude ore	r 178	160	125
Concentrates	r 140	136	85
Zinc:			
Mine output, metal content of ore	r 12,600	14,234	15,707
Metal refined, including secondary	15,294	15,532	16,018

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
NONMETALS			
Barite	1,461	708	315
Cement, hydraulic thousand tons	4,553	4,558	4,806
Clays:			
Bentonite	510	---------	---------
Illite	172,406	234,525	263,058
Kaolin:			
Crude	327,145	348,072	339,844
Marketable	96,485	97,510	98,332
Other	68,988	79,705	74,888
Diatomite	2,979	1,765	3,772
Feldspar	2,174	1,806	1,206
Graphite, crude	25,468	25,825	27,733
Gypsum and anhydrite, crude thousand tons	698	676	628
Lime do	686	731	741
Magnesite:			
Crude do	1,547	1,608	1,609
Sintered or dead burned do	482	526	546
Caustic, calcined do	[r] 176	183	180
Pigments, mineral (iron mica)	7,307	8,363	7,734
Pumice (trass)	18,076	18,519	19,866
Quartz and quartzite	62,562	124,216	85,913
Salt:			
Rock	963	926	940
Other:			
Evaporated thousand tons	201	225	265
In brine do	[r] 200	193	225
Total do	401	418	490
Stone, sand and gravel: [1]			
Dimension stone thousand tons	90	118	NA
Industrial sand do	234	241	NA
Quarry stone and broken stone do	1,117	1,037	NA
Sand and gravel do	[r] 3,314	4,293	NA
Sulfur:			
Byproduct, recovered, elemental do	3	3	[e] 3
Content of gypsum and anhydrite used for sulfur raw material do	57	56	NA
Other, including recoverable content of nonferrous sulfide ores and of spent oxide do	10	10	---------
Total do	70	69	NA
Talc and soapstone	84,554	94,138	100,159
MINERAL FUELS AND RELATED MATERIALS			
Coal, brown coal and lignite thousand tons	[r] 4,177	3,841	3,670
Coke:			
Gashouse do	[r] 198	85	---------
Metallurgical do	[r] 1,624	1,730	1,768
Gas:			
Manufactured, all types [2] million cubic feet	70,523	72,713	[e] 73,000
Natural gas:			
Gross do	[r] 57,567	52,379	67,007
Marketed do	56,356	50,331	66,992
Petroleum:			
Oil shale [3]	400	510	520
Crude oil thousand 42-gallon barrels	18,999	19,236	19,515
Refinery products:			
Gasoline, aviation and motor do	7,350	7,851	8,487
Jet fuel do	650	728	646
Kerosine do	67	26	194
Distillate fuel oil do	7,606	8,174	11,437
Residual fuel oil do	15,176	16,168	17,316
Lubricants do	1,773	1,884	2,128
Liquefied petroleum gas do	1,038	1,109	1,227
Bitumen do	1,455	1,545	1,619
Other do	54	834	1,819
Refinery fuel and losses do	557	567	638
Total do	35,726	38,886	45,511

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] Excluding stone used by the cement and iron and steel industries.
[2] Include blast furnace and coke oven gas. Manufactured gas is reported in original source as gas having a calorific value of 4,200 calories per cubic meter.
[3] Erroneously reported in thousand metric tons in previous editions.

Table 2.—Austria: Exports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Oxide and hydroxide (includes manufactured corundum)	19,070	23,105	Poland 7,210; West Germany 5,182; Italy 2,602.
Metals including alloys:			
Scrap	9,184	8,238	West Germany 3,669; Italy 3,633.
Unwrought	24,804	27,132	West Germany 18,032; Switzerland 3,830; United Kingdom 2,207.
Semimanufactures	r 31,734	39,849	West Germany 6,323; United Kingdom 3,883; Sweden 3,560.
Antimony ore and concentrate	396	196	Belgium-Luxembourg 88; Italy 39.
Cadmium including alloys, all forms kilograms	500	300	All to West Germany.
Chromium:			
Chromite	238	708	West Germany 698.
Oxide kilograms	51,000	2,100	Poland 1,400.
Columbium and tantalum:			
Tantalum including alloys, all forms do	r 5,800	6,800	West Germany 2,500; United Kingdom 2,200; Poland 1,100.
Copper:			
Ore and concentrate	1,110	-------	
Copper sulfate	211	691	Italy 591.
Metal including alloys:			
Scrap	r 237	497	West Germany 180; Italy 154; Hungary 56.
Unwrought	r 5,076	5,707	West Germany 4,883; Switzerland 553.
Semimanufactures	7,057	10,223	Sweden 1,872; Switzerland 1,837; Yugoslavia 1,570; Bulgaria 1,081.
Gold unworked or partly worked troy ounces	14,661	19,162	West Germany 7,813; Italy 5,080; Yugoslavia 4,823.
Iron and steel:			
Iron ore and roasted pyrites	5,812	4,312	Yugoslavia 3,282.
Metal:			
Scrap	6,118	5,041	Switzerland 2,754; West Germany 1,758.
Pig iron, ferroalloys, and similar materials thousand tons	20	40	Italy 27; Hungary 7.
Steel:			
Primary forms do	r 457	413	West Germany 372; United Kingdom 24.
Semimanufactures:			
Bars, rods, angles, shapes, and sections do	187	221	West Germany 47; Switzerland 35; Italy 31; Hungary 23.
Universals, plates, and sheets do	527	613	West Germany 247; U.S.S.R. 106; United Kingdom 40.
Hoop and strip do	70	77	Switzerland 34; West Germany 10; Italy 8.
Rails and accessories do	52	63	Romania 34; Switzerland 11; Bulgaria 5.
Wire do	51	64	Hungary 14; Switzerland 11; West Germany 11; Italy 6.
Tubes, pipes and fittings do	55	71	Sweden 16; United Kingdom 12; Switzerland 12.
Castings and forgings, rough do	3	4	West Germany 1; Switzerland 1.
Lead:			
Oxide	1,427	1,165	Czechoslovakia 975.
Metal including alloys, all forms	1,600	2,464	Italy 1,821; Yugoslavia 475.
Magnesium including alloys, all forms	332	2,079	West Germany 1,359; Italy 316; Belgium-Luxembourg 178.
Manganese oxide	347	351	Brazil 307; West Germany 40.
Mercury 76-pound flasks	490	322	West Germany 244.
Molybdenum including alloys, all forms	500	436	West Germany 233; United Kingdom 98.
Nickel including alloys, all forms	r 243	321	West Germany 197; Italy 26.
Platinum-group and silver including alloys, all forms:			
Platinum-group troy ounces	20,898	9,163	West Germany 5,112; Romania 2,443; France 386.
Silver:			
Bullion thousand troy ounces	180	495	All to West Germany.
Other (powder) do	-------	23	Do.
Semimanufactures do	186	235	Yugoslavia 209; Bulgaria 10.
Tin:			
Oxide long tons	64	21	Bulgaria 14.
Metal including alloys, all forms do	r 29	16	West Germany 5; United Kingdom 4; Denmark 2.
Titanium oxide	62	19	All to United Arab Republic.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Tungsten:			
Ore and concentrate	279	239	All to West Germany.
Metal including alloys, all forms	r 92	93	West Germany 58; Italy 7; France 5.
Zinc:			
Ore and concentrate	3	715	All to Belgium-Luxembourg.
Oxide	-------	27	Ireland 26.
Metal including alloys, all forms	r 4,813	2,298	Italy 1,909; West Germany 167; Yugoslavia 153.
Other:			
Ore and concentrate	139	98	West Germany 97.
Ash and residues containing nonferrous metals	20,366	19,276	Italy 10,371; West Germany 5,227; Yugoslavia 2,699.
Waste and sweepings of precious metals kilograms	20,215	22,049	West Germany 21,581; France 407.
Oxides, hydroxides and peroxides of metals n.e.s	49	53	Czechoslovakia 43, West Germany 9.
Base metals including alloys, all forms, n.e.s	43	55	West Germany 33; Switzerland 9.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum and other natural abrasives	4	6	NA.
Dust and powder of precious and semiprecious stones (including diamond) kilograms	-------	41	NA.
Grinding and polishing wheels and stones	6,600	7,749	West Germany 1,038; Yugoslavia 997; Poland 885; Italy 793.
Asbestos	57	53	Romania 30; Switzerland 12.
Barite and witherite	-------	70	NA.
Cement	r 10,322	38,844	Yugoslavia 21,558; West Germany 15,738.
Chalk	3,408	3,183	West Germany 1,287; Italy 927; Hungary 753.
Clays and products (including all refractory brick):			
Crude:			
Kaolin (china clay)	26,808	29,071	Italy 19,956; Switzerland 5,814; Yugoslavia 1,458.
Other	1,563	1,439	Italy 917; Yugoslavia 229; United Kingdom 100.
Products:			
Refractory (including nonclay bricks)	159,628	207,987	West Germany 50,331; France 36,530.
Nonrefractory	r 1,123	215	West Germany 143; Switzerland 68.
Cryolite and chiolite, natural	38	9	All to Mexico.
Diamond, industrial ---- thousand carats	25	-------	
Diatomite and other infusorial earths	r 225	107	Yugoslavia 53; Switzerland 23.
Feldspar	293	415	Czechoslovakia 314; West Germany 75.
Fluorspar	22	-------	
Graphite, natural	24,720	24,454	Italy 9,529; Poland 7,204; West Germany 5,514.
Gypsum and plasters	106,599	116,470	West Germany 92,125; Switzerland 24,326.
Lime	4,074	4,311	West Germany 3,346; Switzerland 936.
Magnesite	250,761	239,129	West Germany 143,160; France 17,990; Hungary 16,322.
Mica, all forms	42	27	Yugoslavia 10; Romania 6; Poland 3.
Pigments, mineral, including processed iron oxides	r 4,850	5,766	West Germany 1,745; United Kingdom 1,356; France 766.
Precious and semiprecious stones, including diamond:			
Natural ---- kilograms	438	194	United States 86; West Germany 59; United Kingdom 26.
Manufactured ---- do	19	615	Australia 276; United States 96; Sweden 59.
Pyrite	-------	2,288	All to West Germany.
Salt	36	15	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble and limestone	95,806	80,744	West Germany 60,598; Switzerland 20,136.
Slate	40	3	NA.
Other	54,313	57,232	West Germany 52,676; Yugoslavia 3,840.
Worked:			
Paving and flagstone	23,742	19,884	West Germany 10,529; Switzerland 9,266.
Slate	-------	33	West Germany 21; Switzerland 10.
Other	r 2,130	1,306	West Germany 874; United States 243; Netherlands 135.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Dolomite	8,544	16,738	United Kingdom 11,770; West Germany 1,988.
Gravel and crushed rock	337,755	447,043	West Germany 256,061; Switzerland 189,211.
Limestone	291,299	20	NA.
Quartz and quartzite	42	151	Czechoslovakia 93; West Germany 53.
Sand excluding metal bearing	54,684	52,966	West Germany 33,625; Switzerland 15,542.
Sulfuric acid and oleum	424	158	All to Hungary.
Talc, steatite, soapstone and pyrophyllite	72,861	79,723	West Germany 37,157; Italy 11,242; Belgium-Luxembourg 5,621.
Other nonmetals, n.e.s.:			
Crude	2,668	2,974	West Germany 2,479; Yugoslavia 170.
Slag dross and similar waste, not metal bearing	153,459	118,085	Mainly to West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2	109	NA.
Carbon black and gas carbon	14	4	Colombia 1; Yugoslavia 1.
Anthracite and bituminous coal and briquets	24	24	Switzerland 22.
Lignite and lignite briquets	9,192	7,492	West Germany 6,984; Czechoslovakia 278.
Coke and semicoke	124,934	142,453	Romania 122,774; Yugoslavia 14,078.
Hydrogen, helium and rare gases thousand cubic feet	1,600	1,970	West Germany 1,741; Yugoslavia 214.
Peat, including peat briquets and litter	21	20	NA.
Petroleum refinery products:			
Gasoline, aviation and motor thousand 42-gallon barrels	2	26	Mainly to Hungary.
Kerosine and jet fuel do	93	106	All to Poland.
Distillate fuel oil do	6	2	West Germany 1; Switzerland 1.
Residual fuel oil do	(1)	(1)	
Lubricants do	r 705	932	Poland 430; Czechoslovakia 325; Syria 64.
Other do	r 38	53	Poland 23; Yugoslavia 15; Switzerland 8.
Total do	r 844	1,119	
Mineral tar and other coal, petroleum, or gas derived chemicals	r 6,049	4,830	West Germany 3,690; Switzerland 789; France 307.

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

Table 3.—Austria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	25,052	26,060	NA.
Oxide and hydroxide	r 178,172	200,278	Hungary 30,864; Yugoslavia 23,351; Guinea 17,316.
Metal including alloys:			
Unwrought including scrap	r 10,078	11,468	Yugoslavia 2,987; Poland 2,006; Czechoslovakia 1,754; U.S.S.R. 1,163.
Semimanufactures	r 6,809	9,341	West Germany 4,418; Switzerland 2,529.
Antimony including alloys, all forms	129	89	Belgium-Luxembourg 48; Yugoslavia 23.
Arsenic trioxide, pentoxide, and acids	32	66	France 59; West Germany 7.
Cadmium including alloys, all forms	r 10	11	West Germany 7; Belgium-Luxembourg 3.
Chromium:			
Chromite	54,540	85,175	Republic of South Africa 33,126; Iran 19,959; Turkey 17,074.
Oxide and hydroxide	180	294	West Germany 178; France 35; Italy 20.
Cobalt oxide and hydroxide kilograms	1,500	1,200	Belgium-Luxembourg 500; Canada 500.
Columbium and tantalum:			
Tantalum including alloys, all forms do	9,500	7,700	United States 5,700; West Germany 1,400.
Copper:			
Ore and concentrate	(1)	-------	
Metal including alloys:			
Scrap	6,709	9,238	West Germany 5,458; Switzerland 1,255; United States 788.
Unwrought	r 22,587	27,031	West Germany 12,457; Zambia 6,182; Republic of South Africa 2,854.
Semimanufactures	r 4,952	5,481	West Germany 2,414; United Kingdom 833; Sweden 794.
Gold unworked and partly worked thousand troy ounces	r 1,154	787	Switzerland 477; West Germany 153; United Kingdom 121.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and steel:			
Ore and concentrate, except roasted pyrite ... thousand tons	1,375	1,605	Brazil 1,263; U.S.S.R. 326.
Roasted pyrite ... do	245	223	Italy 208; Czechoslovakia 6.
Metal:			
Scrap ... do	61	96	Czechoslovakia 36; East Germany 21; Poland 18.
Pig iron, including cast iron [2] ... do	116	105	U.S.S.R. 57; East Germany 17; West Germany 12.
Ferroalloys:			
Ferromanganese ... do	16	20	Norway 13; Republic of South Africa 2; U.S.S.R. 1.
Other ... do	36	48	Norway 9; U.S.S.R. 6; Czechoslovakia 5; Republic of South Africa 5.
Steel:			
Primary forms ... do	r 165	61	Hungary 27; Czechoslovakia 19; Bulgaria 6.
Semimanufactures:			
Bars, rods, angles, shapes, sections ... do	58	58	West Germany 32; Hungary 11.
Universals, plates, and sheets ... do	66	67	West Germany 26; Belgium-Luxembourg 13; France 10; Romania 5.
Hoop and strip ... do	10	15	West Germany 6; Switzerland 3; Belgium-Luxembourg 3.
Rails and accessories ... do	2	2	West Germany 1.
Wire ... do	10	9	West Germany 4; Belgium-Luxembourg 2; Sweden 1.
Tubes, pipes, and fittings ... do	75	125	West Germany 82; Switzerland 7; Italy 7; Sweden 6.
Castings and forgings, rough ... do	5	6	West Germany 4; Italy 1.
Lead:			
Ore and concentrate	2,594	3,250	Mainly from Italy.
Oxides	189	61	West Germany 36; United Kingdom 21.
Metals including alloys:			
Unwrought including scrap	r 15,715	16,401	Yugoslavia 12,192; Bulgaria 2,481.
Semimanufactures	686	492	Yugoslavia 233; Switzerland 199.
Magnesium including alloys, all forms	r 897	2,765	Poland 1,342; Czechoslovakia 619.
Manganese:			
Ore and concentrate	807	792	Netherlands 334; Morocco 230; West Germany 228.
Oxides	260	256	Japan 180; Netherlands 29.
Mercury ... 76-pound flasks	206	220	Yugoslavia 78; West Germany 52; United States 44.
Molybdenum:			
Oxides	496	801	West Germany 717.
Metal including alloys, all forms	4	13	United Kingdom 10; U.S.S.R. 2.
Nickel:			
Matte, speiss, and similar materials	758	2,088	Netherlands 1,753; United Kingdom 167.
Metal including alloys:			
Unwrought including scrap	r 2,626	2,149	United Kingdom 950; France 427; West Germany 186.
Semimanufactures	r 579	959	West Germany 420; United Kingdom 411.
Platinum-group and silver including alloys, all forms:			
Platinum group ... troy ounces	r 7,909	12,635	West Germany 11,253; Switzerland 675.
Silver:			
Bullion ... thousand troy ounces	2,363	3,495	West Germany 961; United Kingdom 736.
Other (powder) ... do	3	6	All from Sweden.
Semimanufactures ... do	r 447	624	West Germany 373; Switzerland 222.
Tin including alloys, all forms ... long tons	613	685	Netherlands 396; West Germany 83; Belgium-Luxembourg 45.
Titanium oxide	6,357	6,546	West Germany 4,306; United Kingdom 1,160; Finland 611.
Tungsten:			
Ore and concentrate	2,392	3,199	NA.
Oxide and hydroxide	276	254	France 129; West Germany 125.
Metal including alloys, all forms	90	67	United States 27; West Germany 17; France 14.
Zinc:			
Ore and concentrate	10,213	11,431	Italy 10,889.
Oxide	699	711	NA.
Metal including alloys, all forms	7,342	7,839	West Germany 1,636; Yugoslavia 1,514; Zambia 1,229.
Other:			
Ore and concentrate	5,426	15,985	Czechoslovakia 7,938; United States 2,931; Australia 1,469.
Ash and residue containing nonferrous metals	24,205	23,597	East Germany 10,558; Poland 6,011; West Germany 2,388.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Other—Continued			
Waste and sweepings of precious metals .... kilograms	157	10	West Germany 6; Hungary 2.
Oxides, hydroxides and peroxides of metals, n.e.s	3,134	3,071	West Germany 1,254; Republic of South Africa 834.
Base metals including alloys, all forms, n.e.s	647	1,017	Belgium-Luxembourg 310; France 168; Republic of South Africa 100; West Germany 99.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum and other natural abrasives	606	1,737	West Germany 1,417; Italy 206.
Dust and powder of precious and semi-precious stones (including diamond) kilograms	r 42	41	United States 39; Switzerland 2.
Grinding and polishing wheels and stones	r 650	689	West Germany 383; Yugoslavia 46.
Asbestos	31,746	34,353	Canada 16,135; Republic of South Africa 7,229; U.S.S.R. 5,092.
Barite and witherite	5,724	8,460	Yugoslavia 4,420; West Germany 2,789.
Boron materials:			
Crude natural borates	8,332	7,679	United States 6,659; Turkey 1,000.
Oxide and acid	8	301	Turkey 150; Italy 95.
Cement	r 20,516	20,303	West Germany 5,225; Italy 4,745; France 4,556.
Chalk	1,503	2,828	France 2,102; West Germany 336.
Clays and products (including all refractory brick):			
Crude, n.e.s.:			
Bentonite	329	506	West Germany 379; Yugoslavia 85.
Kaolin (china)	r 31,766	39,462	United Kingdom 15,560; West Germany 15,455.
Other	r 67,682	75,792	West Germany 44,576; Czechoslovakia 24,365.
Products:			
Refractory (including nonclay bricks)	12,861	12,086	West Germany 10,263.
Nonrefractory	117,371	118,490	West Germany 50,975; Italy 40,524; Switzerland 11,506.
Cryolite and chiolite, natural	259	416	Denmark 415.
Diamond, industrial ..... thousand carats	80	150	West Germany 130.
Diatomite and other infusorial earths	2,146	2,257	Hungary 923; United States 508; West Germany 400.
Feldspar	r 6,215	6,949	West Germany 3,516; Sweden 1,700.
Fertilizer:			
Crude:			
Phosphatic	321,849	305,866	United States 106,983; Israel 81,303; U.S.S.R. 65,906.
Potassic	60,140	59,475	East Germany 49,645.
Other	1,636	1,949	West Germany 1,479.
Manufactured:			
Nitrogenous	3,069	4,310	West Germany 4,257.
Phosphatic	327,795	249,416	France 117,098; Belgium-Luxembourg 104,765.
Potassic	254,182	237,271	East Germany 93,809; West Germany 84,979; U.S.S.R. 29,967.
Other including mixed	2,045	7,996	Belgium-Luxembourg 3,034; United States 2,520.
Fluorspar	15,426	14,550	East Germany 8,306; West Germany 3,514.
Graphite, natural	694	592	Czechoslovakia 320; West Germany 216.
Gypsum and plasters	30,612	22,277	Poland 8,781; East Germany 5,031; West Germany 4,829.
Lime	454	693	West Germany 395; Switzerland 210.
Magnesite	43,105	65,438	Turkey 49,063; Greece 13,534.
Mica:			
Crude including splittings and waste	437	300	Norway 99; West Germany 88.
Worked including agglomerated splittings	32	37	Switzerland 16; Belgium-Luxembourg 11.
Pigments, mineral:			
Natural, crude	290	195	France 145; West Germany 38.
Iron oxides, processed	1,629	1,685	West Germany 1,650.
Precious and semiprecious stones, including diamond:			
Natural .... thousand carats	67,375	67,530	Brazil 25,700; West Germany 13,935; United States 13,080.
Manufactured .... do	19,425	25,945	France 18,730; Switzerland 7,195.
Pyrite (gross weight)	25,952	26,226	U.S.S.R. 16,893; Italy 5,433.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Salt including brine salt	6,540	13,349	Romania 7,295; West Germany 6,054.
Sand and gravel:			
Gravel (including crushed rock)	50,609	49,791	West Germany 38,431; Italy 9,491.
Sand excluding metal bearing	150,544	128,446	West Germany 95,843; East Germany 14,819; Czechoslovakia 9,928.
Stone, n.e.s.:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble and limestone	8,512	9,277	Italy 6,354; West Germany 1,631; Yugoslavia 824.
Slate	718	830	West Germany 372; Norway 143; Italy 140.
Other	r 27,905	27,105	Italy 13,253; Republic of South Africa 7,355; Sweden 3,106.
Worked:			
Paving and flagstone	9,314	11,213	Yugoslavia 7,025; Romania 1,792; Italy 1,706.
Slate	315	390	Italy 285; West Germany 74.
Other	3,640	4,011	Italy 3,273; West Germany 313.
Dolomite, chiefly refractory grade	3,506	3,294	Italy 2,247; Norway 608.
Limestone, except dimension	r 61	39	All from West Germany.
Quartz and quartzite	15,226	14,782	West Germany 12,274; Yugoslavia 1,618.
Volcanic materials (trass)	1,668	494	All from West Germany.
Sulfur:			
Elemental, all forms	83,889	112,417	Poland 43,091; U.S.S.R. 25,883; East Germany 16,346.
Sulfur dioxide	698	640	West Germany 625.
Sulfuric acid and oleum	9,053	14,074	Czechoslovakia 9,493; West Germany 2,982.
Talc, steatite, soapstone and pyrophyllite	1,718	1,414	Italy 649; Norway 376.
Other nonmetals, n.e.s.:			
Crude:			
Meerschaum, amber, and jet	18	6	Turkey 5.
Other	23,263	27,135	West Germany 23,734; Hungary 980.
Slag dross and similar waste, not metal bearing	7,279	18,700	Hungary 9,014; Yugoslavia 3,106; West Germany 2,766.
Oxides and hydroxides of magnesium, strontium, and barium	521	515	West Germany 434; United States 53.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	879	507	Trinidad and Tobago 383.
Carbon black and gas carbon	r 14,985	17,149	West Germany 6,163; Italy 3,968; Belgium-Luxembourg 3,654.
Anthracite and bituminous coal and briquets thousand tons	r 3,407	3,109	Poland 1,267; West Germany 809; U.S.S.R. 652.
Lignite and lignite briquets do	495	558	East Germany 287; West Germany 211; Czechoslovakia 28.
Coke and semicoke do	1,018	1,070	Czechoslovakia 546; West Germany 167; Poland 110.
Gas, hydrocarbon	r 202,148	645,294	U.S.S.R. 562,796; Czechoslovakia 74,971.
Hydrogen, helium and rare gases thousand cubic feet	26,635	51,009	West Germany 50,802.
Peat including peat briquets and litter	16,543	15,617	West Germany 10,424; Poland 2,936.
Petroleum:			
Crude and partly refined oils:			
Crude thousand 42-gallon barrels	11,009	9,939	U.S.S.R. 4,205; Iraq 1,684: Yugoslavia 1,677.
Partly refined do	4,644	6,744	Czechoslovakia 3,249; Hungary 1,987; Poland 1,328.
Refinery products:			
Gasoline, aviation and motor do	6,400	7,148	Italy 1,964; West Germany 1,863; Hungary 1,370.
Kerosine do	1	1	Mainly from Netherlands.
Distillate fuel oil do	794	770	Italy 409; Yugoslavia 200; West Germany 127.
Residual fuel oil do	11,214	12,158	West Germany 3,655; Czechoslovakia 2,116; Italy 1,573.
Lubricants do	411	449	Italy 151; West Germany 123; Netherlands 56.
Mineral jelly and wax do	68	71	West Germany 37; East Germany 11; Hungary 8.
Other do	r 1,597	2,001	West Germany 669; Italy 661; Hungary 435.
Mineral tar and other coal, petroleum, or gas derived crude chemicals	8,956	8,546	U.S.S.R. 3,208; Czechoslovakia 1,858; West Germany 1,625.

r Revised. NA Not available.

1 Revised to none.

2 Includes spiegeleisen, shot, powder, and sponge.

COMMODITY REVIEW

METALS

Aluminum.—Production of primary aluminum, which remained in 1970 at about the same level as in the previous year, continued to be based entirely on imported bauxite. The combined capacity of Austria's two primary aluminum smelters remained the same as in 1969. The state-owned Vereinigte Metallwerke Ranshofen-Berndorf A.G. (VMRB) is by far the larger of the two smelters. The smaller reduction plant, located near Lend, Salzburg province, was operated by Salzburger Aluminimum G.m.b.H. (SAG), a wholly owned subsidiary of Alusuisse.

During the year, a new extrusion plant was completed at the Ranshofen works of VMRB. Other plans for the facilities at Ranshofen include building a 50,000-ton-per-year aluminum electrolytic plant and a new cold-rolling mill. In addition, a new aluminum powder plant is being installed at Ranshofen jointly by VMRB and the Eckartwerke of Fürth/Bavaria.

Copper.—During 1970 Austria remained a modest producer of copper ore, concentrate, and electrolytic copper. The output of copper ore showed only a slight decrease from that in 1969. A large-scale investment program to double the copper ore mine production at Mitterberg is presently in progress.

In the course of boring at Reith and Obendorf, near Kitzbühel, the Union Corp. apparently found indications of copper mineralization The tourist industry, however, is not in favor of copper prospecting in this area.

Iron and Steel.—Although Austria's iron and steel industry represents less than 1 percent of the world's steel industry, it is a very important segment of the country's economy. Imports of ore and energy are vital to the industry's maintenance, and it also relies heavily on the export of its products. In 1970, however, there was a slowdown of exports in the ferrous sphere, owing to a heavy domestic demand. Exports of rolled products decreased from 1.33 million tons to 1.19 million tons; pig iron shipments dropped to 25,000 tons from 34,000 tons; no raw steel was exported.

The Steirischen Erzberg (Styrian Ore Mountain) mine at Eisenerz, Styria, accounted for most of Austria's output of iron ore. Imports, mainly from the U.S.S.R. and Brazil, supplement the domestic production.

The largest of the Austrian steel companies is the state-owned Vereinigte Österreichische Eisen und Stahlwerke A.G. (VÖEST). The second largest steel company, the state-owned Österreichisch-Alpine Montangesellschaft A.G. (ÖAMG), operates the Eisenerz and Radmer mines in Styria in the northern range of the Eastern Alps and the Hüttenberg mine in Carinthia in the southern range. Gebrüder Böhler and Co. A.G. and Schoeller-Bleckmann, Stahlwerke A.G., both nationalized, specialize in high-grade steels and steel products.

Lead and Zinc.—The Government-owned Bleiberger Bergwerks-Union A.G., which operates the Bleiberg mine in the ancient Bleiberg-Kreuth mining district in Carinthia, is undertaking an expansion program that will add 100,000 tons per year ore capacity and raise total capacity to 300,000 tons per year. The firm has announced completion of an examination of a large, 6-million-ton-zinc-ore deposit in the Bleiberg area, which will help Austria to meet its zinc demands, 70 percent of which already are met by the company. Their electrolytic zinc plant at Gailitz, near Arnoldstein, Carinthia, has an estimated annual capacity for slab zinc of 17,600 short tons. Its lead smelter, also at Gailitz, has an annual capacity for refined lead of 13,500 metric tons.

Tungsten.—Although Austria's production of tungsten concentrate does not satisfy its requirements for that metal, it does provide a very important source of supply to the country's ferroalloy industries. The scheelite comes from the Hintertux magnesite mine of the Österreichisch-Amerikanische Magnesit A.G. at Vorderlanersbach (Tux) in Tyrol.

Uranium.—Uranium exploration in Austria has been carried out, since 1968, by the Vienna-based firm, Bergbau-und Mineralgesellschaft Pryssok. The Pryssok firm, which has largely engaged in surface inspection primarily in the northern portion of Lower Austria and in southeastern Carinthia, expects to undertake core drilling and hopes to estimate the size of the

Lower Austrian/Carinthian deposits in 1 to 2 years.

A team of geologists from the University in Innsbruck, Tyrol, reported finding a uranium ore body south of the villages of Fieberbrunn and Hochfilzen, near the border between the Provinces of Tyrol and Salzburg. Samples reportedly contained 1 to 2 percent uranium.

Other Metals.—In 1970 Austria also produced small quantities of antimony, cadmium, germanium, and silver.

NONMETALS

Graphite.—Production of crude graphite increased from 25,825 metric tons in 1969 to 27,733 metric tons in 1970. A large part of the Austrian graphite production is exported.

A United States firm, the Arcair Co. of Lancaster, Ohio, intends to establish a plant to make graphite welding rods in Austria, either in the Inn Valley or in Styria. The availability of cheap domestic graphite in Austria and the desire to meet European competition is the reason for selecting Austria as the site of the new facility. Arcair estimates that it will export 90 percent of its production.

Magnesite.—Austria is one of the chief producers of magnesite in the world. The principal producing mines are Breitenau in Styria, Hochfilzen in Tyrol, and Radenthein in Carinthia. The Veitsch mine in Styria was shut down at the end of 1968.

The output of crude magnesite in 1970 (1,609 thousand metric tons) remained about the same as that of 1969 (1,608 thousand metric tons); sintered or deadburned magnesite increased from 526 thousand metric tons to 546 thousand metric tons; and caustic-calcined magnesite decreased slightly from 183 thousand metric tons to 180 thousand metric tons. A significant part of the Austrian magnesite production is exported.

Other Nonmetals.—In 1970 Austria also produced a variety of other nonmetals, including gypsum and anhydrite, barite, kaolin, illite, quartz and quartzite, diatomite, feldspar, salt, talc, and pumice (trass).

MINERAL FUELS

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

Coal.—The Austrian coal industry had lower production in 1970 than in the previous year. Three companies, Graz-Köflacher Eisenbahn und Bergbau-Gesellschaft, Salzach-Kohlenbergbau, G.m.b.H., and Wolfsegg-Traunthaler-Kohlenwerks Aktiengesellschaft, were among the principal coal producers.

To meet its coal and coke requirements, Austria relies on imports. In 1970, their total coal (anthracite, bituminous, excluding briquets) imports amounted to 3.45 million metric tons, compared with 3.05 million metric tons in 1969. This increase came, for the most part, from imports from Poland (1.39 million metric tons), the Soviet Union (895,706 metric tons), West Germany (567,010 metric tons), Czechoslovakia (486,731 metric tons) and, for the first time since 1967, the United States (102,584 metric tons).

Deliveries of solid fuel (including coke produced from imported coal) to Austrian consumers in 1970 totaled 8.5 million metric tons of standard bituminous coal equivalent, or 5 percent more than the 1969 rate. This substantial increase in consumption was restricted entirely to the demand for bituminous coal, which gained almost 14 percent. Consumer groups showing an increase in bituminous demand included the following: Railroads, up 13 percent; district heating plants, 51 percent; coking plants, 10 percent; and households, 87 percent. Consumer groups using less bituminous coal in 1970 were the electric powerplants, down 70 percent, and the industry group, down 31 percent.

Petroleum and Natural Gas.—Austria produced both crude oil and natural gas in 1970. Domestic output, however, was far below demand, and both commodities were imported.

Drilling activities for hydrocarbons continued, and the two main drilling areas were the Inner Alpine Vienna basin and the Molasse basin. Fifteen exploratory wells were completed in 1970, resulting in 6 successful wells of which 2 were oil and 4 were gas wells. A total of 45 development wells were completed of which 17 were oil, 19 were gas, and 9 were unsuccessful.

Three companies provided the domestic production: Österreichische Mineralölverwaltung A.G. (ÖMVAG), the Government-owned company; Rohoel-Gewinnungs A.G. (RAG), owned jointly by Shell Austria A.G. and Vacuum Oil; and Richard K. Van Sickle.

Mesa Petroleum A.G., which did not carry out any exploration on its concessions in 1969, relinquished its concession areas covering 3,575 square kilometers in Upper Austria and Styria at the end of 1969.

RAG brought the total of its concession areas in 1970 to 6,474 square kilometers (2,500 square miles), including the addition of a new 277 square kilometers concession area, Schaerding-South, formerly belonging to Mesa Petroleum A.G.

Oil and gas reserves at the end of 1970 were as follows: 22.3 million tons (151.6 million barrels) of oil, and 370.76 thousand million cubic feet of dry gas.

Austria's major petroleum refinery, that of ÖMVAG at Schwechat, increased its capacity by 70,000 barrels per day, raising its total refinery capacity to 155,000 barrels per day; a further expansion of 70,000 barrels per day is planned. Plans for a second major refinery to be built at Lannach, an agreement between ÖMVAG and the main internationally linked oil distributors—Shell, Mobil, British Petroleum Company (BP), Esso, Cie. Française des Pétroles (CFP), and Ente Nazionale Idrocarburi (ENI) have been decided against by the planning consortium. Two small-scale refineries in the Vienna area, Mobil Oil Austria A.G. (4,500 barrels per day) and Shell Austria A.G. (4,800 barrels per day), and a small refinery at Neusiedl/Zaya, Richard K. Van Sickle (335 barrels per day), also contributed in 1970 to Austria's producing capacity.

The 18-inch, 260 mile spur from the Transalpine Pipeline (TAL) at Würmlach to ÖMVAG's Schwechat refinery, was completed in 1970. AWP, the new Adriatic-Vienna (Adria-Wien) pipeline, has a capacity of 6 million tons per year, which later is to be expanded to 10 million tons. Completion of this spur has made it possible for ÖMVAG to start importing directly from the Libyan National Oil Corporation (Linoco) and from Algeria's SONATRACH. Principal suppliers of crude oil in 1970 were the U.S.S.R., Iraq, and Libya.

Deliveries of natural gas to Austria from the U.S.S.R., which began in 1968, reached 31,469 million cubic feet in 1970.

Petrochemicals.—ÖMVAG inaugurated Austria's first ethylene plant with an initial capacity of 70,000 tons per year; the plant is adjacent to its Schwechat refinery. Nearby, the country's first high-pressure polyethylene plant, which uses ÖMVAG's entire ethylene output, was opened by Danubia Olefinwerke, G.m.b.H., an equal partnership of Österreichische Stickstoffwerke A.G. (OSW) and the German Badische Anlin- & Soda-Fabrik A.G. (BASF). ÖMVAG also delivers propylene for use in the adjacent 12,000-ton-per-year polypropylene unit of OSW.

The Mineral Industry of Belgium and Luxembourg

By Frank J. Cservenyak [1]

The economic growth and activity experienced by Belgium and Luxembourg started to slow down in 1970. In Belgium the gross national product (GNP) increased 5.5 percent in 1970 compared with an increase of 6.5 percent in 1969. A greater change was noted in Luxembourg, with an increase of 3.5 percent in the GNP in 1970 compared with 7.0 percent in 1969.

The year 1970 was a record one for industrial investment in Belgium. The gross investment expenditure of firms covered by the National Bank's investment survey was 48 percent higher in 1970 than in 1969. Industrial production averaged about 7 percent above the 1969 level.

Industrial investment in Luxembourg increased 17.5 percent in 1970, but industrial production increased by only 1.5 percent. A 4-percent increase in the output of nonsteel industries more than offset the 1.1 percent decline in steel production.

For the second year in a row the Belgium-Luxembourg Economic Union (BLEU) enjoyed a slightly favorable balance of trade, amounting to about $243 million in 1970 compared with a little over $76 million in 1969. The BLEU's imports in 1970 were valued at about $11.35 billion, an increase of 13.7 percent over 1969. BLEU exports in 1970 were valued at approximately $11.6 billion, an increase of 15.2 percent over 1969. The national economies of the two allied states are strongly export oriented, and trends in economic activity tend to be closely geared to foreign trade performances. Exports in 1970 accounted for over two-fifths of the GNP in Belgium and for about 85 percent in Luxembourg.

Concern was directed to the abatement of water pollution in Belgium. The potential for water pollution is great because Belgium is densely populated and highly industrialized, and its rivers and canals carry heavy traffic. Plans were announced for the expenditure of $3 million over the next 3 years on pollution studies in the North Sea and Sambre River. Several antipollution bills for water, air, and noise were under consideration by the Senate at the end of 1970.

BELGIUM

PRODUCTION

In 1970 Belgium produced 12.6 million tons of steel, a 1.7-percent decrease below 1969 production. Output of steel declined because of the scarcity of coal following strikes in the Belgian coal mines early in the year and because of declining demand in the second half of the year. The decline in steel production followed 2 expansionary years of 12-percent growth in 1969 and 19-percent growth in 1968. Belgium consumed over one-third of its steel production and shipped over 40 percent to its European Economic Community (EEC) partners.

Although copper production increased 18 percent, the production of lead, tin, and zinc declined in 1970. Coal production in 1970 dropped by about 14 percent to 11,358,000 metric tons. This decrease was largely attributable to strikes. Domestic production of coal meets only about 60 percent of the Belgian demand of about 20 million tons per year.

[1] Physical scientist, Division of Ferrous Metals.

Table 1.—Belgium: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum, secondary only	2,200	[e] 2,500	[e] 2,500
Cadmium	80	90	[e] 90
Copper, refined including secondary	[r] 343,189	298,675	351,677
Iron and steel:			
Iron ore and concentrate ... thousand tons	[r] 82	94	94
Pig iron including ferroalloys ... do	[r] 10,448	11,313	10,845
Steel:			
Crude ... do	11,568	12,832	12,612
Semimanufactures ... do	[r] 9,424	10,719	NA
Lead including secondary	[r] 110,753	110,543	106,010
Tin including secondary ... long tons	[r] 5,953	6,474	4,190
Zinc including secondary	[r] 248,983	260,593	241,200
Other nonferrous metals:			
Precious metals unworked n.e.s.[2] ... thousand troy ounces	30,843	46,851	[e] 37,000
Unspecified base metals [3]	3,294	4,573	[e] 4,400
NONMETALS			
Abrasives, natural, whetstones (crude)	36,100	29,400	[e] 24,000
Cement, hydraulic ... thousand tons	[r] 5,740	6,269	6,729
Clays, n.e.s ... do	[r] 199	[e] 220	NA
Fertilizer materials manufactured:			
Nitrogenous, nitrogen content ... do	261	427	[e] 360
Phosphatic, gross weight:			
Thomas slag ... do	1,421	1,534	[e] 1,200
Superphosphate, ordinary ... do	198	204	[e] 160
Other ... do	492	475	[e] 490
Gypsum and anhydrite, calcined	81,406	78,972	[e] 86,000
Lime and dead burned dolomite:			
Quicklime ... thousand tons	[r] 2,501	2,629	[e] 2,500
Dead burned dolomite ... do	[r] 371	388	[e] 371
Stone, sand and gravel:			
Calcareous:			
Marble:			
In blocks ... cubic meters	[r] 4,064	4,761	[e] 3,000
Crushed and other ... do	27,170	21,931	[e] 22,000
Limestone and other ... thousand tons	16,055	19,233	[e] 22,000
Petit granite (Belgian bluestone):			
Quarried ... cubic meters	[r] 266,111	301,161	[e] 301,000
Sawed ... do	[r] 64,283	73,052	[e] 67,000
Worked ... do	[r] 11,717	11,956	[e] 11,000
Crushed and other ... do	[r] 214,251	241,273	[e] 242,000
Porphyry, all kinds ... thousand tons	6,808	6,757	[e] 7,000
Quartzite ... do	351,744	[e] 390,000	NA
Sand and gravel:			
Construction sand ... do	4,849	5,532	[e] 6,200
Foundry sand ... do	1,134	1,354	[e] 1,500
Dredged sand ... do	612	860	[e] 900
Glass sand ... do	[r] 1,661	1,825	1,800
Other sand ... do	1,079	1,465	[e] 1,500
Gravel (dredged) ... do	4,947	5,146	[e] 3,700
Sandstone:			
Rough stone including crushed ... do	1,511	1,554	[e] 1,400
Paving and mosaic stone	[r] 3,367	5,726	[e] 2,300
Other	65,131	67,045	[e] 48,000
Slate, roofing, and other	10,777	8,856	[e] 7,000
Sulfur, byproduct, recovered	[r] 8,658	[e] 9,700	[e] 10,200
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite ... thousand tons	4,320	3,595	[e] 3,067
Bituminous ... do	10,486	9,605	[e] 8,291
Total ... do	14,806	13,200	11,358
Coke, all types ... do	[r] 7,242	7,250	7,005
Fuel briquets, all kinds ... do	823	792	737
Gas manufactured ... million cubic feet	111,847	88,293	75,596
Petroleum refinery products:			
Gasoline, aviation ... thousand 42-gallon barrels	45	18	9
Gasoline, motor ... do	[r] 21,607	26,095	30,405
Jet fuel ... do	[r] 4,712	8,384	8,512
Kerosine ... do	[r] 2,147	922	1,023
Distillate fuel oil ... do	51,467	67,588	70,303
Residual fuel oil ... do	56,523	68,711	74,998
Lubricants ... do	[r] 378	378	378
Other ... do	[r] 19,465	22,924	21,097
Refinery fuel and losses ... do	13,361	16,539	14,656
Total ... do	[r] 169,705	211,559	221,381

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

[3] Figures derived by subtracting estimated or approximate data for aluminum and cadmium from a reported total for unspecified base metals. Other metals in this category as reported include antimony, bismuth, germanium, and vanadium, among other byproducts of copper, lead, and zinc metallurgy.

TRADE

The foreign trade of Belgium is combined with that of Luxembourg in the official returns of BLEU. The member countries of the EEC and the United States were the principal trading partners of Belgium-Luxembourg.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969 [1]
METALS			
Aluminum:			
Bauxite and concentrate	21	182	NA.
Oxide and hydroxide	26	17	European Economic Community (EEC) nations 13.
Metal including alloys, all forms:			
Scrap	11,464	13,610	France 6,378; West Germany 5,337; Netherlands 1,739.
Unwrought	7,143	10,509	West Germany 9,125; Netherlands 682; France 654.
Semimanufactures	r 114,476	131,876	United States 29,890; West Germany 28,325; France 22,678.
Bismuth including alloys, all forms	158	192	France 91; Netherlands 54; West Germany 26.
Cadmium including alloys, all forms	861	1,037	West Germany 609; France 303.
Chromium:			
Chromite	1,924	50	All to West Germany.
Oxides and trioxides	71	104	Mainly to EEC nations.
Metal including alloys, all forms	4	(2)	
Copper:			
Ore and concentrate including matte	10,276	1,247	All to West Germany.
Metal including alloys, all forms:			
Scrap	r 16,002	18,197	West Germany 9,315; France 2,822; Netherlands 2,678.
Unwrought	309,827	260,974	France 101,206; West Germany 51,819; Netherlands 39,320.
Semimanufactures	r 92,481	107,944	Netherlands 42,868; West Germany 32,910; France 12,548.
Germanium, all forms kilograms	5,800	7,000	Italy 2,800; United States 1,200; West Germany 900.
Gold unworked and partly worked thousand troy ounces	548	499	United Kingdom 309; EEC nations 41.
Iron and steel:			
Ore and concentrate except roasted pyrite thousand tons	17	66	West Germany 47; France 18.
Roasted pyrite do	271	224	All to West Germany.
Metal:			
Scrap do	743	690	Netherlands 259; West Germany 225; France 204.
Pig iron, sponge iron, powder and shot do	85	59	France 45; West Germany 10; Netherlands 3.
Ferroalloys do	64	71	West Germany 28; Italy 18; France 15.
Steel, primary forms do	r 1,365	1,838	France 780; West Germany 455; Italy 201.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	4,894	5,173	West Germany 1,638; United States 1,087; France 778.
Universals, plates and sheets do	3,629	4,152	West Germany 1,324; France 1,275; Netherlands 316.
Hoop and strip do	765	950	West Germany 334; France 224; Netherlands 82.
Rails and accessories do	88	108	Italy 23; Argentina 20; France 10.
Wire do	363	408	United States 113; West Germany 72; Netherlands 47.
Tubes, pipes and fittings do	218	244	Netherlands 64; West Germany 58; France 42.
Castings and forgings, rough do	25	32	West Germany 8; France 6; Netherlands 5.
Lead:			
Ore and concentrate	15	1,322	All to France.
Oxides	7,176	6,137	Netherlands 4,498; France 969; West Germany 578.
Metal including alloys:			
Scrap	5,293	12,072	Italy 3,934; West Germany 3,823; France 3,171.
Unwrought	64,101	53,557	West Germany 14,347; Netherlands 12,276; France 11,631.
Semimanufactures	r 6,784	6,389	Netherlands 1,966; West Germany 1,624; Sweden 766.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969 [1]
METALS—Continued			
Magnesium including alloys, all forms	r 207	255	Netherlands 87; United States 60.
Manganese:			
Ore and concentrate	3,019	11,350	United Kingdom 8,832; West Germany 2,024.
Metal including alloys, all forms	2	7	Mainly to EEC nations.
Mercury ... 76-pound flasks	493	522	West Germany 348.
Nickel:			
Matte, speiss, and similar materials	16	251	West Germany 250.
Metal including alloys:			
Scrap	811	859	West Germany 388; France 162; Netherlands 148.
Unwrought	45	481	West Germany 267; Switzerland 157; France 45.
Semimanufactures	r 209	849	France 334; Switzerland 302; United States 81.
Platinum-group including alloys, all forms thousand troy ounces	26	46	West Germany 27; United States 9; United Kingdom 2.
Selenium, elemental ... kilograms	24,700	20,700	Italy 4,300; France 4,200; Netherlands 3,500.
Silver unworked or partly worked thousand troy ounces	r 17,197	45,102	West Germany 1,786; United Kingdom 1,506; Netherlands 587.
Tellurium and arsenic	14	10	France 6; West Germany 4.
Tin:			
Ore and concentrate ... long tons	233	856	Netherlands 494; Spain 362.
Oxides ... do	r 206	371	West Germany 157; France 92; Netherlands 61.
Metal:			
Scrap ... do	144	123	United Kingdom 30; West Germany 24.
Unwrought ... do	r 4,400	3,883	France 1,247; Netherlands 928; West Germany 755.
Semimanufactures ... do	r 161	42	NA.
Titanium:			
Ore and concentrate	--	147	NA.
Oxides	6,986	5,368	France 3,278; Philippines 650; Switzerland 401.
Tungsten:			
Ore and concentrate	r 32	46	Netherlands 39.
Metal including alloys, all forms	2	3	Mainly to Netherlands.
Zinc:			
Ore and concentrate	r 49,972	55,772	Netherlands 26,412; France 20,760; West Germany 7,008.
Metal including alloys:			
Scrap	8,086	8,339	France 8,134.
Blue powder	r 24,318	27,677	West Germany 10,938; France 4,172; United States 4,033.
Unwrought	151,361	155,511	West Germany 87,405; France 11,970; United States 11,562.
Semimanufactures	16,493	15,535	West Germany 6,476; France 2,087; Sweden 1,109.
Other n.e.s.:			
Ore and concentrate	1,086	496	West Germany 283; United States 54.
Ash and residue of nonferrous metals:			
Lead	6,414	5,514	West Germany 1,514.
Zinc	33,512	43,227	Netherlands 28,431; Sweden 7,692; West Germany 3,523.
Other n.e.s	18,853	11,522	West Germany 6,476; France 2,087; Sweden 1,109.
NONMETALS			
Abrasives, natural	855	389	All to EEC nations.
Asbestos	1,003	230	France 146.
Barite and witherite	63	9	All to EEC nations.
Boron materials:			
Crude natural borates	70	515	Do.
Oxide and acid	17	61	NA.
Cement ... thousand tons	1,371	490	Netherlands 360; France 125.
Chalk	110,169	108,536	Netherlands 82,273; West Germany 6,466; Kuwait 2,855.
Clays and products:			
Crude:			
Kaolin	1,069	1,456	France 515; Switzerland 342; Netherlands 185.
Refractory	5,854	3,898	Netherlands 2,852.
Other (including bentonite)	2,779	2,865	Netherlands 1,972; West Germany 53.
Products:			
Refractory	r 52,850	75,432	France 46,742; Netherlands 11,085; Italy 4,614.
Nonrefractory	r 111,916	138,948	Netherlands 64,045; France 38,393; West Germany 29,763.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969 [1]
NONMETALS—Continued			
Diamond:			
Gem not set or strung thousand carats	4,904	5,479	India 2,384; United States 882; Israel 722.
Industrial do	9,991	9,753	United Kingdom 3,761; United States 1,761; Switzerland 1,275.
Diatomite and other infusorial earths	292	399	EEC nations 376.
Fluorspar	469	37	All to EEC nations.
Fertilizer and fertilizer materials:			
Crude:			
Nitrogenous	391	157	NA.
Phosphatic	18,087	11,999	United Kingdom 2,905; Portugal 2,530; Switzerland 2,148.
Potassic	827	6,927	NA.
Other	12,624	8,276	Netherlands 3,361; West Germany 2,396.
Manufactured:			
Nitrogenous thousand tons	r 821	828	West Germany 240; France 195; mainland China 169.
Phosphatic do	r 1,988	1,948	France 866; West Germany 396; Ireland 156.
Potassic do	r 911	644	United Kingdom 101; Japan 62; Netherlands 58.
Other including mixed do	936	1,140	France 596; West Germany 221; Turkey 53.
Ammonia do	148	222	France 165; West Germany 38; Netherlands 10.
Graphite, natural	33	11	EEC nations 7.
Gypsum and plasters	r 10,811	12,403	Netherlands 11,540.
Lime thousand tons	442	489	Netherlands 360; France 125.
Mica:			
Crude including splittings and waste	73	58	EEC nations 51.
Worked including agglomerated splittings	395	468	United Kingdom 190; West Germany 114; France 25.
Pigments, mineral including processed iron oxides	175	213	West Germany 53; France 49; United Kingdom 45.
Precious and semiprecious stones, except diamond:			
Natural thousand carats	r 76,467	72,701	West Germany 17,438; United Kingdom 3,700.
Manufactured do	77	773	EEC nations 190.
Dust and powder do	1,327	985	Israel 211; France 198; West Germany 171.
Salt	6,556	6,793	France 6,585.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked thousand tons	1,511	1,392	Netherlands 1,373.
Worked:			
Slate do	2	2	West Germany 1.
Paving and flagstone do	1	3	NA.
Building stone do	7	8	Netherlands 3; France 2; West Germany 1.
Dolomite, chiefly refractory grade do	784	874	Netherlands 578; France 159; West Germany 99.
Gravel and crushed rock do	6,336	6,569	France 3,367; Netherlands 2,732; West Germany 465.
Limestone (except dimension) do	853	726	Netherlands 593; France 95; West Germany 38.
Quartz and quartzite do	84	39	West Germany 16; Netherlands 10; France 4.
Sand (excluding metal bearing) do	2,902	3,096	France 913; Italy 589; Netherlands 414.
Sulfur:			
Elemental, all forms	3,993	5,674	Netherlands 587; West Germany 525; Philippines 415.
Sulfuric acid	69,365	93,805	United Kingdom 36,606; France 29,745; West Germany 15,345.
Talc, steatite, and pyrophyllite	11,749	14,345	Sweden 4,420; West Germany 2,320; France 1,952.
Other nonmetals, n.e.s.:			
Slag, dross, and similar wastes from iron and steel manufacturing thousand tons	2,443	2,431	Netherlands 1,230; France 702; West Germany 481.
Slag and ash n.e.s	r 119,447	153,911	Netherlands 127,523.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	134	112	Congo (Kinshasa) 62; EEC nations 44.
Carbon black and gas carbon	r 4,454	4,567	Austria 3,610.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969 [1]
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coal and briquets:			
Anthracite and bituminous thousand tons	1,167	923	France 506; West Germany 384; Netherlands 14.
Briquets of coal do	100	119	France 62; West Germany 41; Austria 8.
Coke and semicoke do	328	382	France 132; West Germany 98; Sweden 58.
Gas, natural and manufactured	55,570	119,703	Spain 34,950; United Kingdom 32,273; Argentina 15,218.
Hydrogen, helium, and rare gases	773	2,337	United Kingdom 1,439; France 428; Netherlands 381.
Peat, including litter	282	300	EEC nations 239.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	1,114	240	West Germany 239.
Refinery products:			
Gasoline do	13,685	19,193	United Kingdom 7,323; West Germany 3,869; Netherlands 2,494.
Kerosine do	4,843	6,409	West Germany 1,576; Netherlands 1,421; United Kingdom 1,395.
Distillate fuel oil do	13,920	24,133	West Germany 10,317; Netherlands 3,287; Sweden 3,063.
Residual fuel oil do	21,945	30,723	Ships' stores 16,250; United States 3,716; United Kingdom 2,463.
Lubricants do	1,449	1,434	Netherlands 501; Switzerland 136; Italy 133.
Mineral jelly and wax do	5	2	NA.
Other do	2,342	2,949	Netherlands 1,279; West Germany 451; United Kingdom 348.
Mineral tar and other coal, petroleum or gas-derived crude chemical	113,357	116,325	West Germany 38,883; Netherlands 24,137; France 20,674.

r Revised. NA Not available.

[1] Source fails to give individual destinations for certain commodities shipped to European Economic Community nations; however, where quantity of goods shipped is available it is listed.

[2] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	11,333	17,379	Guyana 12,984; French Guiana 1,555.
Oxide and hydroxide	12,161	12,966	West Germany 11,300; Netherlands 548; France 502.
Metal including alloys, all forms:			
Scrap	2,120	4,778	France 1,415; Netherlands 919; Hungary 808.
Unwrought	159,424	176,452	France 58,250; United States 34,479; Norway 20,663.
Semimanufactures	r 23,093	28,889	West Germany 14,916; Netherlands 6,760; France 4,078.
Antimony:			
Ore and concentrate	11,106	13,124	Republic of South Africa 4,421; Morocco 1,850; Bolivia 1,737.
Metal including alloys, all forms	23	47	France 43.
Beryllium including alloys, all forms kilograms	200	300	Mainly from European Economic Community (EEC) nations.
Bismuth including alloys, all forms	171	240	Canada 119; West Germany 35; Netherlands 30.
Cadmium including alloys, all forms	635	764	Congo (Kinshasa) 406; Japan 103.
Chromium:			
Chromite	14,215	17,770	Republic of South Africa 16,209.
Oxide and hydroxide	505	568	West Germany 302; France 129.
Metal including alloys, all forms	52	57	United Kingdom 27; France 26.
Cobalt oxides and hydroxides kilograms	300	--	
Copper:			
Ore and concentrate	14,432	12,044	Canada 4,113; Australia 3,240; Cuba 1,839.
Metal including alloys, all forms:			
Scrap	r 87,123	85,168	United States 30,256; France 16,185; Netherlands 15,070.
Unwrought	r 377,746	346,854	Congo (Kinshasa) 245,725; Peru 16,140; Chile 13,712.
Semimanufactures	r 8,445	12,293	West Germany 5,865; Netherlands 2,554; France 1,646.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Germanium including alloys, all forms	62	26	Mainly from EEC nations.
Gold unworked or partly worked thousand troy ounces	1,097	1,480	Switzerland 1,137; United Kingdom 175.
Iron and steel:			
Ore and concentrate except roasted pyrite thousand tons	r 26,337	27,643	France 13,378; Sweden 9,044; Brazil 1,344.
Roasted pyrites do	152	126	France 94; West Germany 26; Spain 6.
Metal:			
Scrap do	283	578	France 275; Netherlands 144; West Germany 127.
Pig iron, sponge iron, powder and shot do	222	241	West Germany 111; East Germany 47; France 25.
Ferroalloys do	123	140	Norway 66; France 55.
Steel, primary forms do	r 646	868	Netherlands 196; France 177; West Germany 124.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	450	529	France 247; West Germany 157; Netherlands 34.
Universals, plates and sheets do	407	486	West Germany 240; France 111; Netherlands 54.
Hoop and strip do	52	55	France 27; West Germany 21.
Rails and accessories do	7	9	France 7; West Germany 2.
Wire do	17	14	West Germany 7; France 3; Netherlands 2.
Tubes, pipes and fittings do	109	124	West Germany 56; Netherlands 30; France 27.
Castings and forgings do	4	10	West Germany 4; France 4.
Lead:			
Ore and concentrate	180,723	130,280	Canada 34,595; Peru 31,392; Ireland 20,548.
Oxides	r 2,636	3,285	Netherlands 2,022; West Germany 589; Mexico 259; France 258.
Metal:			
Scrap	11,903	10,829	Netherlands 4,678; West Germany 2,693; Ghana 403.
Unwrought	15,547	14,915	West Germany 5,542; France 2,894; United Kingdom 2,186.
Semimanufactures	r 870	917	West Germany 548; Netherlands 278.
Magnesium including alloys, all forms:			
Scrap	49	37	All from EEC nations.
Unwrought	r 933	1,140	U.S.S.R. 830; Italy 137; Netherlands 32.
Semimanufactures	83	89	Mainly from United States.
Manganese:			
Ore and concentrate	306,943	362,522	Republic of South Africa 133,384; Congo (Kinshasa) 81,469; India 69,229.
Oxides	1,191	604	Mainly from Netherlands 506.
Metal including alloys, all forms	244	233	Republic of South Africa 108; France 55.
Mercury 76-pound flasks	r 2,698	7,223	Spain 4,351; Yugoslavia 1,450; Netherlands 667.
Molybdenum including alloys, all forms	10	10	Netherlands 4; Austria 3.
Nickel:			
Matte, speiss, etc	34	61	Canada 35; United Kingdom 23.
Metal:			
Scrap	r 1,976	2,185	United States 659; France 510; Netherlands 265.
Unwrought	1,440	1,746	United Kingdom 700; France 239; Norway 231.
Semimanufactures	r 1,161	1,579	United Kingdom 723; West Germany 399; France 204.
Platinum-group metals including alloys, all forms troy ounces	r 35,043	43,476	United Kingdom 19,562; EEC nations 18,817.
Rare-earth including alloys, all forms	--	1,078	France 972.
Selenium kilograms	9,500	6,200	Netherlands 2,700; United States 2,300.
Silver:			
Wastes and sweepings value, thousands	$9,793	$8,985	United States $5,621; Netherlands $2,654.
Metal including alloys, all forms troy ounces	35,163	19,596	Mainly from EEC nations.
Tellurium, elemental, including arsenic	50	37	Sweden 31.
Tin:			
Ore and concentrate long tons	6,407	5,556	Congo (Kinshasa) 4,552; Rwanda 964; Burundi 39.
Oxides do	13	7	West Germany 4.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Tin—Continued			
Metal:			
Scrap long tons	9	19	EEC nations 14.
Unwrought do	2,579	3,333	Congo (Kinshasa) 1,777; Netherlands 918; Malaysia 348.
Semimanufactures do	138	138	Mainly from EEC nations.
Titanium:			
Ore and concentrate	33,149	47,309	Canada 45,544.
Oxides	9,690	10,745	West Germany 5,969; Netherlands 1,836; United Kingdom 1,130.
Metal including alloys, all forms	8	16	Netherlands 5; United Kingdom 5; West Germany 2.
Tungsten:			
Ore and concentrate	108	36	Congo (Kinshasa) 24; United Kingdom 6; Rwanda 6.
Metal including alloys, all forms	r 14	29	Netherlands 14; West Germany 8.
Zinc:			
Ore and concentrate	622,108	558,708	Canada 272,980; Finland 67,288; Congo (Kinshasa) 62,707.
Oxide and peroxide	2,673	3,895	Netherlands 1,420; France 1,126; United States 697.
Metal:			
Scrap	1,100	1,370	West Germany 787; Netherlands 185; France 128.
Blue powder	r 1,133	1,317	West Germany 1,199.
Unwrought	19,971	41,659	Congo (Kinshasa) 18,808; Australia 6,153; North Korea 5,871.
Semimanufactures	r 257	188	Mainly from Netherlands.
Other n.e.s.:			
Nonferrous ore and concentrate	r 10,744	4,244	Morocco 1,850; EEC nations 1,180.
Ash and residue of nonferrous metal	r 179,985	242,446	West Germany 135,098; France 22,361; United States 19,273.
NONMETALS			
Abrasives, natural	r 142,061	165,419	West Germany 162,562.
Asbestos	61,116	64,723	Canada 41,403; Republic of South Africa 11,315; U.S.S.R. 6,237.
Barite and witherite	6,074	6,101	France 3,788; West Germany 2,082.
Boron materials, crude natural borates	17,253	22,226	Netherlands 18,493.
Cement	r 48,829	48,395	West Germany 23,953; Netherlands 9,908; France 7,996.
Chalk	72,065	79,771	France 39,269; Netherlands 38,293.
Clays and products:			
Crude:			
Kaolin	130,781	182,728	United Kingdom 84,056; West Germany 47,210; Netherlands 38,136.
Other n.e.s	r 271,880	306,902	West Germany 166,366; France 54,640; Netherlands 34,317.
Products:			
Refractory	r 96,646	130,581	West Germany 76,597; Austria 17,942; France 15,355.
Nonrefractory	r 182,089	223,426	Netherlands 106,963; West Germany 55,445; Italy 25,552.
Cryolite and chiolite	286	328	Denmark 323.
Diamond:			
Gem unset and unstrung thousand carats	r 10,989	20,608	United Kingdom 14,959; Ireland 1,437; Israel 663.
Industrial do	r 10,583	10,989	United Kingdom 7,896.
Diatomite and other infusorial earths	5,940	4,230	United States 1,500; France 1,062.
Feldspar and fluorspar	r 53,593	67,492	Norway 28,942; France 19,267; Finland 7,705.
Fertilizer and fertilizer materials:			
Crude:			
Nitrogenous	23,104	23,481	All from Chile.
Phosphatic thousand tons	1,805	1,840	Morocco 1,146; United States 327; U.S.S.R. 179.
Potassic	r 59,879	67,199	France 42,772; West Germany 23,944.
Other n.e.s.	22,408	19,300	Netherlands 15,071; France 1,834; Peru 800.
Manufactured:			
Nitrogenous	r 240,430	278,933	France 113,803; West Germany 108,738; Netherlands 26,412.
Phosphatic	r 3,230	19,512	United States 15,702; Netherlands 3,592.
Potassic thousand tons	r 1,266	1,098	France 610; West Germany 236; U.S.S.R. 119.
Other including mixed	r 154,599	164,022	France 88,554; West Germany 41,483; Netherlands 24,582.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Graphite, natural	729	874	France 473; West Germany 122; United Kingdom 107.
Gypsum and plasters	r 446,233	458,723	France 384,959; West Germany 67,951.
Lime	113,586	160,938	France 143,366; West Germany 16,405.
Magnesite	4,601	9,760	Brazil 3,880; Czechoslovakia 1,997; Austria 1,525.
Mica, all forms	r 1,865	3,035	Malagasy Republic 1,445; United Kingdom 556; India 421.
Pigments, mineral including processed iron oxides:			
Natural, crude	563	801	Mainly from EEC nations.
Processed iron oxides	6,158	7,299	West Germany 6,698.
Precious and semiprecious stones, except diamond:			
Natural and manufactured thousand grams	3,476	6,250	EEC nations 2,192; United States 1,441; United Kingdom 1,241.
Dust and powder value, thousands	$2,248	$2,754	Ireland $1,190; United States $925; United Kingdom $193.
Pyrite, gross weight	352,712	393,144	Portugal 208,074; Spain 106,597; U.S.S.R. 44,702.
Salt and brine thousand tons	1,140	1,165	West Germany 576; Netherlands 537; United States 27.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	30,908	52,305	Netherlands 20,648; Sweden 13,146; West Germany 8,435.
Caustic potash	432	447	France 191; West Germany 176.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	128,762	134,387	France 59,866; Italy 20,563; Portugal 15,418.
Worked	37,633	40,458	Portugal 13,352; Italy 12,274; West Germany 6,527.
Dolomite	46,190	21,108	France 9,790; West Germany 7,784.
Gravel and crushed rock thousand tons	r 4,192	5,175	Netherlands 2,862; France 1,037; West Germany 746.
Limestone except dimension	81,623	168,060	France 94,008; United Kingdom 65,978; West Germany 8,067.
Quartz and quartzite	17,365	50,954	West Germany 42,879; Netherlands 3,632; Norway 2,532.
Sand excluding metal bearing thousand tons	7,801	8,993	Netherlands 7,706; France 694; West Germany 577.
Sulfur:			
Elemental	r 288,676	303,798	United States 224,058; France 25,286; Netherlands 19,752.
Sulfur dioxide	6,974	8,549	West Germany 336.
Sulfuric acid	106,177	156,762	West Germany 123,783; Netherlands 24,365; Sweden 6,337.
Talc, steatite, soapstone, and pyrophyllite	29,659	32,912	United States 9,746; Australia 7,386; Austria 5,390.
Other nonmetals, n.e.s.:			
Mineral substances	84,166	87,176	Netherlands 31,480; West Germany 16,091.
Slag, dross, and similar wastes, not metal bearing:			
Slag from iron and steel manufacturing	205,741	216,683	Netherlands 97,891; France 87,295; West Germany 31,488.
Slag and ash, n.e.s	135,867	137,026	United States 136,786.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	4,255	8,549	Trinidad and Tobago 1,340; United States 492.
Carbon black and gas carbon	r 20,622	23,647	West Germany 7,693; Netherlands 7,202; France 5,777.
Coal and briquets:			
Anthracite and bituminous thousand tons	6,737	6,667	West Germany 3,448; United States 1,003; Netherlands 932.
Briquets of anthracite and bituminous do	355	317	Netherlands 276; West Germany 40.
Lignite and lignite briquets do	98	120	West Germany 119.
Coke and semicoke do	4,471	5,239	West Germany 4,317; Netherlands 343; France 302.
Gas, hydrocarbon:			
Natural do	1,254	2,668	Netherlands 2,579; West Germany 70; France 12.
Manufactured	NA	NA	All from France.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS —Continued			
Hydrogen, helium and rare gases	1,588	2,143	France 1,222; West Germany 426; Netherlands 362.
Peat and peat briquets	51,308	60,634	Netherlands 37,093; West Germany 23,103.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	173,139	210,559	Iran 46,320; Libya 45,431; Saudi Arabia 34,811.
Refinery products:			
Gasoline do	518	557	Netherlands 245; Italy 86; U.S.S.R. 71.
Kerosine do	122	56	Netherlands 28; Italy 15; United Kingdom 7.
Distillate fuel oil do	1,491	1,255	Netherlands 582; Italy 256; East Germany 86.
Residual fuel oil do	1,919	1,937	Netherlands 1,002; West Germany 344; France 138.
Lubricants do	222	224	Netherlands 57; United States 48; West Germany 40.
Mineral jelly and wax do	7	9	West Germany 3; France 3; Netherlands 1.
Other [1] do	114	141	United States 81; France 35; Netherlands 16.
Mineral tar	41,829	35,853	Netherlands 27,326; France 4,261; West Germany 4,202.

r Revised. NA Not available.
[1] Includes nonlubricating oil, petroleum coke, pitch coke, petrolatum, and other petroleum wastes.

COMMODITY REVIEW

Metals.—*Nonferrous.*—Important mergers took place in the nonferrous metal industry in 1970. Société Général Métallurgie de Hoboken, the largest producer of nonferrous metals in Europe, absorbed the Usines a Cuivre et à Zinc de Liege. In the middle of 1970 Métallurgie Hoboken acquired Compagnie des Métaux d' Overpelt-Lommel et Corphalie S.A. The important position of the Métallurgie Hoboken-Overpelt group, a subsidiary of the Société Générale de Belgique, is shown by the following combined capacities (in metric tons) of the entity: copper 400,000; zinc, 100,000; lead, 125,000; tin, 6,700; cobalt, 5,000; silver, 1,800; cadmium, 300; sulfuric acid, 240,000. The company is a large producer of many other metals and is reported to offer one of the most complete ranges of metals in Europe. It will have about 7,000 employees and funds of $100 million.

Steel.—Two major steel companies merged in June 1970. Cockerill-Ougrée-Providence and Métallurgique d' Espérance-Longdoz approved a merger that has been under negotiation for over a year. The combined production of the two firms is about one-half of the national total. The gross value of the new company's plant and equipment is about $640 million. The headquarters are at Liege, and the various iron and steel works, wire and rolling mills, mechanical engineering and metal construction departments, shipyards, collieries, and kilns are scattered throughout Belgium and northern France. The combined payroll is about 40,000 employees.

The Cockerill-Ougrée-Providence-Espérance-Longdoz group produced 6,134,120 tons of steel in 1970. Société Sidérurgique Maritime (Sidmar) produced 1,826,000 tons and the Forges de Thy-Marcinelle, Hainaut-Sambre, and Boel companies produced 4,385,000 tons. The large group headed by Cockerill is raising its capacity to 7 million tons per year. The Belgian steel companies are planning large expansion and modernization programs and by 1975 are expected to have invested about $600 million in new plants and equipment. New investment in the steel industry during 1970 was estimated at about $130 million compared with $132 million in 1969 and only $74 million in 1968.

Mineral Fuels.—*Coal.*—The rationalization of the domestic coal industry continued as scheduled, with coal production in 1970 decreasing by about 14 percent to 11,358,000 tons. By 1975 coal production is expected to decrease to about 9 million tons, and the number of collieries will be reduced from 24 now in operation to 15. In 1925 there were about 250 active coal mines in Belgium, and by 1960 only 75 mines were in operation. In the past decade the number of operating mines has been reduced to about one-third.

Of the 7.8 million tons of coking coal consumed by the steel industry, 4.3 tons was from domestic sources, 1.8 came from Germany and 1.7 was from other countries.

Petroleum.—Agreement by the Belgian and Dutch Governments for construction of a crude oil pipeline from Rotterdam to Antwerp has insured the future growth of the refining and chemical industries in Belgium. The pipeline will be operated by the Rotterdam-Antwerpen Pijpleiding (Nederland) N.V. Oil companies participating in the pipeline project are British Petroleum (BP), Esso, Chevron, and Marfina (part of the Petrofina concern). The pipeline, expected to start operations in 1971, will have an initial capacity of 24 million tons of crude oil per year; capacity will later be increased to 40 million tons.[2]

Nuclear Energy.—Nuclear power is expected to supply 10 percent of Belgium's energy requirements in the near future. The Groupement Général du Combustible Nucleaire was formed by the association of Belgonucleaire, the authority in charge of atomic power development, and five member companies of the Société Générale des Minerais. This organization will offer its services and knowledge to prospective producers and users of nuclear power. A plant for the production of nuclear fuel, based on plutonium for fast reactors, was being constructed at Dessel and is expected to begin operating in 1972. Métallurgie et Mécaniques Nucleaires was preparing to supply fuel to the atomic power stations at Doel, Chooz, and Tihange.[3]

LUXEMBOURG

The iron and steel industry continued to be the backbone of Luxembourg's economy. The rate of growth of the Luxembourg economy slowed in 1970 compared with the 1969 expansion. The gross national product increased by only 3.5 percent in 1970 compared with 7.0 percent in 1969. The slowdown was attributed mainly to the decline in international demand for Luxembourg steel during the last 6 months of 1970. The Government efforts towards industrial diversification have resulted in the establishment of nonsteel industries. The 4-percent increase in industrial production from the nonsteel sector more than offset the small decline in steel production and resulted in a 1.5-percent increase in overall industrial production. The only booming sector of the economy was investment, which increased in 1970 by 17.5 percent, a slight increase over the 16-percent increase realized in 1969. The increased investment was attributed to the modernization of the steel industry and the installation and expansion of plants and commercial buildings.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—Steel production accounted for about 50 percent of Luxembourg's industrial production in 1970. The country has two steel producers: Aciéries Réunies de Burbach-Eich-Dudelange S.A. Luxembourg (ARBED), which accounted for about 90 percent of the total production in 1970, and S.A. Minière et Métallurgique de Rodange (MMR), which produced about 10 percent. Luxembourg's per capita steel output of 16 tons per person is the highest in the world. In contrast, per capita output in Belgium is 1.3 tons; in Germany, 0.8 ton; in the United States, 0.6 ton; and in France, 0.4 ton.

ARBED and the Continental Ore Corp. of New York established Continental Alloys S.A., with a ferroalloy plant located in Dommeldange, close to Luxembourg City. The $25 million plant started operations in September 1970. ARBED also announced plans to construct a $10 million steel cord plant near Bettembourg, south of Luxembourg City, in collaboration with another U.S. firm, National Standard Co. of Niles, Mich. This plant is scheduled to go on stream in 1971. Other developments include the construction of a new blooming mill by MMR, which it hopes to have in operation during 1971, and construction by Air Liquide of the world's largest plant for making industrial oxygen to supply Luxembourg's increasing use of oxygen-based steel refining processes.[4]

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[2] U.S. Embassy. The Hague, Netherlands. State Department Dispatch A-148, Apr. 29, 1971, 9 pp.

[3] Mining Annual Review. June 1971, pp. 463–464.

[4] U.S. Embassy. Luxembourg. State Department Dispatch A-105, Dec. 2, 1970, 6 pp.

Table 4.—Luxembourg: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Iron ore and concentrate	6,393	6,311	5,722
Pig iron (including blast furnace ferroalloys)	4,308	4,872	4,814
Steel:			
Crude	4,834	5,521	5,462
Semimanufactures	3,771	4,312	NA
NONMETALS			
Cement, hydraulic	191	207	245
Clays, refractory metric tons	NA	1,638	NA
Gypsum and anhydrite, crude do	r 6,365	9,189	5,062
Fertilizers manufactured, phosphatic:			
Thomas slag, gross weight	730	964	795
Other, phosphorus pentoxide content	110	120	NA
Quartz, quartzite, and glass sand cubic meters	25,000	18,100	15,400
Stone, sand and gravel, n.e.s.:			
Sand:			
Molding	24	18	17
Other industrial	NA	712	614
Stone:			
Building stone:			
Rough cut thousand cubic meters	20	19	8
Facing thousand square meters	e r 50	50	42
Cut stone, crude cubic meters	e 1,000	379	539
Crushed rock do	150	477	248
Gravel	NA	173	NA
Dolomite n.e.s	170	284	325
Limestone n.e.s	28	25	14
Paving blocks thousand pieces	33	37	36
MINERAL FUELS AND RELATED MATERIALS			
Coke, gas plant	10	10	--
Manufactured gas million cubic feet	848	812	NA

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

The Mineral Industry of Bolivia

By V. Anthony Cammarota, Jr.[1]

The contribution of the mineral industry to the gross domestic product (GDP) of Bolivia again showed a decrease, from 12 percent in 1969 to 11 percent in 1970. Both the petroleum and mineral segments' contributions decreased. The mineral industry, however, accounted for 95 percent of the total value of Bolivia's exports.

In a press conference on October 10, President Juan Torres stated that there was no danger of devaluation and that the government would take measures to guarantee economic and monetary stability. He stated that the decree, which recognized the paying of indemnification, would not be abrogated. With regard to future nationalizations, his regime would promulgate a law calling for nationalization of foreign capital that monopolized economic and commercial activities.

A list of Supreme Resolutions (S.R.) and Supreme Decrees (S.D.) passed in 1970 affecting the mining and smelting industries follows:

S.D. Number 09082, February 2, 1970: The first article of this decree changed export taxes on concentrates of wolfram, antimony, and copper. At market prices of \$24, \$5, and \$36[2] per long ton of wolfram, antimony, and copper concentrates, respectively, there is no tax. Article two reduced export taxes on copper concentrates below 30 percent copper content for 2 years starting February 2, 1971. Article three stated that when prices of wolfram, antimony, and copper exceed those limits of Article one, there will be a tax of 38 percent on the difference between the high price and the price at which the mineral pays no export taxes.

S.D. Number 09138, March 10, 1970: States that the Mutun iron and manganese mineral deposit, close to the Brazilian border, may only be mined and concentrated by the State, and ordered Corporación Minera de Bolivia (COMIBOL) to invest \$500,000 to install ore-cleaning equipment and start mining operations.

S.R. Number 152002, March 12, 1970: Authorizes formation of a commission to plan, develop, and promote an iron and steel industry.

S.R. Number 152157, April 6, 1970: The Bolivian Government approved a toll contract with Gulf Chemical and Metallurgical Corp. to smelt 15,000 long tons of tin from COMIBOL.

S.D. Number 09175, April 13, 1970: In most cases allows laborers fired for political union activities since 1965 to return to their jobs.

S.D. Number 09231, May 25, 1970: Grants Shaft Sinkers (Pty) Ltd., a South African company, the contract to sink a new shaft at the Corocoro copper mine.

S.D. Number 09233, May 25, 1970: Approved a \$5 million credit from the Development Corp. of South Africa to COMIBOL to pay Shaft Sinkers for the shaft.

S.R. Number 152875, May 7, 1970: Recognizes that Scurry Rainbow Bolivia Limitada fills all legal requirements to operate in Bolivia in the mining and petroleum industry.

S.D. Number 09359, August 20, 1970: Determines that producers of minerals and ore concentrates in general that are smelted in Bolivia shall pay export taxes to the State through Empresa Nacional de Fundiciones (ENAF) at the time of delivery to ENAF. National smelters are freed from paying export taxes on their metallic exports.

S.D. Number 09360, August 27, 1970: Changes S.D. Number 08916, of September 3, 1969, which permitted ENAF to capital-

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[1] Physical scientist, Division of Nonferrous Metals.

[2] Where necessary, values have been converted from Bolivian dollars (B\$) to U.S. dollars at the rate of B\$11.885 = US\$1.00.

ize itself at $4 million by retaining part of the export taxes. The $4 million is increased to $7.8 million. ENAF is allowed to retain 30 percent of the export taxes from the mineral concentrates which ENAF buys from COMIBOL and 100 percent of the export taxes derived from concentrates that ENAF buys from the Banco Minero de Bolivia (BAMIN) and private mining companies.

S.R. Number 153985, July 21, 1970: ENAF is authorized to acquire 2,000 metric tons of petroleum coke from the United States through the services of the Continental Ore Corp. (The price was reported as $28.50 per ton.)

S.D. Number 09434, November 4, 1970: Approves and ratifies agreements with Hungary on economic, scientific, and technical cooperation.

S.D. Number 09463, November 16, 1970: Reestablished the salaries of COMIBOL's work force and contract prices to what they were in May 1965. This move is estimated to increase COMIBOL's costs about $2.5 million annually.

S.D. Number 09478, November 23, 1970: Modifies Chapter V, Title IV, and Chapter II, Title IX, of the first book of the Mining Code. The change reserves for the State the right to install and own smelters and refineries, but private enterprise may continue its current smelting practice within limits of present installed capacity. There are no important private smelters in Bolivia. In addition, the old version of Article 77 of the Mining Code, which guaranteed small miners equal or better terms for their mineral concentrates compared with those from smelters abroad, has been withdrawn. The combination of this Decree, which enables ENAF to determine the prices it will pay for the ores, and S.D. Number 18950, of October 6, 1969, which gave ENAF the right to choose which producers must deliver their concentrates to the national smelter, places the mining industry in the hands of ENAF.

PRODUCTION

Production of most metals and nonmetals showed little change from the previous year. The notable exceptions were substantial increases in iron ore, 139 percent; silver, 13 percent; and zinc, 77 percent. Gold and sulfur production decreased 39 and 55 percent, respectively, from 1969 levels. The only significant change in mineral fuels was a 40-percent drop in crude oil production.

Table 1.—Bolivia: Approximate production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS [2]			
Aluminum, bauxite and concentrates	---------	---------	19
Antimony:			
Mine output, metal content	[2] 11,117	[2] 13,137	11,766
Metal [3]	47	28	33
Beryllium, beryl concentrate [3]	1	---------	---------
Bismuth:			
Mine output, metal content	611	607	608
Metal	---------	3	8
Cadmium mine output, metal content [4]	NA	35	69
Copper:			
Mine output, metal content	7,131	7,983	8,759
Metal	---------	13	---------
Gold mine output, metal content [5] troy ounces	69,031	r 49,854	30,603
Iron ore	---------	1,765	4,217
Lead:			
Mine output, metal content	21,684	24,703	25,397
Metal including alloys	204	22	8
Manganese ore, gross weight	---------	---------	84
Mercury [3] 76-pound flasks	134	68	12
Silver mine output, metal content thousand troy ounces	5,180	6,013	6,816
Tin:			
Mine output, metal content long tons	28,945	29,415	28,787
Metal including alloys do	---------	47	301
Tungsten mine output, metal content	1,771	1,841	1,845
Zinc mine output, metal content	11,223	26,195	46,483
NONMETALS			
Asbestos	1	---------	NA
Cement thousand tons	71	80	115
Gypsum, crude [3]	1,600	3,613	500
Mica	---------	---------	6
Sulfur, elemental [3]	35,429	36,219	16,313
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural:			
Gross production million cubic feet	32,683	28,409	29,000
Marketable e do	400	400	400
Natural gas liquids:			
Natural gasoline thousand 42-gallon barrels	NA	NA	95
Liquefied petroleum gas do	NA	NA	32
Petroleum:			
Crude oil do	14,974	14,759	8,820
Refinery products:			
Gasoline and naphtha do	1,652	1,846	1,870
Kerosine and jet fuel do	740	808	898
Distillate fuel oil do	624	612	1,583 (Distillate and residual fuel oil combined)
Residual fuel oil do	1,020	958	
Liquefied petroleum gas do	21	27	36
Lubricants do	177 (Lubricants, other, and refinery fuel and losses combined)	51	47
Other do		3	4
Refinery fuel and losses do		128	127
Total do	4,234	4,433	4,565

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

[1] In addition to the commodities listed, salt and a variety of crude nonmetallic 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] Exports by medium and small mines only.

[4] Contained in zinc concentrates produced by COMIBOL for export.

[5] Sum of placer production, COMIBOL production (in ores and concentrates of other metals), and medium mines' exports (in ores and concentrates of other metals).

TRADE

Preliminary figures indicated an export value for minerals of $172 million (f.o.b.) and $9 million for petroleum. This is an increase over 1969 figures of $32 million for the former but a decrease of $16 million for the latter.

For the first year since nationalization of the mines in 1952, the privately owned or operated mines exported more in dollar value than COMIBOL. The greatest value gain in 1970 was in the export of antimony, about $20 million more in 1970 than in 1969. In 1970 there were 1,573 metric tons less of antimony exported compared with 1969. COMIBOL does not mine antimony. The tin portion of the total export market declined to 44 percent. On a weight basis, tin continued to be a major metallic export, although down slightly from 1969.

The relation of mineral trade to total trade for 1968–70 is tabulated as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports (f.o.b.):		
1968	143	150
1969	165	173
1970	181	193
Imports (c.i.f.):		
1968	NA	153
1969	NA	158
1970	NA	e 160

e Estimate. NA Not available.

Table 2.—Bolivia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Antimony:			
In ore and concentrate	11,070	13,149	Mainly to United States.
Metal including alloys, all forms	47	28	Do.
Beryl	1,309	--------	
Bismuth in ore and concentrate	575	669	Peru 517; United States 149.
Copper in ore and concentrate	6,930	8,012	Japan 4,250; United States 2,099.
Gold troy ounces	745	44,072	Mainly to United States.
Iron ore	--------	1,765	All to Argentina.
Lead in ore, concentrate, and metal	22,326	25,252	United States 18,880; Japan 2,314.
Mercury 76-pound flasks	134	67	Mainly to United States.
Silver in ore and concentrate thousand troy ounces	5,180	6,035	United States 3,713; United Kingdom 1,000.
Tin long tons	28,945	29,487	Mainly to United Kingdom.
Tungsten in ore and concentrate	1,811	1,841	Mainly to United States.
Zinc in ore and concentrate	11,785	26,521	Japan 18,291; United States 7,972.
NONMETALS			
Asbestos	1	--------	
Gypsum	1,600	4,613	All to Brazil.
Sulfur, elemental	35,429	36,219	Mainly to Chile.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, crude thousand 42-gallon barrels	10,329	10,068	United States 6,846; Argentina 3,222.

COMMODITY REVIEW

METALS

Antimony.—An official Czechoslovak delegation arrived in Bolivia in late 1970 to determine how the Czechoslovaks might collaborate in the building of a 5,000-metric-ton antimony smelter in Vinto, near Oruro. If the Bolivian Government approves the credit conditions offered by Skoda, the Czechoslovak company, construction of the smelter may begin in 1971. The estimated cost of the smelter is reported to be about $5 million.

Hibino Metals, a Japanese consortium which had signed a letter of intent with Empresa Minera Unificada, S.A. (EMUSA), offered to build and finance an antimony smelter in Tupiza, closer to the larger antimony producers. However, Hibino's proposal agreed to furnish only engineering and technological "know-how," whereas the Czechoslovaks offered technology, machinery, and financing.

A Yugoslav mission representing the Rudarsky Beograd de Zemun-Jugoslavya Co. was to make a feasibility study financed by the Small Miners Association and BAMIN to install an antimony concentrating plant in Tupiza.

Bismuth.—Cerro de Pasco Corp., a subsidiary of Cerro Corp., has signed a contract with COMIBOL for bismuth and copper concentrates. These supplies would be used as supplementary feed for Cerro's Oroya smelter in Peru.

There were no plans for expansion of production during 1970 from the 500 tons of contained bismuth over the past year or so. There have been, however, some developments in its distribution pattern. COMIBOL has reportedly cut the usual tonnage of concentrates it supplies to Cerro and Philipp Brothers Corp., by about 40 percent, so that between them they received 350 tons of bismuth in concentrate. The remaining 150 tons is being refined on a toll basis for COMIBOL by Sidech in Belgium. The bismuth will be marketed directly by COMIBOL under its own brand name.

The new COMIBOL bismuth smelter at Telemayer was under construction during 1970, and should be ready to produce 98 percent bismuth metal by the end of 1971. The $1.1 million facility has a capacity of 400 tons per month of ore, from which about 70 tons per month of bismuth metal will be recovered.

Bismuth production from the important Tasna mine, which is part of the Quechisla group in southern Bolivia, shows signs of decreasing, mainly because of lower ore grade. There has been almost no exploration for new bismuth mines, and no development of new bismuth properties.

Gold.—The dredge of South American Placers, Inc. (SAPI), at Teoponte, sank during a rain squall in January. The dredge was raised in June, but because of guerrilla activities, it did not begin operations until August. As a result of these delays, production by SAPI was only 8,430 troy ounces of gold and 347 troy ounces of silver. Tipuani cooperatives produced 15,265 ounces of gold, and other Sucre cooperatives produced 350 ounces of gold.

Iron Ore.—COMIBOL was scheduled to start mining the Mutun iron deposit, located in Santa Cruz near the Brazilian border, in September 1970. A concentrating plant was shipped from Oruro to the site and assembled. Upon completion of the plant, a road would be constructed from Mutun to Puerto Busch on the Paraguay River. The Minister of Mining and Metallurgy stated that a trial shipment of 60,000 tons of hematite will be shipped to Argentine smelters in San Nicolas, 1,000 miles downriver from Puerto Busch.

Tin.—In September ENAF inaugurated the country's first tin smelter on a trial basis at Vinto. Regular production was scheduled for January 1971. Output may reach 7,500 tons in 1971, with later expansion to twice that capacity. The refined metal produced by electrolysis will be 99.9-percent pure. The $15 million plant, built by West Germany's Klockner-Humboldt-Deutz, took 4 years to build.

ENAF assigned obligatory quotas to four private mines and COMIBOL for supply of tin concentrates. The schedule called for ENAF to receive 9,490 tons of concentrate containing over 40 percent tin, for the first 6 months of operation. Most of the ore would come from COMIBOL mines. The private mines assigned supply quotas were Estalsa, Barrasquira, Totoral, and Cerro Grande. These mines were selected from among the country's tin producers because their quality of concentrate fits ENAF's needs. The amount was fixed arbitrarily, based on each company's output and ENAF's demand. The companies cannot export until they fill the ENAF quota. However, ENAF is supposed to match or improve the best price the companies can get in the world market.

ENAF obtained a loan from Denmark to purchase material and equipment for its smelting operations. A previous Danish loan of $1.3 million was used to pay for Danish tin anodes to be used in the electrolytic refinery of the Vinto smelter.

Bolivia and the Soviet Union signed a tin contract that calls for the sale of 800 tons of tin and another 2,400 tons of tin concentrate during the second half of 1970.

COMIBOL's total costs to place 1 pound of tin in the world market rose from $1.34 per pound in 1969 to $1.46 per pound in 1970. Much of this increased cost can be attributed to a labor force increase of about 1,000 workers. Major financial losers are the San José and Colquiri mines.

COMIBOL announced that Williams Harvey & Co., the United Kingdom smelting subsidiary of Consolidated Tin Smelters, would accommodate 22,000 tons of tin concentrates during 1970, and that excess COMIBOL production would be processed by other companies. COMIBOL signed a contract with Gulf Chemical and Metallurgical Corp. to refine 15,000 tons of Bolivian tin concentrates at the rate of 1,000 tons per month to produce 7,000 tons of fine electrolytic tin at the Texas City, Tex., smelter. The metal will be branded as "Double Circle—COMIBOL Bolivia" and sold by COMIBOL in the United States.

Several expeditions headed by geologists of COMIBOL and the Servicio Geológico de Bolivia are exploring river beds in the eastern part of the Pando Department for alluvial tin deposits similar to those found in Rondônia, Brazil. The only mode of transportation into the region is airplane, and therefore very expensive for the transportation of equipment and supplies.

The Albert Funk Institute of East Germany sold to the University of Tomas Frias and COMIBOL the Lange Bartel process of flotation and volatilization for low-grade tin concentrates. There are reportedly 70 million tons of 0.44 percent tin material in dumps and alluvial and talus deposits in Potosí. The East Germans are proposing the construction of a $20 million flotation and volatilization plant to be amortized in 20 years. No capacity for the plant was given, although 4,000 tons of fine tin in concentrate form is considered possible annual production.

Table 3.—Bolivia: Exports of tin by grades, groups, and companies, 1970
(Kilos of contained tin)

Grade	COMIBOL	Medium mines	BAMIN (medium)	BAMIN (small)	Other	Total
0 to 10	123,164	74,320	---------	17,269	59	214,812
10 to 15	58,864	26,400	6,691	57,203	---------	149,158
15 to 20	1,047,225	445,504	73,407	920,951	88,557	2,575,644
20 to 25	652,375	1,542,879	24,998	524,217	63,997	2,808,466
25 to 30	733,316	678,664	5,762	183,188	---------	1,600,930
30 to 35	531,542	399,939	---------	72,408	---------	1,003,889
35 to 40	1,702,969	904,857	---------	134,828	---------	2,742,654
40 to 45	2,464,127	957,772	---------	313,781	---------	3,735,680
45 to 50	4,954,375	457,787	---------	608,794	---------	6,020,956
50 to 55	1,725,678	429,025	---------	765,683	---------	2,920,386
55 to 60	3,147,518	58,089	---------	172,032	---------	3,377,639
60 to 65	24,054	289,515	---------	18,683	---------	332,252
65 to 70	-----------	49,684	---------	-----------	---------	49,684
70 to 80	-----------	-----------	---------	-----------	5,590	5,590
Over 99	300,214	-----------	---------	-----------	---------	300,214
Total	17,465,421	6,314,435	110,858	3,789,037	158,203	27,837,954

Source: Ministerio de Mineria y Metalurgia.

Table 4.—Bolivia: Exports of tin by groups
(Long tons of contained tin)

Group	1968	1969	1970 p
Tin in concentrates:			
Corporación Minera de Bolivia (COMIBOL)	18,520	18,575	16,653
Medium-size mines	6,674	6,687	6,480
Banco Minero	3,751	4,219	3,728
Smelter products:			
Refined metal and solder	-------	27	301
Volatilization products	-------	267	236
Total	28,945	29,775	27,398

p Preliminary.

Zinc.—Production from the Matilde Mine Corp. continued building to a target figure of 100,000 tons of zinc concentrate and 10,000 tons of lead concentrate annually. Most of the zinc concentrate will be exported to Japan. Toho Zinc Co., Ltd., has contracted to purchase 77,000 tons of zinc concentrate per year. In late 1970, the Bolivian Mining and Metallurgy Ministry formed a committee to review the royalties and taxes paid by Matilde.

The U.S.S.R. is making a final feasibility study on a zinc smelter. A Yugoslav technical mission in 1968 announced that zinc reserves thoroughly justified a zinc smelter.

NONMETALS

Asbestos.—A joint United Nations-Bolivia contract was completed with the consulting firm Surveyor Nenninger and Chenevert, Montreal, Canada, for a feasibility study on asbestos deposits in the Department of Cochabamba. Total cost for the treatment plant is estimated at $775,000. The plant would treat 1,500 tons of asbestos per year, and if the results are favorable, the construction of a 10,000-ton plant would follow.

MINERAL FUELS

Petroleum and Natural Gas.—The petroleum industry showed a 40-percent loss in total petroleum production in 1970 from that of 1969. There was a drop from 14,759,000 barrels in 1969 to 8,820,000 barrels in 1970. Petroleum exports were also drastically reduced in 1970 to 46 percent of those in 1969. There were 10,067,844 barrels exported in 1969, compared with 4,662,004 barrels in 1970. This was the result of Bolivian Gulf Oil Co.'s (BOGOC) nationalization and the lack of markets for Bolivian petroleum. The petroleum price of $2.25 per barrel in 1970 was high compared with that of Venezuela and the Middle East.

GEOPETROLE, the French company contracted by Bolivia to determine its debt to Gulf, finished its investigations and made a report in September 1970, stating that Gulf's net investment was $101,098,961. By Supreme Decree Number 09381, of September 10, 1970, Bolivia accepted GEOPETROLE's estimate. The Decree determined that Bolivia would pay Gulf for the expropriation of Gulf's properties by giving 25 percent of the value of all hydrocarbons exported from the former Gulf fields of Caranda, Colpa, and Rio Grande. However, a tax of 22 percent on the value of these exports will be applied to all the hydrocarbons turned over to Gulf. Instead of $101,098,961, the sum to be received by Gulf will be $78,622,171. In addition, in April 1970 Bolivia recognized its own outstanding debt and that of Yacimientos Petrolíferos Fiscales Bolivianos (YPFB) to Gulf amounting to $11,073,000 for loans and advanced payment on taxes made by Gulf, but stated that it intends to retain $3,671,000 of this to cover unpaid taxes on foreign personnel salaries destined for Social Security payments. However, according to Gulf, the foreign personnel paid Social Security to their own countries by permission and arrangements with past Bolivian Governments.

At yearend, Bolivian negotiations with the World Bank and the Inter-American Development Bank (IDB) to obtain loans to finish the 24-inch gas pipeline to Argentina were far from completed, but it is expected that about mid-1971, the loan papers will be signed for a total of $41,750,000 ($23,250,000 from the World Bank and $18,500,000 from IDB). It is estimated that the gas pipeline will be finished by April or May 1972 if Williams Brothers and the local company, Bartos Construction, start working on the line by July 1971.

YPFB drilled 23 development wells and 10 exploration wells, having a total drilled length of 174,862 feet or 5,299 feet per well. In 1969, YPFG drilled 22 development wells and 19 exploration wells, drilling a total of 255,246 feet or 6,226 feet per well. YPFB developed the La Peña field found by Gulf and hit a petroleum-gas horizon at a depth of 8,842 feet. Wells 5 and 6 in this field were reportedly producing 1,260 and 1,117 barrels per day, respectively, in November 1970. However, all of the original YPFB fields produced less in 1970 than they did in 1969. The former Gulf fields of Colpa and Rio Grande remained closed throughout the year, but Caranda was producing about 13,000 barrels in October 1970.

Petroleum production in former Gulf fields declined from 10,604,069 barrels in 1969 to 5,419,137 in 1970, a loss of 49 percent with respect to the 1969 total. The price which Gulf paid at Arica was $2.25 per barrel. In comparison, petroleum from the Near East or Venezuela was reportedly priced at $1.80 to $2.00 per barrel at a South American port. YPFB's 1970 production also declined from 4,153,031 barrels in 1969 to 3,401,098 in 1970.

The proven reserves for petroleum in former Gulf fields were estimated at 167,200,495 barrels of petroleum condensate on January 1, 1969. If production for 1969 (10,604,069 barrels) and for 1970 (5,419,137 barrels) is subtracted from Gulf's January 1, 1969, estimate, proven petroleum reserves on December 31, 1970, would be 151,177,289 barrels. If current estimates of Colpa's proven petroleum-condensate reserves are correct, instead of the 151,177,289 barrels in the former Gulf fields, there would be only about 113 million barrels. Including the new reserves found in the La Peña field recently, the total would be estimated at 120 million barrels.

Reserves in YPFB fields on January 1 1970, were estimated at 36,407,373 barrels. If 1970 production is subtracted, the reserves would be 33,006,275 barrels. However, there is reason to believe that the Camiri field, credited with having a reserve of about 15,000,000 barrels on January 1, 1970, actually had much less. The fall-off rate in production indicates Camiri may run out of reserves sooner than expected at the present rate of production. Reserves are more likely to be 25,000,000 barrels.

Proven gas reserves on January 1, 1970, in former Gulf fields were 2,588,369,240 thousand cubic feet and have not significantly changed since then because YPFB gas production from these fields was only 209,146,641 thousand cubic feet in 1970.

Crude petroleum processed at refineries in 1970 was 4,565,040 barrels, or 131,732 barrels more than in 1969. This is a 3-percent increase in 1970 over that of 1969. In 1961 there were only 2,260,500 barrels of petroleum processed in YPFB's refineries, and almost the same amount in 1960. Therefore, in the last 10 years the amount of petroleum refined has increased about 10 percent per year. The nationalization of the Bolivian Gulf Oil Co. very likely was the main cause of the reduction of the last 10 years' average annual rate of oil processing in YPFB's refineries. Gulf used a considerable quantity of refined petroleum products which it obtained from YPFB in return for Gulf's crude.

Petroleum exports in 1970 to Argentina through the 6–5/8-inch pipeline from Camiri to Yacuiba and extending to Pocitos in Argentina averaged 9,125 barrels per day. The pipeline has a potential capacity of 12,000 barrels per day if another pump is added.

Petrochemicals.—According to YPFB's management, Stanford Research Institute's and Syracuse University's technical teams have completed the feasibility study on the manufacture and marketing of the following petrochemical products—SBR resin, ABS resins, styrene, acrylonitrile, phenol, acetone, and polystyrene. The same source said that the study for the manfacture of the above products was favorable only if the other Andean Pact countries give Bolivia the monopoly to manufacture and sell these products. The investment necessary to build this industry is estimated at $120 million.

However, YPFB still considers a combined explosive and fertilizer plant more important for Bolivia in the immediate future. The plant would produce 90 metric tons per day (m.t.d.) of ammonia, 150 m.t.d. of nitric acid, and 200 m.t.d. of ammonium nitrate. YPFB needs about $12 million to build the plant, but the source of financing reportedly has not been found.

Table 5.—Bolivia: Crude petroleum by company and field

(Thousand 42-gallon barrels)

Company and field	1969	1970 p
Yacimientos Petrolíferos Fiscales Bolivianos:		
Camiri	1,385	1,076
Tatarenda	699	381
Monteagudo	1,748	1,682
El Toro	112	96
Bermejo	127	123
Camatindi	38	36
El Tigre	20	6
Guayrui	25	-------
San Alberto	-------	1
Total	4,154	3,401
Bolivian Gulf Oil Co.:		
Caranda-Colpa-Rio Grande	10,605	[1] 5,419
Grand total	14,759	8,820

p Preliminary.
[1] Includes La Peña.

Table 6.—Bolivia: Consumption [1] of petroleum refinery products

(Thousand 42-gallon barrels)

Product	1969	1970
Gasoline, aviation [2]	r 110	98
Gasoline, motor	1,633	1,748
Kerosine	705	771
Diesel oil	505	603
Fuel oil	656	651
Lubricants	51	50
LPG	43	35

r Revised.
[1] Figures refer to actual civilian and military consumption through sales to consumer, and including YPFB consumption.
[2] Imports.

The Mineral Industry of Brazil

By Frank E. Noe [1] and Alfred L. Ransome [2]

The Brazilian mineral industry for the fifth consecutive year continued its overall marked upward trend in development and production, which for certain items showed remarkable gains to new record levels. On the basis of preliminary information, it appears that strong advances were established in the output of iron ore, bauxite and aluminum, columbium (in pyrochlore concentrate), chromite, nickel, tungsten, and zinc in the metals group, and cement and magnesite among the nonmetals. More modest gains were recorded for many of the remaining minerals, and what declines were noted generally were insignificant in amount or relatively unimportant as to commodity. The one notable exception was production of petroleum which showed a modest decline. Of significance during 1970 were the continued remarkable growth in iron ore developments which in time may well see iron ore exceed coffee in total export value, and the offshore Continental Shelf petroleum discoveries by Petróleo Brasileira, S.A. (PETROBRÁS) which are indicative of possible commercially important new petroleum reserves in the near future.

Gross national product (GNP) in 1969 (the most recent year for which comparable data are available) was US$32.27 billion—up 10 percent from the $29.30 billion in 1968. Although value data for 1969 mineral production have not been officially released, the total exceeded $600 million, of which iron ore alone accounted for at least one-third, and petroleum nearly one-fourth. Thus, the total value of all minerals represented less than 2 percent of the GNP of which petroleum alone was nearly 0.5 percent. In 1968, the percentages were 1.86 and 0.44, respectively. Sufficient data were not available to develop figures for 1970, but the GNP-mineral industry proportion will probably remain fairly constant.

Governmental attitude toward mineral development not only continued favorable in 1970, but assumed a position of priority in the awareness of the importance of exploration and development in as short a time as possible. Private industry showed an increasing interest in and desire to develop minerals, and capital became more available. Mineral exploration groups in the field, representing several nations in addition to Brazil (principally United States and West Germany, but including Japan, Switzerland, France, England, Australia, and Canada, and probably others), continued to grow in numbers. Petroleum exploration, however, continued to be restricted to PETROBRÁS, except as may be allowed under specific contractural arrangements with and for PETROBRÁS. Not only has the economic and political climate remained stabilized, but the potential for success resulting from exploration efforts is relatively high. Also with the movement toward nationalization and expropriation in the field of minerals and mining in other Latin American countries, Brazil has become an even greater land of mineral opportunity than ever before.

Decree Law 1083, issued in February, revised slightly the mineral sole tax of October 21, 1969.

Decree Law 1096, issued in March, granted to mining companies a fiscal incentive in the form of a 20 percent depletion allowance as an income tax deduction.

In September, the Brazilian Government announced a program of economic development, called "Metas e Bases" which included definite objectives for the mineral industry whereby mineral production would be doubled in value within a 4-year period 1969–73.

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PRODUCTION

In 1970, the Brazilian mineral industry continued to show increases, which in many instances were markedly above 1969. Iron ore, Brazil's most important mineral commodity, increased in output by 22 percent and in exports by 31 percent, again establishing new records. In the aluminum category, bauxite, alumina, and primary metal output all advanced by one-third or better as also did tin and tungsten (scheelite concentrate). The most spectacular gains were noted for pyrochlore which was 53 percent higher than in the previous year, and nickel, chromite ore, and zinc metal, all three of which increased more than 70 percent. In contrast, ferrocolumbium, gold bullion, silver bullion, and white arsenic declined in output but only to a minor degree in each instance. Among the nonmetals, cement, salt, and sulfur all increased in output substantially to continue an established upward trend. Barite and ammonium sulfate declined. Crude oil production and marketable coal output also declined, while carbon black, included in the fuels group because it is a hydrocarbon, again advanced substantially. No oil was produced from processing oil shale.

Production of steel ingots increased 9 percent to a new record output, while rolled steel advanced 8 percent and pig iron 14 percent to also establish new all-time highs.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite, gross weight	313,748	348,000	e 500,000
Alumina	81,011	87,000	118,600
Metal, primary	39,220	43,200	e 57,600
Antimony [2]	102	104	43
Arsenic, white	312	300	298
Beryllium, beryl concentrate, gross weight [3]	2,078	3,596	3,333
Chromium, chromite, gross weight	17,032	15,766	27,617
Columbium and tantalum ore and concentrate, gross weight:			
Columbite [3]	63	69	41
Tantalite [3]	272	203	209
Pyrochlore	4,999	8,663	13,285
Copper:			
Mine output, metal content e	2,700	4,100	4,420
Metal, smelter (blister)	3,493	3,250	e 3,800
Gold [4] ... troy ounces	176,628	176,925	171,331
Iron and steel:			
Iron ore and concentrate ... thousand tons	25,123	e 33,000	e 40,200
Pig iron excluding ferroalloys ... do	3,369	3,717	4,235
Ferroalloys:			
Ferromanganese	35,336	38,107	37,240
Ferrosilicon	15,859	18,891	23,158
Ferrochromium	3,642	2,221	2,001
Ferrocolumbium	1,144	2,128	1,921
Ferronickel	3,898	5,331	11,144
Silicomanganese	6,986	8,276	15,282
Other	210	695	538
Total	67,075	75,649	91,284
Steel excluding castings ... thousand tons	4,453	4,925	5,369
Steel semimanufactures ... do	3,425	3,863	4,186
Lead:			
Mine output, metal content	27,018	27,593	27,578
Metal, primary	16,167	18,720	19,286
Manganese ore and concentrate (marketable), gross weight ... thousand tons	1,680	1,691	1,880
Nickel:			
Mine output, metal content e	1,240	1,700	2,900
Ferroalloy, nickel content	1,076	1,277	2,506
Rare earth, monazite concentrate, gross weight	1,691	1,999	2,308
Silver ... thousand troy ounces	464	360	357
Tin:			
Mine output, metal content ... long tons	r 2,824	2,608	3,263
Metal, primary ... do	r 1,716	2,245	2,982
Titanium:			
Ilmenite concentrate, gross weight	17,881	20,283	20,644

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS—Continued			
Titanium—Continued			
Rutile concentrate, gross weight	114	9	234
Tungsten mine output, metal content	434	868	1,156
Zinc, smelter	3,507	4,897	10,500
Zirconium concentrate, gross weight:			
Zircon	2,312	3,129	3,838
Baddeleyite-caldesite	485	385	229
NONMETALS			
Abrasives, natural n.e.s., corundum and emery	2,110	2,740	2,998
Asbestos [5]	4,360	13,000	16,000
Barite [6]	43,066	44,000	25,600
Cement, hydraulic (including pozzolanic) thousand tons	7,281	7,824	9,002
Diamond: [7] e			
Gem thousand carats	160	160	160
Industrial do	160	160	160
Total	320	320	320
Fertilizer materials:			
Crude, phosphates: [8]			
Apatite	143,893	e 150,000	e 150,000
Phosphate rock	3,430	e 3,000	e 3,000
Manufactured, nitrogenous, gross weight	34,733	33,909	37,583
Fluorspar e	15,000	35,000	35,000
Graphite, all grades	2,260	e 2,250	2,500
Gypsum and anhydrite, crude	216,798	e 220,000	e 220,000
Lime thousand tons	1,514	e 1,600	e 1,600
Lithium minerals [3]	--	1,550	3,651
Magnesite	137,820	180,000	235,000
Mica, all grades [3]	1,668	1,778	2,019
Precious and semiprecious stones, except diamond:			
Agate, rough [3]	571	595	904
Other stones, uncut [3]	236	460	862
Quartz, crystal, all grades [3]	2,400	3,826	5,908
Salt, marine thousand tons	1,248	1,630	1,823
Stone, n.e.s.:			
Dimension stone, marble	40,993	NA	NA
Crushed and broken, dolomite	353,091	NA	NA
Sulfur, elemental, byproduct	6,925	7,250	8,950
Vermiculite	2,471	e 4,240	e 4,240
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	45,000	49,500	67,300
Coal, bituminous (washed) thousand tons	2,364	2,436	2,367
Coke:			
Metallurgical do	1,407	1,507	1,630
Gashouse do	198	173	187
Gas:			
Manufactured, all types million cubic feet	12,718	12,996	14,196
Natural:			
Gross withdrawal do	34,726	44,080	44,602
Marketed production e do	7,000	8,000	8,000
Natural gas liquids thousand 42-gallon barrels	1,031	925	956
Petroleum:			
Crude do	58,785	63,045	59,969
Refinery products:			
Gasoline do	46,842	53,591	60,083
Jet fuel do	2,402	4,420	5,143
Kerosine do	5,335	4,977	4,887
Distillate fuel oil do	35,134	40,026	43,827
Residual fuel oil do	46,601	54,967	54,763
Lubricants do	36	64	45
Other do	6,609	6,820	6,794
Refinery fuel and losses do	6,636	7,556	10,589
Total do	149,595	172,421	186,131

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

[1] In addition to the commodities listed, molybdenite, fluorspar, 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 small quantity of metal contained in antimonial lead.

[3] Exports.

[4] Officially reported and estimated. Much placer gold produced eludes statistical coverage.

[5] Production from Bahia and Goiás, 1968. Asbestos is produced in three other States, but data are not available.

[6] Includes both ore and concentrate.

[7] By far the larger part of Brazil's diamond production is not reported statistically; hence the estimates tabulated are based only on very general market information.

[8] Data for 1968 furnished by the São Paulo Sindicata da Industria de Adubos e Colas.

TRADE

In 1970, the probable value of mineral exports accounted for nearly 10 percent of the total value of all exports. Mineral and metal imports in contrast amounted to 18 percent of the total value of all imports, and of this, crude petroleum alone accounted for nearly one-half. Iron ore exports, valued at $208.6 million, were the highest ever recorded for that commodity and in terms of value ranked second after coffee. In comparison, imports of crude oil alone were valued at $243.3 million. In addition, $67.7 million was expended for certain refined petroleum products such as aviation gasoline, lube oils, and greases.

The following table shows total visible foreign trade compared with trade in mineral commodities for 1967, 1968, and 1969:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1967	183	r 1,654
1968	177	1,881
1969	245	2,311
Imports:		
1967	505	r 1,667
1968	598	2,132
1969	663	2,265

r Revised.

Among the many countries involved in international minerals trade with Brazil, the United States continued to be a principal source of imports (excluding petroleum) and the destination of much of the exports.

Table 2.—Brazil: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite	3,244	2,720	Uruguay 1,500; Argentina 1,220.
Oxide	(1)	156	Mainly to Argentina.
Metal:			
Unwrought	349	160	All to Colombia.
Semimanufactures	17	10	Mainly to Paraguay.
Beryl ore and concentrate	2,078	3,596	Mainly to United States.
Chromium ore and concentrate	55	--	
Columbium and tantalum ore and concentrate:			
Columbite and tantalite	334	272	Mainly to United States.
Pyrochlore	2,861	5,741	United Kingdom 1,700; United States 1,280; Netherlands 1,200.
Copper including alloys	622	358	Mainly to France.
Iron and steel:			
Ore and concentrate ______thousand tons	15,050	21,478	West Germany 6,524; Japan 4,532; France 1,596; United States 1,404.
Metal:			
Scrap	64	173	Netherlands 111; Argentina 40.
Pig iron and similar materials	66,583	49,877	Argentina 34,576; Japan 15,296.
Ferroalloys:			
Ferromanganese	80	150	All to Uruguay.
Ferrosilicon	31	330	Venezuela 250; Uruguay 80.
Ferrochrome	65	390	United Kingdom 200; Argentina 190.
Ferrocolumbium	988	2,086	United States 1,267; Netherlands 340.
Ferronickel	1,531	2,129	Japan 689; Netherlands 416; Argentina 293; United States 225.
Steel:			
Primary forms, ingot	130,786	117,750	Mainly to Argentina.
Semimanufactures	175,913	211,317	Argentina 107,325; United States 28,811; Uruguay 24,323.
Lead ore and concentrate	--	4,000	All to France.
Manganese ore and concentrate	1,123,909	860,619	United States 359,210; Netherlands 128,426; Norway 115,884.
Nickel	--	98	All to West Germany.
Rare earth, ferrocerium ______kilograms	7,000	1,000	All to Argentina.
Tin and alloys unwrought ______long tons	5	413	Mainly to Argentina.
Tungsten:			
Ore and concentrate	670	1,408	Netherlands 750; West Germany 350; Belgium-Luxembourg 155.
Metal including alloys, all forms ______kilograms	80	1,566	Mainly to Sweden.
Zinc ore and concentrate	198	--	
Zirconium and hafnium ore and concentrate	35	10	All to Argentina.
Other:			
Ash and residue containing nonferrous metals	42	302	Mainly to Belgium-Luxembourg.
Metals including alloys, all forms	7	3	Mainly to France.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS			
Abrasives,[2] emery and corundum	500	1,335	Mainly to Argentina.
Asbestos	20	--	
Barite	12,292	18,292	Venezuela 12,292; United States 6,000.
Cement	7,053	1,412	Mainly to Bolivia.
Clays and products:			
Crude n.e.s., kaolin	1,425	825	Mainly to Uruguay.
Products, refractory	981	1,697	Mainly to Paraguay.
Diamond:			
Gem uncut and cut, but unset....carats..	4,340	25,210	United States 20,450; Netherlands 3,120.
Industrial....do....	1,620	21,945	Mainly to United States.
Fertilizer materials manufactured	30	523	Mainly to Paraguay.
Fluorspar	--	10,337	All to United States.
Lime	14	13	All to Paraguay.
Magnesite	4,578	10,945	Argentina 4,730; Belgium-Luxembourg 3,580; France 2,485.
Mica, all forms	1,668	1,779	Norway 800; United States 564; West Germany 190.
Precious and semiprecious stones...kilograms..	442,589	460,258	West Germany 149,671; United States 131,567; Japan 94,556.
Salt	--	1	All to Bolivia.
Stone, sand and gravel, dimension stone:			
Crude and partly worked	9,354	12,185	Italy 6,086; Japan 3,050; United States 1,027.
Worked	r 124	1,390	Mainly to Argentina.
Other	--	67	All to Paraguay.
Talc, steatite, soapstone, and pyrophyllite	369	726	Mainly to Colombia.
Other nonmetals, n.e.s.:			
Agate, rough....kilograms..	571,454	595,077	Japan 269,626; United States 132,349; West Germany 93,513.
Lithium minerals:			
Spodumene	--	50	All to United Kingdom.
Other	--	1,500	All to Japan.
Quartz crystal:			
Electronic and optical grade	72	75	Japan 19; United States 17; United Kingdom 13.
Other	3,526	3,751	West Germany 1,200; Japan 985; France 472; United Kingdom 426.
Slag not metal bearing	15	295	Netherlands 145; Argentina 140.
Other [3]	22	10	All to Uruguay.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	561	1,101	Uruguay 823; Chile 222.
Petroleum refinery products:			
Gasoline.....thousand 42-gallon barrels..	117	--	
Kerosine....do....	64	785	Trinidad and Tobago 648; India 109.
Gas oil, diesel oil....do....	--	219	Netherlands Antilles 119; Argentina 100.
Lubricants....do....	1	(1)	Mainly to Uruguay.
Other	3	1,633	Mainly to Argentina.

r Revised.
[1] Less than ½ unit.
[2] Excludes diamond and rough agate.
[3] Includes material not identified by commodity in source and commodities not listed separately in table.

Source: Ministério da Fazenda, Secretaria da Receita Federal, Centro de Informações Econômico-Fiscais, Comércio Exterior do Brasil. V. II, 1968 and 1969.

Table 3.—Brazil: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Oxide (alumina)	720	1,084	West Germany 588; United States 488.
Metal:			
Unwrought	31,505	49,271	Canada 15,822; United States 15,619; Norway 9,503; France 3,628.
Semimanufactures	1,337	4,929	France 1,276; United States 1,121; Belgium-Luxembourg 428; Switzerland 388.
Antimony:			
Ore and concentrate	231	185	Peru 151; Colombia 29.
Metal including alloys, all forms	318	259	Czechoslovakia 90; Belgium-Luxembourg 48; Denmark 38; United Kingdom 28.
Arsenic, trioxide and regulus	545	279	Sweden 168; France 50; West Germany 50.
Bismuth including alloys, all forms..kilograms	19,632	11,508	Mainly from Mexico.
Cadmium including alloys, all forms....do	62,992	68,644	Mexico 47,810; Peru 9,995.
Chromium:			
Chromite	7,181	7,324	Philippines 6,000; United States 1,116.
Metal including alloys, all forms	15	12	Mainly from Japan.
Cobalt:			
Oxide and hydroxide	55	59	United Kingdom 31; Belgium-Luxembourg 26.
Metal including alloys, all forms	111	102	Mainly from Belgium-Luxembourg.
Columbium and tantalum, all forms, tantalum	(1)	--	
Copper:			
Copper sulfate	2,408	2,236	Chile 1,162; Peru 835.
Metal:			
Scrap	386	306	Mainly from United States.
Unwrought:			
Refined unalloyed	49,683	47,082	United States 20,827; Chile 10,803; Zambia 8,287; West Germany 2,694.
Alloys	5	10	United Kingdom 7; United States 2.
Semimanufactures	698	911	West Germany 322; United States 292; United Kingdom 137.
Gold unworked or partly worked.troy ounces	81,856	39,148	United Kingdom 16,156; Canada 12,378; Switzerland 10,255.
Iron and steel:			
Ore and concentrate	5	7	Switzerland 5; United States 2.
Scrap	90	47	All from United States.
Sponge iron, powder and shot	1,358	1,837	United States 1,291; Japan 337.
Ferroalloys	2,457	3,485	Republic of South Africa 2,080; United States 786.
Semimanufactures	246,527	387,340	Japan 132,306; West Germany 107,806; Republic of South Africa 52,600.
Lead:			
Oxides	1,116	935	Mexico 824; Belgium-Luxembourg 50.
Metal including alloys, all forms	11,763	12,624	Mexico 7,598; West Germany 2,000; Peru 1,675.
Magnesium including alloys, all forms	3,069	5,217	United States 2,879; Norway 2,333.
Manganese:			
Ore and concentrate	297	3,421	Gabon 2,200; United States 811.
Oxide	747	803	Japan 739; Netherlands 24; France 20.
Metal	56	223	France 105; Japan 59; Republic of South Africa 30.
Mercury.................76-pound flasks	2,357	1,683	Mainly from Mexico.
Molybdenum:			
Ore and concentrate	83	205	Canada 134; United States 70.
Metal including alloys, all forms	5	11	United States 5; Netherlands 4.
Nickel:			
Scrap	1	--	
Unwrought	583	320	Canada 140; United States 80; West Germany 34.
Semimanufactures	660	687	United States 248; West Germany 143; United Kingdom 102; France 91.
Platinum group including alloys, all forms:			
Platinum [2]...............troy ounces	r 1,166	3,059	West Germany 1,878; United States 652.
Other..........................do	r 5,418	3,954	West Germany 2,608; Italy 808.
Radium.....................milligrams	290	100	All from West Germany.
Rare earth.....................grams	282	115	All from United States.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Selenium, elemental kilograms	7,545	6,406	Canada 4,800; United States 1,605.
Silicon	861	1,276	Norway 640; France 476.
Silver including alloys, all forms troy ounces	1,003,488	1,199,800	West Germany 400,823; United States 348,385; Peru 285,305.
Sodium kilograms	11,266	3,163	United States 2,282; West Germany 820.
Tellurium, elemental do	92	2	United Kingdom 1; United States 1.
Tin:			
Ore and concentrate long tons	30	384	Mainly from Bolivia.
Oxides do	r 57	63	United Kingdom 38; West Germany 25.
Metal including alloys, all forms do	11	8	United States 5; United Kingdom 1.
Titanium:			
Ore and concentrate, rutile	805	1,192	All from Australia.
Oxides	15,307	16,212	United Kingdom 7,867; West Germany 2,716; Finland 1,793; France 1,122.
Tungsten including alloys, all forms kilograms	5,375	10,738	United States 6,556; Netherlands 1,806.
Uranium and thorium, isotopes and compounds value	$107,522	$961,657	United States $561,484; Belgium-Luxembourg $248,984; Canada $101,756.
Zinc:			
Oxide	88	100	West Germany 51; United States 42.
Metal:			
Unwrought	43,085	55,677	Mexico 17,721; Peru 12,138; Canada 10,358; Republic of the Congo 3,425.
Semimanufactures	37	47	Belgium-Luxembourg 21; West Germany 16.
Zirconium and hafnium ore and concentrate	1,455	4,639	Mainly from Australia.
Other [3]	62	252	United States 201; Panama 45.
NONMETALS			
Abrasives, natural n.e.s.:			
Pumice, emery, tripoli, etc	937	1,047	Mainly from United States.
Grinding flints	14	104	France 84; West Germany 20.
Asbestos	27,586	20,703	Canada 16,030; Republic of South Africa 2,167.
Barite	84	25	All from United States.
Boron materials:			
Crude, natural borates	2,710	2,679	Mainly from United States.
Oxide and acid	1,422	1,385	United States 1,115; Argentina 172.
Bromine kilograms	253	209	Mainly from West Germany.
Cement	584,562	609,359	U.S.S.R. 108,426; Uruguay 83,646; Colombia 59,530; Mexico 58,320; Romania 55,423; Venezuela 48,043.
Chalk, natural	2,200	2,859	France 1,579; Belgium-Luxembourg 700.
Clays and products:			
Crude n.e.s.:			
Bentonite	7,933	9,837	United States 8,177; Argentina 1,660.
Fire	65	77	United States 50; West Germany 27.
Kaolin	1,751	2,364	United States 1,132; United Kingdom 878; Belgium-Luxembourg 350.
Other	968	654	Mainly from United States.
Products, refractory	2,913	12,679	United States 5,920; France 2,345.
Cryolite, natural	1,389	1,160	Mainly from Denmark.
Diamond, industrial carats	5,000	8,810	United Kingdom 3,900; United States 3,760.
Diatomite and other infusorial earths	684	988	United States 778; West Germany 186.
Fertilizer materials:			
Crude:			
Nitrogenous, nitrates, natural	r 25,346	34,843	All from Chile.
Phosphatic, phosphate rock	329,808	310,120	Mainly from United States.
Manufactured:			
Nitrogenous	482,290	528,949	West Germany 201,845; United States 81,147; Netherlands 79,512; United Kingdom 52,321; Belgium-Luxembourg 30,818.
Phosphatic:			
Thomas slag	12,189	8,457	West Germany 5,481; Belgium-Luxembourg 2,976.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials—Continued			
Manufactured—Continued			
Phosphatic—Continued			
Other	231,600	260,521	Mainly from United States.
Potassic	307,397	332,890	United States 116,967; Israel 61,690; West Germany 61,443; Canada 36,850.
Other including mixed	r 7,292	19,277	Mainly from Chile.
Graphite, natural	157	113	West Germany 61; Malagasy 20.
Gypsum and plasters	1,620	3,122	Mainly from Bolivia.
Iodine kilograms	21,605	27,104	Chile 15,700; Argentina 4,800; Belgium-Luxembourg 2,963.
Mica:			
Crude including splittings and waste do	29,577	9,826	All from United States.
Worked do	9,062	7,407	Switzerland 4,394; United States 1,658.
Phosphorus, elemental	98	94	United Kingdom 54; Japan 16; Sweden 11.
Pigments, mineral including processed iron oxides	r 3,607	2,327	Czechoslovakia 703; West Germany 664; Netherlands 512.
Precious and semiprecious stones, except diamond grams	231,973	176,371	West Germany 78,862; Switzerland 72,254.
Pyrite, gross weight	7,611	1,520	Mainly from Spain.
Salt	651	6	West Germany 4; United Kingdom 1.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	193,223	105,065	United States 27,562; West Germany 22,727; France 17,339; United Kingdom 16,172.
Caustic potash	859	1,053	United States 352; Italy 247; West Germany 208.
Soda ash	4,021	281	West Germany 200; France 60.
Sodium, sulfate	25,800	26,023	Mexico 18,273; Chile 5,454.
Stone, sand and gravel:			
Dimension stone, marble	933	404	Mainly from Italy.
Dolomite	533	1,023	Italy 969; Argentina 50.
Quartz and quartzite	1	66	Mainly from United States.
Sand	185	513	United States 287; Bolivia 225.
Sulfur, elemental, all forms	238,493	218,086	United States 144,467; Poland 32,416.
Talc, soapstone, and pyrophyllite	104	1	Mainly from United States.
Other [3]	--	35	United States 24; West Germany 11.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	551	549	Mainly from United States.
Carbon black	5,226	4,657	United States 1,616; Colombia 1,030; West Germany 641; Argentina 605.
Coal including briquets, all grades	1,408,279	1,921,382	Mainly from United States.
Coke and semicoke	62,531	88,175	West Germany 45,850; United States 30,406.
Gas, hydrocarbon, natural gas liquids (LPG) thousand 42-gallon barrels	4,756	4,889	Venezuela 3,875; United States 560; Saudi Arabia 268.
Petroleum:			
Crude do	93,312	98,884	Iraq 22,961; Saudi Arabia 18,687; Venezuela 16,141; Nigeria 12,213.
Refinery products:			
Gasoline do	5,625	2,578	Netherlands Antilles 1,300; U.S.S.R. 475; United States 406.
Kerosine do	1,570	101	Mainly from Netherlands Antilles.
Residual fuel oil do	3,260	--	
Lubricants do	2,439	1,929	Mainly from United States.
Mineral jelly and wax	30,444	19,276	United States 7,501; Japan 3,321; East Germany 3,269; Romania 2,428.
Other:			
Petroleum coke	30,205	25,476	Mainly from United States.
Bitumen and other residues	1,414	139	United States 58; Japan 52.
Mineral tar and other hydrocarbon based chemicals	256,563	965,513	Saudi Arabia 313,588; Trinidad and Tobago 268,779; Bahrain 148,804.

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.
Source: Ministério da Fazenda, Secretaria da Receita Federal, Centro de Informações Econômico-Fiscais, Comércio Exterior do Brasil. V. I, 1968 and 1969.

COMMODITY REVIEW

METALS

Aluminum.—Interest in the presence of bauxite in the Amazon River region continued to grow during the year, and a number of well-known mining and mineral development companies had scouts in the area. Mineração Rio do Norte, S.A., a subsidiary of Alcan Aluminum, Ltd. (ALCAN), reported that development work at its bauxite property near the Trombetas River northwest of Obidos, Pará, continued throughout the year. Port facilities were under construction, and the first shipment of washed and dried bauxite for export was scheduled for 1974. Beneficiation will be limited to crushing, washing, and drying in a rotary furnace. Ship loading will begin at a 3,000-metric-ton-per-hour rate and will eventually be increased to 5,000 tons per hour. During 1970, three major firms mined one-half million metric tons of bauxite in the Ouro Prêto and Poços de Caldas districts for a production of an estimated 119,000 tons of alumina. A small quantity of bauxite was exported to Argentina and Uruguay.

Alumínio Minas Gerais, S.A. (ALUMINAS), at Saramenha, near Ouro Prêto, with a reported output of 25,129 metric tons for the year, maintained its position as the number one producer of aluminum in Brazil. The number of pots in operation at yearend included 82–30.0 KA and 134–60.0 KA. The company produced 50,885 tons of alumina for use in its reduction plant. ALUMINAS continued construction of a new aluminum metal plant at Aratú, Bahia, but some delays were encountered so that startup is now scheduled for yearend 1971.

Cia. Brasileira de Alumínio (CBA), Sorocaba, São Paulo, reportedly produced 23,118 tons of metal during the year, a total substantially above 1969 but still below plant capacity. Cia. Mineira de Alumínio (ALCOMINAS) started production at its new 25,000-ton-per-year plant at Poços de Caldas, Minas Gerais, in July, and for the first 6 months of operation reported metal output totaling 9,342 tons. It appears probable that the three companies operating four plants will have a combined capacity by the end of 1971 approaching 90,000 metric tons per year and that the combined production rate will approach this level.

Columbium-Tantalum.—Brazil again maintained its position as the world's major producer of columbium with an output of 13,285 tons of a pyrochlore concentrate averaging 59 percent Cb_2O_5. All production came from the mine-mill of the Cia. Brasileira de Metalurgia e Mineração (CBMM) at Araxá, Minas Gerais. Ferrocolumbium also was produced at the operation using a batch thermite process. The company's flotation plant was expanded during the year by the addition of a new Marcy ball mill and complementary magnetic separators, pulp distributors, and flotation cells, which brought capacity to a rated level of 25 million pounds of Cb_2O_5 per year. The ferroplant also has been expanded by the addition of four batch crucibles to a total of eight.

The pyrochlore at Araxá occurs in a series of decomposed intrusive alkaline rocks (carbonatites). A number of similar volcanic "chimneys" occur in Brazil, but the one at Araxá currently is by far the most important insofar as pyrochlore mineralization is concerned. Considerable interest has been shown in other localities, however, wherein the presence of pyrochlore is indicated. One such at Catalão, Goiás, appears to be promising, but as yet no active development has taken place.

Columbium and tantalum in columbite-tantalite and microlite continued to be produced in limited quantities from pegmatite operations located principally in Minas Gerais. As all output is exported, an official record of such shipments is the best indicator of mine output. In 1969, columbite totaling 69 metric tons and tantalite totaling 203 tons were exported, mainly to the United States. During 1970, comparable figures were 41 and 209 tons, respectively. The major portion of these totals came from the Jazida de Nazareno of the Cia. de Estanho de São João del Rei in Minas Gerais. Production is mainly in the form of microlite.

Copper.—Brazil is deficient in copper, and 50,000 tons or more of refined unfinished copper is imported annually to make up the deficit from the relatively small amount produced domestically. The Cia. Brasileira do Cobre is the only copper-producing company in Brazil and operates the Mina de Camaquã in Rio Grande do Sul. No official statistics on production are released by the company. As the result of an intensive program of exploration drilling and sampling at the Camaquã property, a reported 6 million tons of 1.4 percent copper ore has been developed. Toward the end of the year, a new concentrator was being completed which would raise the total ore milling capacity from 30,000 to 80,000 tons per month.

Caraiba Metais, S.A., a Pignatari-group firm, had its Bahian copper project—involving an open pit mine, flotation mill, smelter, and electrolytic refinery at Jaguari, Bahia—approved by the Superintendencia do Desenvolvimento do Nordeste (SUDENE) in September for a total planned investment of Cr$468 million. Initial mine production is to be at an 8,000-ton-per-day rate with a projected output of refined copper set at 35,000 tons per year by 1973. Water for the operation will have to be pumped 65 miles from the San Francisco River.

Gold.—The bucketline dredge which had been operating on the Rio das Velhas was dismantled at yearend and moved to the Jequitinhonha River for the purpose of mining for diamonds. One large lode mine and two dragline-floating washing plants produced most of the statistically reported gold. Mineração Morro Velho, S.A., reported production from its mines near Belo Horizonte of 5,329 kilograms of gold, 899 kilos of silver, and 298 tons of white arsenic from the 505,000 tons of ore mined. The Companhia Mina da Passagem continued to operate two dragline-floating washing plants on the Rio do Carmo and Rio Canela and recovered 199 kilos of gold.

Iron Ore.—Another record year was established for Brazilian iron ore with a substantial gain of 22 percent in production and 31 percent in exports. The Companhia Vale do Rio Doce (CVRD) continued to be the largest iron ore mining and exporting company by a wide margin. This firm, mainly Government-owned, accounted for 78 percent of the total iron ore exports. In addition to its own ore, the CVRD shipped ore for the account of S.A. Mineração Trindade (SAMITRI) and FERTECO, S.A., Administração e Fomento Industrial, all through the port of Tubarão. The CVRD also made domestic sales of iron ore of 1.16 million tons, again almost entirely to Usinas Siderúrgicas de Minas Gerais (USIMINAS). Following a period of adjustment and problem solving at the new 2-million-ton-per-year pellet plant, production quickly reached the designed capacity, and by the end of the year, 750,000 tons of pellets had been exported. In July a contract was signed for the supplying of necessary material and equipment for a second pelletizing unit with a 3-million-ton-per-year capacity to be ready at the end of 1972.

Primary projects of CVRD during the year included the start of the installation of a concentrator for itabirite with an annual capacity for treating 20 million tons, the development of an integrated system of communications and automatic train control and double tracking of the present narrow gauge railroad, and expansion of the Tubarão port facilities. For the concentrator at Itabira, a total of 28 110-ton-per-hour Jones wet magnetic separators either were delivered during the year or were on order for delivery in 1971. The railroad integrated control system was ordered from Japan and will be in operation at the end of 1972. At Tubarão, a second car-dumper and a new ship-loader were installed by the end of the year and work was begun in expanding the port to receive ore carriers of up to 250,000 tons. The overall expansion schedule of CVRD envisions by 1976 an annual production capacity of 48 million tons of ore at the mines, transport of 70 million tons over the railroad, and handling of 78 million tons at Tubarão including 8 million tons of pellets.

SAMITRI and the Cia. Siderúrgica Nacional (CSN) were the next in importance as iron ore producers. SAMITRI reported a total of 3.37 million tons produced during the year including 270,000 tons from the newly developed Alegria mine. The CSN reported production of nearly 2 million tons of iron ore of which 1.63 million was consumed at the company's Volta Redonda steel mill.

Iron ore is exported from Brazil at only two points—the CVRD facility at Tubarão, Espírito Santo, and the port of Rio de Janeiro, which in 1970 handled 4 million metric tons from shippers in the Paraopeba Valley. The two largest exporters through Rio were Minerações Brasileiras (MBR) and Philip Brothers.

Amazônia Mineração, S.A. (CVRD and Cia. Meridional de Mineração, a United States Steel subsidiary) continued successfully throughout the year its program of exploration and development of iron ore deposits in the Serra dos Carajas, Pará. By the end of the year, a proved multimillion-ton reserve had been developed with much more indicated. The general grade of the hematite is 68 percent Fe, and as has been usual in Brazilian deposits of iron ore, a large proportion will be fine material. A feasibility study involving the problem of transportation was begun.

The merger plan whereby Cia. Mineração Novalimense (Hanna Mining Co. interest) would be absorbed into the Antunes group interest (MBR) on a 49 to 51 percent basis still was not completed by the end of 1970 pending final financing discussions. The project will mine and export iron ore at an initial rate of 10 million tons annually beginning in 1973 from the Aguas Claras mine near Belo Horizonte, Minas Gerais, over the Central Railroad to a new ore-loading terminal to be constructed on Sepetiba Bay near Rio de Janeiro. Ships of up to 250,000 tons will be serviced. Initial financing for the mine, railroad, and port will total US$200 million. The Bechtel Corp. of San Francisco is in charge of engineering supervision for the project.

Iron and Steel.—Production of steel ingots broke the previous year record of 4.9 million tons by 9 percent. Rolled steel advanced 8 percent and pig iron 14 percent above 1969 totals to also establish new all-time highs. The Cia. Siderurgica Nacional (CSN) retained its position as the dominant Brazilian steel producer and once again accounted for nearly one-third of the total ingot steel produced. Complete data on foreign trade in steel products were not available at time of report preparation, but preliminary data indicate that exports increased in 1970. However, during the same period, imports of steel needed to supplement domestic production in certain categories showed evidence of a substantial gain compared with 1969 figures. At yearend, the National Council of Iron and Steel was studying a plan to quadruple domestic steel output to 20 million tons of steel ingots per year by 1980 and thereby establish a high enough level of output to supply internal demand and an increasing export market.

Manganese.—Although production stayed about the same as in 1969, exports almost doubled to reach 1.6 million tons. Indústria e Comércio de Minérios, S.A. (ICOMI), continued to be the largest producer and exporter by a wide margin, accounting for 81 percent of the total exports destined for 12 countries, the primary recipient being the United States followed by the Netherlands, Norway, and Canada. Construction continued on the manganese pelletizing plant of ICOMI at Serra do Navio, Amapá, with completion scheduled for the end of 1971 or early in 1972.

Nickel.—Several groups representing private firms continued their investigations in 1970 of the technical and economic feasibility of developing known areas of garnierite-type mineralized zones. One of particular interest was the Barro Alto area in Goiás. A German firm was reportedly continuing extensive exploration there, but no active development had taken place by yearend. Morro do Niquel, S.A., continued to be the largest producer in Brazil. The company has planned no additional expansion of its Pratápolis, Minas Gerais, operation because of the limited ore available at this location. The company has undeveloped reserves in the Niquelândia area and is preparing a feasibility study for a 10,000-ton-per-year (contained nickel and ferronickel) $45 million plant. The advancement of the entire Niquelândia project depends on the obtaining of substantial Brazilian share participation as well as foreign capital. The company mined better than 180,000 tons of ore averaging 1.5 percent nickel in 1970. Cia. de Nickel do Brasil with mine and plant at Liberdade, Minas Gerais, during the year produced a reported 286 tons of ferronickel from 5,800 tons of ore averaging 1.8 percent nickel. Brazilian production of nickel, all as ferronickel, is much larger than needed to supply domestic demand, and the greatest proportion is exported. Such exports in 1969 totaled 2,129 tons of which about one-third went to Japan, and in 1970, 7,400 tons of ferronickel was exported of which 51 percent was shipped to Japan.

Tin.—Tin production in 1970 totaled an estimated 5,020 tons of cassiterite concentrates and 2,982 tons of refined tin. The concentrates came primarily from the Rondônia tin district. Decree Law 1101, March 30, 1970, ordered the end of all "garimpeiro" production activity by March 1971 to make way for more efficient mechanical operation by organized mining companies. Four major operators in the Rondônia area were the W.R. Grace & Cia. - Cia. Estanífera do Brasil (CESBRA) group at the Santa Barbara mine, Cia. Industrial Fluminense at Ferusa, chiefly a Canadian-financed group at Massangana, and the Cia. Cimento Portland Itaú - National Lead Co. combination (organized in March 1970). The Companhia Industrial Amazonense (CIA), a combination of CESBRA, Companhia Industrial Fluminense, and Best Metais e Soldas, S.A., produced a major share of the total Brazilian metallic tin output from its new plant at Manaus which started up in 1969. Production at this facility did not reach its capacity level of 300 tons per month.

Titanium.—Titânio do Brasil, S.A. (TIBRAS), continued construction of its titanium dioxide and sulfuric acid plant near Salvador, Bahia. Initial production at a rate of 22,000 tons of TiO_2 annually, using the sulfate process, was scheduled to begin in 1971. Ilmenite imported from Australia is to be used at the plant. Currently there is only one plant producing titanium dioxide in Brazil, Companhia Química Industrial "CIL", S.A., in São Paulo. What may be a major deposit of titanium at Tapira, near Araxá, is being explored. This volcanic chimney has been known for many years as an interesting but not necessarily commercial occurrence of pyrochlore. Reportedly the TiO_2 is found with the pyrochlore as perovskite or anatase.

Tungsten.—Scheelite concentrate averaging better than 70 percent WO_3 was produced at a rate which resulted in a total output 33 percent higher than in 1969. All activity was centered in the Northeast (Currais Novos-Lages areas in Rio Grande do Norte and Paraiba). The Brejui mine continued to be the largest single operation in the region, producing 559 tons of 73 percent WO_3 concentrates from 117,563 tons of ore. Output from other properties in the area has been estimated to total 1,500 tons of 70 percent WO_3 concentrate (as based on the volume of purchases by exporters) and represents the output by several hundred "garimpeiros" in addition to the production of three other larger mines that were active during the year. The Barra Verde mine at Currais Novos, operated by Mineração Acauã, S.A., inaugurated a concentrator during the year.

Uranium.—A small quantity of uranium ore was produced by the Comissão Nacional de Energia Nuclear (CNEN) during the year from its experimental Agostinho mine near Poços de Caldas, Minas Gerais. There is no commercial output of uranium in Brazil nor is there any facility for processing ore to produce "yellow cake" or uranium. The CNEN has reported continued success in its program of exploration in the Agostinho area and has indicated that additional veins of the Agostinho type have been discovered that are of the same or even higher grade. The measured reserve of ore in this area, averaging 0.2 percent U_3O_8 associated with molybdenum, has been reported by the CNEN to total 1,000 metric tons of contained U_3O_8, but this may be increased by the end of 1971. The CNEN reported that plans are proceeding for the construction of a mill to produce 200 tons of "yellow cake" annually from the Agostinho ore. CNEN has contracted for exploratory drilling at several localities in Brazil. At Encruzilhada do Sul, Rio Grande do Sul, exploratory drilling has resulted in finding localized areas of radioactivity that appear highly indicative of uranium mineralization, although not in commercial quantities.

Zinc.—Cia. Mercantil e Industrial Ingá operated its electrolytic zinc plant on the Ilha da Madeira on Sepetiba Bay, using silicate ore from Vazante, Minas Gerais. Following a period of several years of experimentation and difficulties in treating the zinc silicate plant feed, the process was successfully modified, and for the first time, the plant produced 99.99 percent zinc at a rate of 20 metric tons per day. In addition, the plant produced zinc powder and zinc oxide. The mine run ore reportedly averages 7 percent zinc and is upgraded by gravity methods at the mine to a 30 percent zinc concentrate which is trucked 1,180 kilometers to the plant. The company plans to expand capacity to a 30-ton-per-day rate by the end of 1971 and reach a projected 100-ton-per-day rate by the end of 1972. In order to insure an adequate raw materials supply, zinc concentrates will be imported, reportedly from Peru. Cadmium is being recovered electrolytically as a byproduct.

A second Brazilian zinc plant, also using an electrolytic recovery process, is located at Três Marias, Minas Gerais. This facility, recently constructed by the Companhia Mineira de Metais, produced zinc in 1970, also from Vazante silicate ore. Reportedly the plant was encountering problems and fell far short of its 11,000-ton-per-year designed capacity.

Total output of zinc from both plants, estimated at 10,500 tons in 1970, is projected to reach 18,000 tons in 1971. In order to supply domestic demand in 1970, some 42,000 tons of zinc was imported, a total slightly less than in 1969.

NONMETALS

Asbestos.—Approximately 80 percent of production came from the operation of the Sociedade Anônima Mineração de Amianto at its Cana Brava deposit, Uruaçú, Goiás. The company has indicated that its production in 1971 may reach 17,000 tons and in 1972 as much as 27,000 tons. Alagoas also is a source of fiber.

Cement.—Cement was produced at 32 plants operated by 31 companies in 17 States, and in 1970 again broke all records with a 15 percent advance over 1969 production. In spite of this advance, a shortage of cement continued, although not to a serious degree, and only 334,510 tons were imported, primarily from Uruguay, U.S.S.R., Colombia, and Spain. Actual output represented only 82 percent of an installed capacity of 11.04 million tons. Ten new plants reportedly were under construction at the end of the year, and two additional plants were planned for construction. Minas Gerais with eight plants was the largest producing State by a narrow margin over São Paulo, while São Paulo continued to be the largest cement-consuming State by a wide margin, accounting for 36 percent of the total apparent consumption.

Fertilizer Materials.—Natural phosphate, in the form of the mineral apatite, was produced by the State-owned Companhia Agricola de Minas Gerais (CAMIG) from its mine and grinding plant at the outskirts of Araxá, Minas Gerais; the raw rock is dryground to 200 mesh and bagged for sale for use in direct application to the soil; P_2O_5 content averages 28 to 30 percent. The Japanese-owned thermophosphate plant near Poços de Caldas, Minas Gerais, using ground magnesium silicate slag from Pratápolis, produced approximately 25,000 tons of a 96-percent-soluble 19-percent-P_2O_5 electric furnace product. The Jacupiranga, São Paulo, operation of Serrana, S.A., reached a normal rate of output of 10,000 tons per month of a 35 to 37 percent P_2O_5 concentrate.

No potash is produced in Brazil, and as a result, imports annually of manufactured potassic materials have exceeded 300,000 tons valued above US$10 million. This situation may be changed as the result of development of large deposits of potassium in evaporites (reportedly totaling 450 million tons of sylvite and 6,060 million tons of carnallite) in reserves near Carmópolis, Sergipe. At yearend, it was anticipated that the Government would call for public bidding to put these deposits into production of potash at an annual rate of not less than 250,000 tons per year.

Gypsum.—Large deposits of gypsum are known to occur in the Northeast, but until recently, utilization was limited to production for use in cement manufacture. In 1969, a new company, Gypsum do Nordeste, S.A., Indústria e Comércio de Gêsso, was formed for the purpose of producing gypsum-board, a first for Brazil. Located on the margin of the Rio São Francisco in Petrolina, the plant is well placed near the deposits, will utilize eletric power from Paulo Afonso, and have the benefit of relatively cheap river transportation to Minas Gerais and then by rail to the south-central markets. The enterprise, reaching its final construction phase late in the year, is scheduled for an initial production rate of 2 million square meters annually in 1971.

Salt.—For the third consecutive year production of salt—mainly by solar evaporation of sea water—was free of major problems and gained by a substantial 12 percent. Output, primarily from Rio Grande do Norte, reached 1,823,086 tons which was considerably in excess of deliveries to consumers. It has been reported that AKZO N.V. of the Netherlands with International Salt have acquired a 90-percent interest in Companhia Industrial do Rio Grande do Norte (CIRNE) whose salt facility near Macau supplies about one-fourth of the Brazilian market. Plans call for a doubling of CIRNE's output to about 700,000 tons per year. Byproduct recovery of salt from the potential potash development at Carmópolis could add substantially to the salt availability in Brazil and even result in a serious oversupply to the detriment of the solar-evaporation salt industry in the Northeast.

Sulfur.—Brazil continued in short sulfur supply during the year with only about 9,000 tons recovered from "sour" refinery gas at the Capuava refinery of União, S.A., near São Paulo by Indústria Brasileira de Enxofre, S.A. A plan to construct two coal pyrite reject concentration plants in Santa Catarina to produce feedstock for a 300,000-ton-per-year sulfuric acid plant to be built in the same area, failed to reach fruition in 1970. A contract for engineering design was signed with Mitsubishi in mid-1969. PETROBRÁS, reported that a new sulfur-recovery unit at the Duque de Caxias refinery had been contracted for which will have a 15,000-ton-per-year capacity for recovering sulfur from "sour" refinery gas.

MINERAL FUELS

Coal.—Coal output increased slightly in Santa Catarina, the principal producing State but decreased in both Paraná and Rio Grande do Sul. As a result, run-of-mine coal advanced only 4 percent, but washed coal production was 3 percent less in 1970. Necessary preparation of Brazilian coal, particularly from Santa Catarina, results in a high loss factor, and in 1970 only 46 percent of the total coal mined was usable. Data on production and consumption of coal by industry during 1969 and 1970 follows, in thousand metric tons:

State	Production			
	1969		1970 p	
	Run-of-mine	Washed	Run-of-mine	Washed
Paraná	415	253	373	230
Rio Grande do Sul	1,006	872	965	857
Santa Catarina	3,706	1,311	3,845	1,280
Total	5,127	2,436	5,183	2,367

Industry	Consumption					
	1969			1970 p		
	Domestic	Imported	Total	Domestic	Imported	Total
Iron and steel	734	1,382	2,116	690	1,830	2,520
Thermoelectric power	1,537	--	1,537	1,550	--	1,550
Manufactured gas	33	266	299	30	270	300
Railroads	35	--	35	30	--	30
Miscellaneous	4	1	5	--	--	--
Total	2,343	1,649	3,992	2,300	2,100	4,400

p Preliminary.

At the end of the year, a move was under way to change the Comissão do Plano do Carvão Nacional (CPCN) from a separate governmental agency to a unit of the Conselho Nacional de Petróleo (CNP), called Serviço de Combustiveis Sólidos within the Ministry of Mines and Energy.

Petroleum and Natural Gas.—PETROBRÁS, the Brazilian petroleum monopoly (except for distribution of refinery products and for a limited refinery output by six private refineries that were in operation prior to Decree Law 2004 of October 3, 1953), continued to engage actively in exploration, refining, and products distribution at an increasing rate throughout the year. No other company, domestic or foreign, is permitted to conduct any activities within the sectors of petroleum exploration, development, or refining except as noted above or as may be allowed under a specific contractual arrangement with and for PETROBRÁS.

Production of crude petroleum was 5 percent below the recordbreaking 63 million barrels produced in 1969. Apparent consumption of crude (input to refineries) gained 8 percent with the result that domestic crude production represented only 32 percent of Brazil's requirements. Natural gas output increased 1.2 percent, and production of natural gas liquids (NGL) gained a modest 3 percent. Recovery of the latter was from the expanded NGL plant at Mataripe, Bahia.

Reserves of petroleum at the end of the year totaled 857 million barrels, an increase of 0.6 percent from the reserves at yearend 1969. Natural gas reserves at yearend totaled 918 billion cubic feet, 14 billion cubic feet more than at yearend 1969.

Geologic and geophysical exploration

and exploratory, development, and injection drilling activities, all of which were performed by PETROBRÁS or its contractors, were as follows:

	1969	1970
Geologic and geophysical exploration:		
Surface geology .... party months	122	72
Seismic surveying .... do	82	92
Magnetic surveying .... do	5	6
Photogeology .... do	--	24
Total .... do	209	194
Drilling:		
Wells drilled:		
Exploratory:		
Oil .... number	15	28
Gas .... do	5	5
Dry .... do	66	79
Subtotal .... do	86	112
Development:		
Oil .... do	r 59	62
Gas .... do	1	--
Dry .... do	r 19	15
Subtotal .... do	79	77
Injection .... do	10	22
Total .... do	175	211
Footage drilled .... thousand feet	514	708

r Revised.

PETROBRÁS continued to give a high priority to exploration, and such activity was centered in the offshore areas, particularly at the mouth of the Amazon and on the Continental Shelf along the coast of Sergipe-Alagoas. Inland exploration continued with activity in Barreirinhas, in Sergipe-Alagoas, and in the Recôncavo Basin, Bahia. Two seismographic ships covered 23,500 kilometers of lines for interpretation of new structures encountered on the Continental Shelf. Seismic operations on land covered better than 2,000 kilometers of lines. On the Continental Shelf, the intensification of the exploratory program required the contracting of two new offshore drilling rigs—"Penrod 55" and "Neptune-I"—both operating at the mouth of the Amazon. This brought to five the number of platforms in operation along the Brazilian coast. The offshore petroleum field at Guaricema, discovered by PETROBRÁS in 1968, as a result of subsequent development now embraces an area of 15 square kilometers. The Caioba offshore field, discovered in 1969, continued under development and was being further evaluated of its commercial possibilities. One well showed a production potential of a reported 16,000 barrels daily. Initial production from this area is tentatively scheduled for 1972.

As of the end of the year, total nominal refining capacity in Brazil amounted to 508,600 barrels per day. According to the CNP, 186 million barrels of crude petroleum were processed during the year by all refineries, national and private, which reflects essentially 100-percent utilization of installed capacity. PETROBRÁS operated five refineries with a combined nominal operating capacity of 450,000 barrels per day of crude input. In addition, the six privately owned Brazilian refineries continued to operate throughout the year, except for Riograndense-Uruguaiana which operated only about one-half of a year total time, at near the legally allowed limit of 58,700 barrels per day.

Construction of the new 126,000-barrel-per-day Planalto refinery near Campinas, São Paulo, continued, and by yearend, the plant was about 30 percent completed. Two other projects were also under way to keep abreast of the evergrowing demand for petroleum products: the doubling of the capacity of the Cubatão refinery to 90,000 barrels per day, including a petroleum coke unit, and the construction of a lube oil unit at the Duque de Caxias refinery with a capacity to produce 4,700 barrels per day of bright stock. Completed were the vacuum distillation catalytic cracking, and gas recovery and treatment units, and the asphalt mixing unit at the Minas Gerais and Rio Grande do Sul refineries.

PETROBRÁS' tanker fleet (FRONAPE) increased its tonnage slightly, and by the end of the year had 32 tankers totaling 820,000 metric tons. In addition to several smaller tankers added to the fleet during the year, a contract was signed with Japan for the construction of a 265,000-deadweight-ton ore and oil ship, and with Brazilian shipyards for four 26,400-deadweight-ton tankers. These fleet ships and others leased by FRONAPE transported 22.6 million metric tons of crude oil during the year. Ocean terminals and pipelines of PETROBRÁS carried 258 million barrels of oil during the year.

Privately owned companies continued to distribute the greatest proportion of petroleum derivatives produced in the country. However, PETROBRÁS' aggressive efforts in obtaining a larger share in this competitive market were beginning to show positive results. One definite indicator was the increase in the number of filling stations owned and operated by PETROBRÁS which increased from 376 to 527 during 1970.

PETROBRÁS, still the only company actively engaged in oil shale development, continued work on construction of its prototype plant at São Mateus do Sul Paraná. By the end of the year, the plant complex was essentially completed, and it was expected that the 1,000-barrel-per-day PETROSIX retort unit would be operational in 1971 for testing the economic and technical feasibility of producing oil from the Irati shale formation. There has been no progress or positive activity reported at the property of the Cia. Industrial de Rochas Betuminosas (CIRB), although promotional advertisements appeared periodically in the press.

The Conjunto Petroquímicó da Bahia (COPEB) continued to be under construction in 1970, and by the end of the year was almost ready to operate with a capacity to produce 250 tons of urea and 200 tons of ammonia daily from natural gas obtained from Bahian fields. The Cubatão fertilizer plant of PETROBRÁS produced 45,000 tons of nitrogenous products in 1970.

The Mineral Industry of Bulgaria

By Bernadette Michalski [1]

The Bulgarian mineral industry in 1970 was of modest proportions by world standards, contributing about 4 percent of the total world lead output, 2 percent of the zinc output, and about 1 percent of the copper output. However, the industry, is of considerable significance when related to the domestic economy. Expanded copper, lead, and zinc operations have provided Bulgaria with an exportable supply of commodities salable in the hard currency markets of the United Kingdom, West Germany, Italy, and other West European countries. These nonferrous metals, together with iron and steel, ranked as the principal mineral commodity exports to the Western World and afforded Bulgaria an opportunity to trade at world market prices.

Bulgaria's principal domestic fuel source is lignite, supported in limited quantities by natural gas and petroleum. More than half of the nation's energy demands were imported in 1970 with the U.S.S.R., Poland, Czechoslovakia, and Romania virtually capturing the market. By the end of the sixth 5-year plan (1975), Bulgaria will be even more dependent upon imports. Crude oil shipments from the U.S.S.R. for 1975 are planned at 200,000 barrels per day to supply a part of the expanded refinery capacity.

Natural gas from the U.S.S.R. (at over 100 billion cubic feet annually) together with increased solid-fuel imports from the U.S.S.R., Poland, and Czechoslovakia are programed to support expanded iron and steel output at the Kremikovtsi and Lenin iron and steel combines. In addition to greater dependence on communist economies for fuel supplies, Bulgaria has participated in a unique joint-investment venture with the Soviet Union. Bulgaria supplies a labor force in exchange for machinery, raw materials and fuel from the U.S.S.R. The 1970 expansion of the Azovstal metallurgical plant in the U.S.S.R. is one such venture which places 5,000 Bulgarian laborers in the Soviet Union in exchange for rolled steel shipments to be used by Bulgaria's machine building industry. Various joint projects will place a total of 12,000 Bulgarian workers in the Soviet Union during the sixth 5-year plan.

Bulgaria's fifth 5-year plan ended in 1970. While in general the plan was not achieved (the annual average growth rate was only 8 percent, rather than the planned 8.5 percent), production and development programs for many of the mineral and metal industries were carried out. Major disappointments in the mineral field were domestic natural gas and petroleum outputs which failed to meet expectations.

PRODUCTION

Bulgaria's 1970 mineral output data are incomplete. For most major commodities, figures were available for only the first 9 months of the year. Additional production capacity was realized in the cement and fertilizer manufacturing industries. Petroleum refinery product output, based principally on imported Soviet and Iranian crudes, increased by an estimated 10 million barrels.

[1] Foreign mineral specialist, Division of Fossil Fuels.

Table 1.—Bulgaria: Production of selected mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Cadmium [e] ______ tons	200	200	200
Copper:			
Mine output, metal content ______ do	37,300	39,300	[e] 40,000
Blister including secondary ______ do	38,200	38,000	42,000
Refined electrolytic including secondary ______ do	36,500	36,300	[e] 40,000
Iron and steel:			
Iron ore and concentrate	2,645	2,688	2,412
Pig iron (including blast furnace ferroalloys)	1,109	1,134	1,231
Crude steel	[r] 1,464	1,515	1,800
Steel semimanufactures	[r] 1,048	1,287	1,460
Lead:			
Mine output, metal content ______ tons	[r] 93,900	91,200	[e] 120,000
Smelter including secondary ______ do	92,700	95,100	[e] 98,000
Manganese ore, gross weight	41	39	[e] 40
Molybdenum mine output, metal content ______ tons	NA	255	300
Zinc:			
Mine output, metal content ______ do	74,500	77,000	[e] 90,000
Smelter including secondary ______ do	75,100	75,800	[e] 78,000
NONMETALS			
Asbestos ______ do	2,100	2,800	[e] 3,500
Cement, hydraulic	3,516	3,552	3,672
Clays, kaolin	127	122	125
Fertilizer materials, manufactured:			
Nitrogenous:			
Gross weight	[r] 1,323	1,385	[e] 1,500
Nitrogen content	503	541	[e] 600
Phosphatic:			
Gross weight	409	394	NA
Phosphorus pentoxide content	135	140	NA
Gypsum and anhydrite:			
Crude	194	170	[e] 170
Calcined	15	20	NA
Lime (quicklime)	970	909	[e] 910
Pyrite:			
Gross weight	164	170	[e] 180
Sulfur content	65	67	[e] 72
Salt (all types)	118	120	[e] 120
Sulfur, elemental, recovered ______ tons	8,658	5,320	[e] 7,000
MINERAL FUELS AND RELATED MATERIALS			
Coal (marketable):			
Anthracite	176	155 }	397
Bituminous	263	215 }	
Lignite and brown	28,282	28,632	28,836
Total	28,721	29,002	29,233
Natural gas ______ million cubic feet	[r] 17,875	18,537	[e] 19,000
Petroleum:			
Crude oil:			
As reported	475	325	334
Converted [e] ______ thousand 42-gallon barrels	3,468	2,373	2,438
Refinery products:			
Gasoline ______ do	5,143	7,353	NA
Kerosine ______ do	775	969	NA
Distillate fuel oil ______ do	7,535	10,526	NA
Residual fuel oil ______ do	[r] 11,502	14,945	NA
Lubricants ______ do	343	280	NA
Asphalt including natural ______ do	[r] 491	570	NA
Total ______ do	25,789	34,643	[e] 45,000

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, bismuth, chromite, gold, silver, barite, fluorspar, magnesite, and tellurium are also produced, but information available is inadequate to make reliable estimates of production levels.

TRADE

The U.S.S.R. is by far Bulgaria's leading trade partner, accounting for at least 55 percent of that nation's total trade turnover and an estimated 75 percent of total mineral trade turnover. Mineral and metal exports from the U.S.S.R. were valued at $350.3 million [2] in 1969, a 16-percent in-

[2] 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 U.S.S.R. amd 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 [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum and alloys:			
Scrap	698	200	All to United Kingdom.
Unwrought and semimanufactures	6,795	5,938	Yugoslavia 4,224; Japan 874.
Copper and alloys:			
Scrap	253	NA	NA.
Unwrought and semimanufactures	4,883	3,713	West Germany 3,516; Austria 169.
Iron and steel:			
Scrap	575	9,240	Italy 9,180.
Pig iron [2]	17,500	14,100	Turkey 3,000.
Ferroalloys	7,061	6,703	Italy 3,825; Poland 1,805; Turkey 721.
Steel:			
Primary forms ... thousand tons	145	98	Italy 47; France 16; Spain 13.
Semimanufactures:			
Bars, rods, and sections ... do	72	109	U.S.S.R. 87; Yugoslavia 17.
Plates and sheets [2] ... do	309	383	West Germany 68; U.S.S.R. 62; Italy 42.
Hoop and strip ... do	---	18	Japan 10; Poland 8.
Pipe and tube ... do	---	10	Poland 6; Yugoslavia 4.
Lead:			
Oxides	858	744	Italy 501; West Germany 243.
Metal and alloys:			
Scrap	617	900	All to Austria.
Unwrought and semimanufactures [2]	33,119	28,569	Italy 9,220; United Kingdom 8,210; Austria 4,871.
Nickel and alloys, unwrought and semimanufactures	---	142	Austria 101; Netherlands 41.
Platinum-group metals, unworked and partly worked ... value, thousands	$180	---	
Silver and alloys, unworked and partly worked ... value, thousands	$2,715	$2,895	United Kingdom $2,446; West Germany $449.
Titanium oxides	290	158	All to Turkey.
Zinc:			
Oxides	133	138	Do.
Metal and alloys, unwrought and semimanufactures [2]	51,006	50,006	United Kingdom 13,771; West Germany 7,786; Austria 5,181.
Other:			
Metal bearing slag, ash, and dross	416	260	All to West Germany.
Metals and alloys, all forms	178	113	West Germany 76; Belgium-Luxembourg 16; United Kingdom 16.
NONMETALS			
Asbestos	3,526	3,732	All to Poland.
Barite	27,500	25,600	All to U.S.S.R.
Boron compounds, acid and oxide	---	329	All to West Germany.
Cement [2] ... thousand tons	280	207	Yugoslavia 84; Libya 52; Turkey 34.
Clay products, nonrefractory	---	5,652	All to Yugoslavia.
Diamond, gem ... value, thousands	$30	---	
Feldspar and fluorspar	1,600	---	
Fertilizer materials:			
Crude, phosphatic	---	3,300	All to Yugoslavia.
Manufactured, nitrogenous [2]	129,266	69,635	Greece 31,328.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	922	1,738	All to Turkey.
Soda ash	9,200	25,600	All to U.S.S.R.
Stone, dimension	6,793	5,302	West Germany 4,293; Poland 1,009.
Sulfur, sulfuric acid [2]	57,206	61,412	Romania 26,810; Hungary 16,631; Greece 7,099.
Talc	22,100	45,700	All to U.S.S.R.
Other crude	1,693	1,254	All to Italy.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude oil ... thousand 42-gallon barrels	1,506	278	All to Austria.
Refinery products: [2]			
Distillate fuel oil ... do	427	159	Greece 107; Albania 30.
Residual fuel oil ... do	448	766	Yugoslavia 357; Greece 13.
Lubricants ... do	25	19	Yugoslavia 11; Poland 7.
Crude chemicals from distillation of coal, gas, or oil	1,701	4,318	Yugoslavia 3,077; Netherlands 1,241.

NA Not available.
[1] Compiled from official export statistics of Bulgaria and from import data of selected trading partners.
[2] Data from official Bulgarian export statistics.

Sources: Official trade returns of Bulgaria, Poland, and the U.S.S.R. and the 1968 and 1969 editions of Supplement to the World Trade Annual, V. I, Statistical Office of the United Nations, New York: Walker and Company, 1970 and 1971.

crease over the previous year's figure. Crude oil and refined petroleum product deliveries accounted for nearly a third of the Soviet exports to Bulgaria, or $112.3 million, as compared with $98.7 million in 1968. With expansion of domestic refining facilities, Bulgaria's imports of Soviet refined petroleum products will decline in favor of expanded crude oil imports. The trade agreement for 1971-75 schedules a total of 60 million barrels of refined petroleum product imports, as compared with 100 million barrels imported in the previous 5-year plan. Bulgarian minerals and metal imports by the U.S.S.R. were valued at $17.9 million in 1969, with more than 90 percent of this total attributed to iron and steel products.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Oxide	NA	735	West Germany 670; France 65.
Metal and alloys, unwrought and semimanufactures [2]	29,358	28,161	U.S.S.R. 24,960; Yugoslavia 631; Hungary 624.
Antimony	401	1,225	All from U.S.S.R.
Chromium, chromite	17,250	3,400	All from Turkey.
Cobalt oxide and hydroxide	90	---	
Copper:			
Ore and concentrate	5,502	---	
Metal and alloys, unwrought and semimanufactures	4,593	8,262	U.S.S.R. 5,822; Austria 1,108; Yugoslavia 905.
Iron and steel:			
Iron ore [2] ... thousand tons	888	1,020	U.S.S.R. 870; Algeria 150.
Pig iron ... do	[2] 219	[2] 307	U.S.S.R. 255[2]; Poland 25.
Ferroalloys	13	13	U.S.S.R. 12.
Steel:			
Primary forms ... do	---	27	Yugoslavia 19; Poland 8.
Semimanufactures: [3]			
Bars, rods, and profiles ... do	373	399	U.S.S.R. 274; Poland 104.
Plates and sheets ... do	252	273	U.S.S.R. 172; Italy 42; Austria 18.
Hoop and strip ... do	20	11	West Germany 5; Poland 2.
Railway materials ... do	10	46	U.S.S.R. 31; Austria 5; Poland 5.
Wire ... do	160	127	U.S.S.R. 120; West Germany 4.
Pipes, tubes, and fittings ... do	82	79	U.S.S.R. 64; West Germany 10.
Unspecified rolled ... do	21	35	All from U.S.S.R.
Castings and forgings ... do	6	4	Mainly from Poland.
Total ... do	924	974	
Lead ore and concentrate	2,284	11,708	Turkey 9,320; Yugoslavia 1,388.
Manganese:			
Ore and concentrate	74,653	98,345	U.S.S.R. 97,000; Turkey 1,345.
Oxide	---	80	All from Japan.
Mercury ... 76-pound flasks	174	319	Spain 174; Italy 145.
Nickel and alloys, unwrought and semimanufactures	175	262	Sweden 206; West Germany 56.
Platinum-group metals ... value, thousands	$220	$81	All from West Germany.
Silver ... do	$5	---	
Tin:			
Oxides ... long tons	---	14	All from United Kingdom.
Metal and alloys, unwrought and semimanufactures ... do	263	168	United Kingdom 129; Yugoslavia 20; Spain 19.
Titanium oxides	805	1,368	Italy 930; West Germany 438.
Zinc ore and concentrate	15,551	37,750	Yugoslavia 30,886; Turkey 6,864.
Other and unspecified, unwrought and semimanufactures	1,851	1,373	U.S.S.R. 1,151; United Kingdom 187.
NONMETALS			
Asbestos	20,600	24,600	All from U.S.S.R.
Barite and witherite	---	3,050	All from Turkey.
Borates, crude	3,400	5,200	Do.
Cement ... thousand tons	107	113	U.S.S.R. 110; Poland 3.
Clay products, refractory	40,224	22,143	U.S.S.R. 16,500; Austria 2,672.
Diamond, industrial ... value, thousands	$73	$60	All from Belgium-Luxembourg.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials: [4]			
Crude:			
Phosphatic (apatite concentrates)	363,400	345,300	All from U.S.S.R.
Potassic (salts)	91,900	51,700	Do.
Manufactured:			
Phosphatic	452,138	183,070	U.S.S.R. 92,300; Yugoslavia 90,770.
Mixed	28,220	12,924	All from Greece.
Graphite	900	1,100	All from U.S.S.R.
Magnesite	599	193	All from Austria.
Pigments, mineral, iron oxide	156	172	All from West Germany.
Salt	---	12,009	All from Turkey.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	438	---	
Caustic potash, sodic and potassic peroxides	206	---	
Sulfur	1,994	27,787	U.S.S.R. 26,300.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black [2]	8,843	9,860	U.S.S.R. 7,125; East Germany 1,387.
Coal, all grades ....thousand tons	3,422	4,088	All from U.S.S.R.
Coke ....do	221	196	U.S.S.R. 115; Yugoslavia 45; Poland 36.
Petroleum refinery products:			
Crude oil [2] thousand 42-gallon barrels	24,329	35,331	NA.
Refinery products: [2]			
Gasoline ....do	3,298	2,958	U.S.S.R. 2,644.
Distillate fuel oil ....do	3,700	4,028	U.S.S.R. 2,917.
Residual fuel oil ....do	10,410	11,002	U.S.S.R. 10,390.
Lubricants ....do	485	616	U.S.S.R. 564; Romania 11.
Crude chemicals from distillation of coal, gas, or oil	1,177	286	All from West Germany.

NA Not available.
[1] Compiled from official import statistics of Bulgaria and from export data of selected trading partners.
[2] Data from official Bulgarian import statistics.
[3] Official import statistics report the receipt of only 548,000 tons in 1968 and 523,000 tons in 1969, but these represent receipts of only a select few categories of semimanufactures. These include construction steel, wire rod, sheet iron, sheet steel, tinplate, hoop, and strip. Because of the incomplete nature of these data, export statistics of trading partners have been used for the entire steel section, but their data exclude imports from Czechoslovakia, East Germany, and Hungary which were listed in the Bulgarian source publication as source countries. Total iron and steel imports from these nations as recorded in the Bulgarian import statistics were 1968: 26,000 tons and 1969: 22,000 tons.
[4] Official import statistics report the receipt of 1,509,000 tons of all types of fertilizers in 1968 and 1,063,000 tons in 1969, quantities which considerably exceed the totals for the commodities listed below, which were 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 213,000 tons of presumably all phosphate rock in 1968 and 305,000 tons in 1969.

Sources: Official trade returns of Bulgaria, Poland, and the U.S.S.R. and the 1968 and 1969 editions of Supplement to the World Trade Annual, V. I, Statistical Office of the United Nations, New York: Walker and Company, 1970 and 1971.

COMMODITY REVIEW

METALS

Copper.—Ore production was derived from seven mines, of which six together produced a total of about 2 million tons of ore in 1970; the ore ranged in copper content from 0.5 to 1.5 percent. Principal output however was from the Medet porphyry deposit which yielded about 7 million tons of ore, grading 0.4 percent copper and 0.008 percent molybdenum. By 1971 the Medet mine and mill facilities should attain planned capacity of 8 million metric tons of ore annually with an anticipated recovery of 120,000 tons of 12-percent copper concentrates. Medet copper concentrates were trucked to the Pirdop smelter and refinery where they were processed into an estimated 28,000 tons of metal in 1970, about 70 percent of Bulgaria's copper output for the year. By 1972 copper metal production from Medet concentrates is planned at 34,000 tons. Nearly half of Bulgaria's copper output is processed into copper profiles, sheet, and wire at the Dimiter Ganev plant near Sofia. The plant was under expansion during 1970 with construction of additional hot- and cold-rolled product units, a casting unit, and a pressing and drawing unit. The Dimiter Ganev plant is scheduled to attain planned capacity of

110,000 tons of semimanufactured nonferrous metals by 1973.

Iron and Steel.—The steel industry accounted for an estimated 3.5 percent of Bulgaria's gross national product in 1970. The 9-percent increase in pig iron and 19-percent increase in ingot steel output was attributed to the additional furnace capacity installed during 1969–70. In 1969, the last year for which a breakdown of steel output by type of processing facility was available, oxygen converters accounted for 53 percent of total output, open-hearth furnaces for 31 percent, and electric furnaces for 16 percent.

In 1969 rolled sheet accounted for 61 percent of total output of rolled products. However, the installation of a new continuous wire mill during 1970 reduced the rolled sheet portion of total rolled products to 49 percent despite no reduction in the quantity of rolled sheet produced. A contract for the supply and installation of sheet finishing equipment for the Kremikovtsi metallurgical combine was awarded to Dresser-Dujardin (French) under license from Aetna, Blaw Knox, and United States Steel Corp. Output of the 450,000-ton-annual-capacity unit will include 135,000 tons of galvanized sheets, 120,000 tons of electrolytic tin plate, and 105,000 tons of aluminum plate. Domestic seamless pipe output was below 20,000 tons annually until the new seamless pipe unit was commissioned at Kremikovtsi in 1969; this raised the country's seamless pipe output to an estimated 90,000 tons in 1970. Expanded wire, sheet, and pipe capacity will afford Bulgaria an estimated 80 percent self-sufficiency in steel products, limiting imports to specialized varieties of angles, shapes, sections, and pipes.

Molybdenum.—Molybdenum concentrate with a high rhenium content is recovered by the mill at the Medet porphyry copper mine. When the Medet mine and mill reach capacity in 1971, an annual output of 350 tons of 40-percent molybdenum concentrate is planned.

Titanium.—Bulgaria claimed discovery on the Black Sea coastline of a black sand deposit containing 10 percent titanium dioxide (TiO_2) and 50 percent iron. The deposit ranges from 3 to 7 feet in thickness and covers an area of 8 square miles. No exploitation plans were announced by yearend; however, development of this deposit could reduce Bulgaria's dependence upon TiO_2 imports. Net imports were reported at 510 metric tons in 1968 and 1,211 tons in 1969.

NONMETALS

Limited development activity was reported in the nonmetallic industry in 1970. Production of fluorspar, gypsum, and refractory clays remained stable, while asbestos and pyrite made appreciable gains. Byproduct sulfur produced from metallic sulfide ores apparently recovered from the 1969 slump. Near yearend, cement output registered limited gains with completion of the 1.6-million-ton-capacity Loukovit cement plant. Manufactured fertilizer output, although unreported, presumably increased owing to the midyear completion of the Varna fertilizer complex where daily production was reported at 630 tons of ammonia, 850 tons of ammonium sulfate, and 2,500 tons of end-product complex nitrogenous-phosphatic fertilizers.

MINERAL FUELS

Energy consumption in 1970 was estimated at 29 million tons of standard coal equivalent (SCE). About 60 percent of this supply was obtained from domestic sources, principally from lignite and brown coal. In 1968, the latest year for which a breakdown of energy consumption by source fuel is available, solid fuels provided 65.7 percent; liquid fuels, 31.2 percent; natural gas, 2.4 percent; and hydroelectric power, 0.7 percent of a total 27.8 million tons of SCE.

Construction was started on Bulgaria's first nuclear powerplant. Located at Kozludui on the Danube, the plant will have two water-type reactors, each of 400-megawatt capacity. Each reactor will supply two turbines of 200 megawatts. The first reactor is scheduled for service in 1973 and the second in 1974. Design and construction of the Kozludui plant was undertaken by the U.S.S.R., which will also furnish nuclear fuel.

Coal.—Coal output exceeded 29 million tons, with low-quality lignite and brown coals constituting about 98 percent of the total output. The bulk of lignite production is derived from open pit mining operations in the Maritza Istok basin where reserves are estimated at 3,000 million tons of lignite averaging 1,300 kilocalories per kilogram. In 1970 at least three open pit mines were in operation. Troyanovo 1 operated at a 12-million-ton-annual capacity level with an overburden-to-coal ratio of 2.8 to 1. Troyanovo 2 was expanded to a 15 million-ton-capacity with overburden to coal ratio of 4.45 to 1. Troyanovo 3 was still under development; however, pit production was at least 2 million tons of lignite from producing levels. It operated on a continuous system consisting of excavators, traveling cranes, and loading conveyors. Equipment for open pit operators in the Maritza Istok area was manufactured in East Germany.

Natural Gas.—Optimistic plans set a domestic natural gas output of 25 billion cubic feet annually by the close of the 5-year plan in 1970, but actual production in 1970 fell far below the goal, reflecting disappointing results in Black Sea exploration. Domestic production, estimated at 19 billion cubic feet in 1970, was derived from Stara Orjachovo field south of Varna on the Black Sea Coast and from Chiren (Tcherven) near Vratsa in western Bulgaria. The latter field provides a gas containing 92 percent methane, 3 percent heavier hydrocarbons, and 5 percent nitrogen. In operation since 1965, the field produced a cumulative total of 60 billion cubic feet through January 1, 1970. Plans for the current 1971–75 5-year plan anticipate raising output from both fields to a total of 35 billion cubic feet annually.

The bulk of Bulgaria's natural gas supply will be imported from the U.S.S.R. via a 1,020-millimeter-diameter pipeline. The first section of the line running from Izmail in the Ukraine to the Black Sea port of Varna, is scheduled for completion in 1972, when Soviet natural gas will supply the industrial complex in the Devnya lowlands. From Varna the line will run to Burgas to provide natural gas for the expanding chemical combine and then through Plovdiv to Sofia where it will service the Kremikovtsi metallurgical combine. The pipeline, covering a distance of 435 miles, will have a 106-billion-cubic-foot annual capacity (3 billion cubic meters) and will reportedly be shipping natural gas from the U.S.S.R. at capacity level by 1975.

Petroleum.—Domestic crude oil output was an estimated 9,800 barrels per day, falling far short of the 20,000-barrel-per-day planned output for 1970. Production from the northwestern fields of Dolni Dubnik and Gigen did not meet expectations, and offshore development in the Tyulenovo field extension, north of Varna on the Black Sea, appears to have at best a meager yield. Bulgarian crudes are widely divergent. The Dolni Dubnik field, the country's largest yields a crude averaging 42° API gravity and 0.12 percent sulfur from depths in excess of 11,000 feet. Gigen field crude is produced at 4,000-foot depths and averages 12.7° API gravity and about 0.9 percent sulfur. Production from the Tyulenovo field is from a depth of 1,300 feet and is 19.3° API gravity oil with 0.32 percent sulfur. Crude oil from Bulgaria's northwest fields are refined at Plevin, where the nation's second refinery came on stream during 1970. Production capacity at Plevin is reported at 20,000 barrels per day. Product yield in 1970 included 2,536,000 barrels of diesel fuel. Imported Soviet crude oil, railed to the refinery from the Black Sea port of Shabla, supplements domestic crude oil runs.

Two pipelines for handling Soviet crude oil imports are under consideration. The Kavarna-Plevin line is scheduled for completion in 1972, and the Shabla-Plevin line is scheduled for completion in 1975 when the Plevin refinery daily capacity will be expanded to 120,000 barrels.

Bulgaria's largest petroleum refinery and petrochemical complex is located on the coast at Burgas. Daily refining capacity was expanded from 80,000 barrels in 1968 to 120,000 barrels in 1970. A 175-mile, 40,000-barrel-per-day pipeline for refined products was under construction from the Burgas refinery to Stara Zagora and Plovdiv. The Burgas-Kariobat section should be completed by 1971 and the entire line finished by 1973. The U.S.S.R. and Poland are providing equipment for the project.

Total imported crude runs in 1970 were estimated at 100,000 barrels per day, with the U.S.S.R. providing about 85,000 barrels per day. Iran and possibly the United Arab Republic (U.A.R.) supplied the remainder. By 1975 plans call for crude shipments from the U.S.S.R. to average 200,000 barrels per day, covering the major portion of crude consumption of the expanded Plevin (120,000 barrels daily) and Burgas (180,000 barrels daily). To meet heavier demands on Black Sea tanker capacity, Bulgaria will expand its 1970 tanker fleet capacity of 257,000 deadweight tons (d.w.t.) to 850,000 d.w.t. by 1975.

Carrier units will range from 70,000 to 100,000 d.w.t.

In addition to expansion of refining capacity, three petrochemical units were brought into production at the Burgas complex near yearend. These included units for production of rubber, latex, acrylic fibers, and polystyrene.

The Mineral Industry of Burma

By K. P. Wang [1]

Burma's "hard rock" part of the mineral industry had another lackluster year in 1970. Production from the Bawdwin enterprise near Lashio and the Chinese border remained at its lowest level within a decade, with the modernization program behind schedule. Tin and tungsten output also showed little if any improvement. Nothing was done on the Monywa copper deposit. A Soviet technical assistance team arrived in July to rehabilitate the Mawchi tin-tungsten mine and a West German team was assigned to help develop tin mines in the Heinda district. Antimony mining was resumed. Near yearend, a special technical aid agreement was being negotiated with the West German Government regarding exploitation of mineral resources in Burma in general.

The West Germans were also active in oil and fertilizers. An agreement was signed to conduct seismic surveys for oil in the Gulf of Martaban. The Germans, who are to assist in onshore exploration as well, were negotiating for a production-sharing contract. The Japanese tried to negotiate a similar contract for the Arakan coast, which they have surveyed on a preliminary basis, with no success as yet. Meanwhile, the Burmese made some headway themselves in exploration and exploitation. The Mann oilfield near Minbu was discovered and brought into production. New oil rigs were purchased. However, the overall Burmese effort was small, because of limitations in domestic capital and technical capability. On a related front, one fertilizer plant had been completed by the Japanese and another (virtually the same size) was being constructed by the West Germans, both to utilize local natural gas to make urea.

The mineral industry of Burma has become very much a government business. About 5 percent of the national budget in 1969, or $109 million,[2] was allocated to the Ministry of Mines, which also runs the petroleum industry. Various government corporations are assigned to manage the different mining sectors. In fiscal 1969–70,[3] the budget for national development showed the following anticipated capital expenditures: People's Oil Industry (POI), $11.8 million; People's Bawdwin Industry (PBI), $2.1 million; and Mineral Development Corporation (MDC), $1.7 million. In February 1970, the Myanma Oil Corporation (MOC) took over the duties of POI and the Myanma Bawdin Corporation (MBC) took over the duties of PBI and other organizations. The power of MDC had been reduced, although it still supervises tin, tungsten, coal, and certain nonmetallics. Even the precious stone industries have been nationalized.

PRODUCTION

According to official Burmese national budget estimates, "mineral" output totaled $37.8 million in fiscal year 1968–69 and the target for 1969–70 was $41.3 million. 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. Reported output values for major minerals were, as follows, for 1968–69 (tar-

[1] Supervisory 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 BKs4.76 = US$1.00. In the open market, the kyat is worth much less; actually, one dollar can buy 15 kyats or more.

[3] Burma's fiscal year runs from October to the following September.

gets for 1969–70 are in parentheses): Crude oil, $16.6 million ($18.2 million); nonferrous output of the Bawdwin enterprise, $7.2 million ($8.5 million); and tin and tungsten concentrates, $2.4 million ($2.8 million). In fiscal year 1968–69, salt output was reported at $3.3 million, cement output as $5.0 million, refined petroleum output at $48.8 million, and iron and steel products output at $12 million.

Table 1.—Burma: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968 r	1969 r	1970 p
METALS			
Antimonial lead (18 to 20 percent Sb)	290	302	239
Copper matte, gross weight	160	167	166
Iron and steel:			
Steel ingots and castings e	21,000	21,000	21,000
Steel semimanufactures e	28,000	25,000	25,000
Lead:			
Concentrate (50 to 60 percent Pb)	17,984	15,810	14,700
Metal	9,370	9,720	9,510
Nickel speiss (20 to 30 percent Ni)	115	119	84
Silver thousand troy ounces	790	902	572
Tin concentrate (68 to 72 percent Sn) e long tons	370	300	230
Tin-tungsten concentrate (35 percent Sn and 30 percent WO_3) e do	500	440	630
Tungsten concentrate (55 to 65 percent WO_3) e	160	110	90
Zinc concentrate (52 to 55 percent Zn)	8,550	9,060	7,530
NONMETALS			
Barite	e 9,000	9,703	13,463
Cement, hydraulic thousand tons	155	183	157
Gypsum	e 3,000	3,500	5,334
Limestone, crushed and broken thousand tons	530	572	604
Salt do	136	176	159
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude oil thousand 42-gallon barrels	5,634	6,433	6,050
Refinery products:			
Gasoline do	1,515	1,486	1,801
Kerosine and jet fuel do	1,450	2,057	2,373
Distillate fuel oils do	1,818	1,705	2,002
Residual fuel oil do	1,313	1,014	1,115
Other do	122	192	400

e Estimate. p Preliminary. r Revised.

TRADE

Burma's overall foreign trade declined sharply, from $290 million in fiscal year 1968–69 to about $235 million in 1969–70. Total exports at approximately $110 million showed little change, whereas total imports declined $50 million to $125 million. Measured in a span of a few years, mineral exports roughly equaled the combined production of the Bawdwin enterprise, the tin-tungsten industry, and parts of the precious stones industries. These items generally added up to $10 to $13 million annually, although actual mineral exports varied considerably from year to year. In fiscal 1968–69, Burma exported $6.14 million in base metals and ores and $3.66 million in silver; in fiscal 1969–70, base metal exports were slightly down and silver exports, sharply reduced to less than half the total for the previous year.

Burma's imports of mineral and related products dropped from roughly $36 million in 1967–68 to $31 million in 1968–69, and possibly only to $20 million in 1969–70. The largest item was base metals and manufactures which held somewhat steady at $17.5 to $19.5 million each year. Fertilizer imports showed the greatest change, with imports declining from $12 million in 1967–68, to $6 million in 1968–69, and not much more than $1 million in 1969–70. Construction of new fertilizer plants brought about the sharp decline. During these 3 years, refined oil imports dropped from $3.5 million to $1 million. Lesser mineral imports included coal and, secondarily, cement.

COMMODITY REVIEW

METALS

Antimony.—In recent years, until 1970, the only antimony produced in Burma had been a few hundred tons of antimonial lead annually, analyzing 18 to 20 percent antimony, by the lead smelter in Namtu. Early in 1970, small-scale extraction of antimony ore and concentrate was resumed, owing to extremely high prices and government assistance by MDC. In fact, an intensive search for antimony led to the discovery of various deposits. By yearend, however, antimony prices had dropped from the high of $4 per pound early in 1970 to US $0.70. This rapid change of events undoubtedly will affect future operations.

Unevaluated antimony finds reported in the press include Matsan in Kyaikmaraw township, Moulmein district; Mongshu township, Southern Shan State; headwater of the Taung Daung stream between Thanbyuzayat and Mudon Townships, Moulmein district; Konsut and Peinchit in the Loikaw district, Kayah State; near the villages of Peinnegon and Mwehaukkon; and near the Yadana Theingi mine in the Kalagwe area of the Nawnghkio district.

Iron and Steel.—The Ywama steel plant, with an electric furnace and rolling mills, remained the country's only steel producer. Scrap iron for feeding the furnace came from domestic sources, but a shortage seemed imminent. The steel plant rated at 40,000 tons of products annually was worked at about half capacity. Bars and rods were the main products, followed by wire nails, galvanized iron, and barrel sheets. Plans have been made to build additional facilities for wire netting, roller extension, tubes, and sheets, although funds were not in sight. Burma also has plans to build an integrated steel industry, a project which is even more uncertain.

Lead, Zinc, Copper, Silver, and Nickel.—The Government-owned Bawdwin enterprise in Northern Shan State near the Burma Road, originally under the Burma Corporation, then the PBI, and now the MBC, continued to be Burma's sole significant producer of nonferrous metals. Bawdwin has been producing refined lead, zinc concentrate, and byproducts for decades. The zinc concentrate 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, with more than 7,000 workers, was capable of producing each year 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 decline of the historically famous Bawdwin mine is mainly attributed to depletion of high-grade reserves that have analyzed one-third combined base metal content in the ore. Reserves at yearend had dwindled to roughly 6 million tons, assaying only 11 percent lead, 5.5 percent zinc, 0.3 percent copper, and 7 to 8 ounces of silver per ton. The average grade of ore mined in 1969–70 was even lower—about 9 percent lead and 5 percent zinc. A changeover to work low-grade ores in the mine has been behind schedule because of shortage of funds and equipment. The plan is to raise production considerably under a modernization program now in progress. Meanwhile, the mine has been struggling along. However, the old smelter with surplus capacity reportedly produced only 9,510 metric tons of refined lead in fiscal 1969–70. A new lead oxide plant being built at Namtu had not been completed by yearend.

The small Bawsaing mine in the Taunggyi district, 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. What little so far produced has been sent to Namtu for smelting.

The new Yadana Theingi mine in the Nawnghkio district, Northern Shan State, was being built up to produce over 40,000 tons of silver-lead-zinc ore annually. The plan is to construct a powerplant, a mill, and a 32-mile road from the mine to Ohnmathi on the Mandalay-Lashio highway. In addition to many lead-zinc veins, ore bodies of copper and antimony have also been reported in the vicinity.

Little work was done during the year on the Monywa copper deposit located 110 kilometers west of Mandalay. Reserves of this deposit may be on the order of 100 million tons of 0.5 to 1.0 percent copper ore.

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. Concentrates were produced separately or in mixed form. Combined annual output of the two related minerals has been less than 1,000 tons of concentrates during the last 5 years, a far cry from pre-World War II levels. Although statistics are conflicting, Burma has been producing, in terms of metal content, approximately 300 to 500 tons of tin and 100 to 200 tons of tungsten yearly. Most production has come from the Tavoy and Mergui districts in the Tenasserim Division near the Thai border. The Government helps the small miners with implements. It also buys concentrates at relatively low prices, an action which has brought about smuggling into Thailand. Large scale dredging operations have virtually ceased.

In an effort to spur production, a 4-year technical assistance agreement was signed between MDC and the Soviets to rehabilitate the once-famous Mawchi tin-tungsten lode mine. The mine was reopened on March 27 and a Soviet team of five experts arrived in July 1970. The initial goal is to produce about 100 tons of concentrates monthly—roughly twice the monthly levels late in 1970. The agreement specifically calls for the Soviets to furnish 1.5 million rubles ($1.65 million) in loans at an interest rate of 2.5 percent to be repaid within 12 years after concentrate production reaches 1,200 tons annually. At its peak in 1939, the mine produced 5,800 tons of mixed concentrates. The high-grade reserves have since been depleted.

Another agreement was signed near yearend with the West Germans, who will develop tin mines in the Heinda district. A $2.7 million long-term, low-interest loan will be provided.

NONMETALS

Cement.—Burma's only cement plant at Thayetmyo is also a government enterprise. The plant has two wet process rotary kilns and has been producing about 180,000 tons annually.

The Industrial Development Corporation, operators of the Thayetmyo plant, ordered a second plant from Japan near yearend. Kawasaki Heavy Industries is to supply a 800-ton-per-day cement plant valued at about $8.5 million, to be installed in the Kyangin area in the upper reaches of the Irrawaddy River in 1972.

Fertilizer Materials.—Difficulties in rice production influenced the Government to encourage the use of chemical fertilizers in Burma. During the 5 years preceding 1970, annual fertilizer consumption rose to approximately 150,000 tons, all imported. In 1970 the first of two similar fertilizer plants was completed, signaling the eventual stoppage of large-scale imports of nitrogen fertilizers. Complex or mixed fertilizers, however, would 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, will be 40,000 tons of ammonia and an associated 65,000 tons of urea. The first plant, located at Pagan 20 kilometers north of Chauk, was built by the Japanese firm Hitachi Zosen. The second plant, near Sale at Kyunchaung 30 kilometers south of Chauk, is being built by a consortium of West German firms and is scheduled for completion late in 1971. The West German Government is contributing $4 million, with the rest financed by the contractors in the way of long-term loans.

Gem Stones.—Uncut Burmese jade continued to be of importance in world jewelry circles. Annual output usually varies from 52,300 to 93,300 kilograms of uncut jadeite. Since many mines are in insurgent territory near the border, additional jade presumably was produced and smuggled out of the country. Burma also produces ruby, sapphire, spinel, other "precious stones." and cultured pearls. The pearl industry was nationalized in 1964, when the Japanese part of a joint venture was dissolved. Jade and precious stone producers were first required to sell to MDC. By 1970, both these industries had become totally nationalized.

During the seventh annual emporium held in Rangoon in February 1971, sales totaled $2.6 million, including $1.96 million for jade, $480,000 for pearls, and $154,000 for precious stones. Pearl sales have lost ground steadily ever since the Japanese left. Recorded output of precious stones also declined sharply since nationalization.

Salt.—Burma produces the salt it needs, which amounted to about 175,000 tons annually during 1969–70. Early in 1970 the Burma Salt Industries, the sole operator harvesting salt from brine pits located along the Indian Ocean coast, started a modernization program. The company has placed a $1 million order with Allis-Chalmers Manufacturing Co. for tractor scrapers, crawler dozers, and graders to build pits, dikes, and channels, which will displace elephants and bullocks formerly employed.

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 form Kyaukpadaung; bentonite from Shwebo; gypsum from Chauk; dolomite from Kalaw and feldspar from Thazi and Taungtha for the Syrium glass factory; quartz from Choungzon in Amherst district; and barite from Kyaukse and elsewhere. Barite and bentonite extraction were being stepped up because of growing demand by MOC. The industrial clay near Minhla may turn out to be rather important.

MINERAL FUELS

Coal.—The Kalewa coalfield in the northwest, sole producer in Burma, turned out only about 15,000 tons of low-rank coal annually during 1969–70. The Government hopes that output can be raised somewhat. Burma's imports of coal are also small.

Petroleum.[4]—The year 1970 was a turning point for the oil industry of Burma, which, although small, showed significant progress. The West Germans were awarded an offshore survey contract. The new Mann oilfield onshore north of Minbu helped push Burma's daily crude output to 19,000 barrels at yearend. The Syriam refinery near Rangoon and the smaller Chauk refinery upstate, with a combined throughput capacity of about 31,000 barrels per day, were able to handle more crude than what was produced. Imports of refined products were equivalent to about half the domestic output in 1970. The Government, however, hopes to achieve self-sufficiency shortly. With the building of the two fertilizer plants previously mentioned, natural gas, hitherto flared, will have a commercial outlet of 5 million cubic feet per day for each plant. The Burmese hope eventually to develop a petrochemical industry.

Two aid agreements were signed between the Federal Republic of Germany and Burma in September 1970. These call for a $6 million loan (2.5 percent interest and 30 years) for both onshore and offshore exploration and exploitation and for a $2.1 million grant for experts and equipment. The above agreements probably represent only the first installment, which in total may reach $23 million. A joint exploitation agreement between the two countries was being discussed at yearend. Negotiations have also been taking place with the Japanese to exploit offshore oil. Despite lack of capital, the Burmese seem to prefer contractural assistance rather than investment. For this and other reasons, U.S. companies have not been able to get into Burma as yet.

Offshore, as part of the aid program, the West German firm Prakla (Gesellschaft fuer Praktische Lagerstaettenforschung GmbH) of Hannover will conduct a 4,500-mile seismic survey for MOC in the Gulf of Martaban. Oil was discovered on Bilugyun Island off Moulmein in the Gulf of Martaban. The Japanese conducted seismic work off the Arakan coast. Negotiations between the Japanese Petroleum Corporation and MOC were at a stalemate, because the Japanese wanted a percentage-share arrangement whereas MOC insisted on a fixed return.

Onshore, the Mann field on the west bank of the Irrawaddy was discovered in March and shows good promise. The Prome field performed well, but Myanaung had not lived up to expectations and the Shwepyitha field proved a failure. At Chauk and Yenangyaung, Burma's two old oilfields, secondary methods were being employed. Onshore exploration covered about 6,760 square miles in fiscal year 1969–70, down from 9,220 square miles in 1968–69. MOC had 11 drilling rigs at year-

[4] U.S. Embassy, Rangoon, Burma. State Department Airgram A–257 (Annual Petroleum Report), Dec. 15, 1970, pp. 1–7.

end, with six more out of eight scheduled to arrive from the United States in 1971. The U.S. rigs and West German aid represent encouraging signs. The Upper Chindwin area, the Chin Hills, the Arakan Division, and Prome-Myanaung area were scheduled to receive the most attention in onshore exploration. Upper Chindwin looks extremely promising, but security conditions are bad. Uncertainties in Burma have made distribution most difficult, with most of the crude to refineries being shipped by water and trucks rather than by pipeline.

The Mineral Industry of Canada

By Lester G. Morrell [1] and J. Patrick Ryan [1]

In 1970, the value of Canada's mineral industry output rose an estimated $990 million [2] to a record total $5,526 million. This represents an increase of nearly 22 percent over the value of minerals produced in 1969 and marks the 12th successive annual increase. The sharp departure from the 9-percent average annual growth rate of the 1960–70 decade results from a return to "normal" following labor disputes that struck iron ore and nickel-copper producers in 1969, and to a continued uptrend in commodity prices.

Canada's per capita output of minerals is one of the highest in the world. Among nations of the world Canada ranks third as a producer of indigenous minerals; surpassed only by the United States and the Soviet Union. Canada also ranks as one of the leading exporters of minerals and metals. Since domestic requirements are geared to the needs of a relatively small population (21.5 million in 1970), about 60 percent of the crude and processed mineral products are exported to some 90 countries. In the past 10 years the value of mineral and mineral product exports grew 13 percent annually, reaching $4.7 billion in 1970. Mineral imports, principally processed metals and fuels, were valued at $1.6 billion, resulting in a favorable trade balance of about $3.1 billion; an important contribution to the national income.

According to indexes compiled by the Dominion Bureau of Statistics, the minerals industry was a major contributor to the 3-percent rise in Canada's real domestic product in 1970. Compared with rather sluggish performance in other industry sectors, the minerals index was up 16 percent, to 173.4 (1961 base=100). Indexes for agriculture, construction, and manufacturing industries were below 1969 levels. Related to gross national product (GNP), estimated at $83,200 million in 1970, minerals accounted for 6.9 percent, compared with 6.0 and 6.6 percent for 1969 and 1968, respectively.

With the exception of structural materials which were about $6 million below the 1969 level, each of the major commodity group categories contributed to the substantial increase in total value of Canada's mineral output in 1970. Metallic minerals, which normally make up about half of the national total value accounted for $2,985 million. This represented a 31-percent increase over the value of metallics produced in 1969. Nonmetallic minerals (exclusive of structural materials) were up about 11 percent to a total value of $477.5 million. Mineral fuels, as a group, recorded the greatest annual gain—over 17 percent, to a value of $1,646 million in 1970.

Of the more than 60 mineral commodities regularly produced in Canada, the following 10 accounted for 84 percent of the total value in 1970: Crude petroleum—$1,080 million; nickel—$795 million; copper—$755 million; iron ore—$564 million; natural gas (including sulfur and other byproducts)—$499 million; zinc—$370 million; asbestos—$211 million; cement—$154 million; lead—$122 million; and sand and gravel—$112 million. In addition to these indigenous mineral products, and generally excluded from official mineral statistics, Canada's internationally based aluminum industry produced primary ingot metal valued at over $600 million in 1970.

Ten of the 12 Canadian Provinces and Territories attained record mineral production levels in 1970. Ontario strengthened its perennial position as Canada's leading mineral Province and accounted for 28.3 percent of the nation's value total in 1970.

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[1] Mining engineer, Division of Nonferrous Metals.

[2] Values quoted in this chapter have been converted from Canadian dollars (Can$) to U.S. dollars. Conversion of 1970 values has been at the average annual rate of Can$1.00=US$0.958; for year 1962–69 conversion has been at Can$1.00 =US$0.925.

Alberta recorded healthy annual increases in coal, petroleum, and natural gas output and contributed 24.2 percent. The value of Quebec's production in 1970 was up 11.3 percent as a result of increased output of copper, iron ore, and asbestos; nevertheless that Province's share of the national total fell from 15.3 percent in 1969 to 13.8 percent in 1970. British Columbia reported a Provincial gain of 14 percent and accounted for 8.6 percent of the nation's total. Saskatchewan, Newfoundland, and Manitoba supplied, respectively, 6.8, 6.2, and 5.8 percent, and the two Territories and three remaining Maritime Provinces, combined, accounted for 6.3 percent of Canada's 1970 mineral production value.

General wholesale price indexes for minerals and metals in 1970 and 1969 (the latter in parentheses) compared with the 1935–39 base period were as follows: Nonferrous metals—281.0 (264.0); iron products—305.8 (285.8); nonmetallic minerals —215.7 (210.0); chemical products—225.6 (219.7). Average hourly earnings of a mining industry employee was Can$3.84 in December 1970, compared with Can$3.51 for the same month in 1969. Capital expenditures for new construction and equipment by minerals and mineral processing industries (including petroleum and gas wells) are expected to total $1,810 million in 1970, compared with $1,652 million in 1969. Metal mines, smelters and refineries accounted for expenditures totaling $890 million; industrial minerals and coal projects—$221 million; and petroleum and gas wells—$692 million.

Dividends paid by Canadian mining companies set a new record in 1970 with payments by 59 companies totalling $372 million. Payments in 1969 and 1968 totaled $322 million and $324 million, respectively. Among the largest dividend payers in 1970 were International Nickel Company of Canada Ltd. (Inco)—$100 million; Iron Ore Company of Canada Ltd. (IOC) —$31 million; Pine Point Mines Ltd.—$30 million; Noranda Mines Ltd.—$26 million; and Cominco Ltd.—$22 million. Each of 13 others paid over $5 million.

Exploration and new development activities by industry and government groups has continued throughout the year at a high level despite apprehension concerning suggested changes in taxation and foreign participation policies. Thirty-one new mines and mills began production during the year. Although widely scattered across the Dominion, most of the 1970 geological investigation and drilling activity has been in the vicinity of established mines. Aerial surveys have been the principal technique employed in remote areas of Yukon, and Northwest Territories and in northern Quebec and Ontario. Nova Scotia's offshore petroleum potential and copper and lead-zinc prospects in the Bathurst-Newcastle area and antimony deposits near Fredericton, New Brunswick, have continued to attract attention. Nearly a dozen mining companies have recently established permanent field offices in the Maritime Provinces. In Quebec, investigations by private companies and Provincial Government groups have continued at a high level in many new and established copper-nickel, copper-zinc, iron ore, asbestos, and precious metals areas. Five new mines and two reopenings were reported during 1970. Exploration for oil and gas in southern Quebec has continued. Construction programs announced in 1970 call for a copper-nickel refinery (Falconbridge Nickel Mines Ltd.) at Bécancour. Noranda Mines Limited will expand its Quebec facilities, at Noranda, Murdochville, and Montreal East estimated to cost a total of $120 million. Canadian Johns-Manville Co. Ltd. plans a $73 million expansion at its Jeffrey asbestos mine.

Indicative of the extent of exploration activity in Ontario, 40,700 mining claims were recorded in 1970 (45,850 in 1969). Approximately two-thirds of these were in the Patricia, Red Lake, Kenora, and Thunder Bay districts of northwestern Ontario. Three new names were added in 1970 to the long list of producing mines. In addition to several Dominion Government field teams, the Ontario Provincial Geological Branch carried out studies in 36 localities during the 1970 field season. Investigation of nickel-copper deposits continued in a wide area of northern Manitoba. Sherritt Gordon Mines Ltd. started production at its Fox Lake mine and continued development at the Ruttan Lake property during the year. In Saskatchewan, Gulf Minerals Company, with a West German partner, announced a $50 million project plan to start production of uranium at Wollaston Lake. Oil and gas exploration in Alberta declined generally but no fewer than 14 new gas processing plants went on stream in 1970. In the foothills area of southwest Alberta, exploration for coking coal continued at a high level and three mines, with a combined annual capacity of 1.7 million tons of coking coal started during the year. And in the Arctic, two major gas discoveries were made, on Melville and King Christian Islands, by the Government sponsored Panarctic Oils Ltd.

The intense scale of new project activity in British Columbia during 1970 may be gaged by the estimate of 70,000 claims recorded and reports of geological, exploration, and mining work on 800 properties during the year. Eleven new mines started production operations. Four of these, including the 24,000-ton-per-day Brenda Mines, Ltd., and Granduc Mines Ltd. are copper producers. Kaiser Resources Ltd. also started in 1970 with a coal production target of 3 million tons for export annually. The great increase in value of minerals produced in Yukon in 1970 is attributed to the first full year of lead-zinc-silver concentrates shipments by Anvil Mining Corporation Ltd. at Ross River.

Several recent legislative events reflecting Dominion and Provincial policy changes have been of concern to the minerals industry. On May 31, 1970, the Canadian Government abandoned its fixed exchange parity of US$0.925 for Can$1 and throughout the balance of the year, the rate floated in the range of US$0.95 to US$0.99. This resulted in a significant reduction of revenue from products exported to the United States and imposed additional cost on U.S. investors in Canadian minerals projects. The high degree of foreign, predominantly United States control of Canadian industry has continued to generate public and official controversy. According to a 1967 survey, 65 percent of Canada's minerals industry (including over 99 percent of 45 petroleum and coal companies) was owned by nonresidents. In 1970 a U.S. company proposal to acquire control of a Canadian uranium producer was denied, and the action initiated proposed legislation to effectively limit nonresident ownership of any uranium enterprise.

Pollution and jurisdictional problems have grown in both scope and intensity as subjects of interest to both Federal and Provincial legislators. The Canada Water Act, the Fisheries Act, and Northern Inland Waters Act have come under renewed scrutiny. Studies on Federal tax reform proposals originating with the Carter Commission Report (1967) and modified in the White Paper of 1968 have continued to arouse criticism. Nevertheless, the Minister of Finance has indicated that legislation implementing the new measures would be introduced in Parliament in 1971. A résumé of the proposals and their anticipated impact on the mining industry has recently been published by the Bureau of Mines.[3]

PRODUCTION

Canada's mineral production in 1970, as recorded by the Mineral Resources Branch, Department of Energy, Mines, and Resources, included a total of 62 commodities: 27 metallics, 31 nonmetallic and structural materials, and four types of fuel minerals. To this list may be added certain products for which neither quantity nor value are reported in preliminary statistics, such as alumina, aluminum metal, and ferroalloys made in Canada from imported raw materials; abrasives, lightweight aggregates, carbon black, mineral pigments, and a new product—cesium concentrates. All of the fuels and many of the metal products rose to alltime highs in 1970. More than half of the commodities listed in table 1 recorded gains over production levels of 1969.

[3] Bureau of Mines. Mineral Trade Notes. V. 68, No. 5, May 1971, pp. 18–40.

Table 1.—Canada: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Alumina e	1,000,000	1,000,000	1,100,000
Refined metal	887,862	996,162	964,576
Antimony [1]	526	372	279
Arsenic, white	r 306	154	91
Bismuth [2]	294	263	259
Cadmium [3]	2,275	2,365	1,926
Calcium ... kilograms	212,513	427,593	181,437
Cobalt [4]	1,828	1,477	2,371
Columbium concentrates (shipments) e	1,979	3,098	4,462
Copper:			
Mine, recoverable	574,532	520,039	613,263
Smelter, refined	r 475,795	407,537	492,665
Gold ... thousand troy ounces	2,688	2,545	2,338
Iron and steel:			
Iron ore ... thousand tons	r 43,040	36,337	48,271
Pig iron and ferroalloys ... do	7,756	6,954	8,433
Steel ingots and castings ... do	10,207	9,350	11,200
Rolled steel ... do	8,559	7,642	8,886
Lead:			
Mine ore and concentrates, content	326,610	300,080	357,927
Refined, primary	183,342	169,773	185,637
Magnesium	9,007	9,650	8,694
Mercury ... 76-pound flasks	r 5,700	21,200	24,400
Molybdenum	10,189	13,450	16,036
Nickel [5]	r 239,822	193,785	276,960
Platinum group ... troy ounces	485,891	310,404	461,200
Selenium ... kilograms	288,262	360,998	274,106
Silver ... thousand troy ounces	r 45,013	43,531	44,615
Tantalum concentrates	--	112	270
Tellurium ... kilograms	32,201	32,845	26,717
Thorium (ThO_2) ... do	63,136	13,161	--
Tin, mine ... long tons	160	129	125
Titanium slag (70–72 percent TiO_2)	610,415	679,737	766,305
Tungsten concentrates (W content)	1,295	1,462	1,341
Uranium (U_3O_8)	3,357	3,497	3,639
Yttrium (Y_2O_3) ... kilograms	51,406	38,756	33,100
Zinc:			
Mine ore and concentrates, content	1,155,084	1,194,234	1,239,208
Refined, primary	387,307	423,072	417,907
NONMETALS			
Asbestos ... thousand tons	r 1,370	1,462	1,500
Barite	125,245	129,936	214,096
Cement [6] ... thousand tons	7,408	7,484	7,316
Clays and products [7] ... value, thousands	$45,067	$47,328	$42,209
Diatomite (shipments)	r 777	442	e 440
Feldspar (shipments)	9,634	11,235	10,000
Fluorspar	r 91,300	119,400	124,100
Gypsum and anhydrite ... thousand tons	5,377	5,782	5,844
Lime ... do	1,306	1,483	1,475
Magnesite and brucite ... value, thousands	$2,818	$2,969	$3,450
Nepheline syenite	381,001	454,111	445,000
Potash (shipments, K_2O equivalent)	2,646,813	3,167,890	3,106,000
Pyrite and pyrrhotite (gross weight)	285,035	341,246	295,470
Salt ... thousand tons	4,413	4,225	4,583
Sand and gravel ... do	186,186	182,872	176,085
Sodium sulfate	417,005	470,193	434,000
Stone [8] ... thousand tons	68,891	61,214	64,100
Sulfur [9] ... do	r 3,862	4,506	5,233
Talc, soapstone, and pyrophyllite (shipments)	73,109	68,810	68,000
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous ... thousand tons	7,945	7,849	11,598
Lignite ... do	2,041	1,833	3,465
Coke, high-temperature ... do	4,818	4,538	5,142
Fuel briquets ... do	36	NA	NA
Natural gas ... million cubic feet	1,692,301	1,977,838	2,295,278
Peat moss ... thousand tons	266	300	288

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude ----- thousand 42-gallon barrels	379,396	410,990	455,382
Refinery products:			
Gasoline, total ----- do	149,736	156,655	164,745
Kerosine and jet fuels ----- do	28,174	31,619	35,756
Distillate fuel oil ----- do	114,412	118,208	127,756
Residual fuel oil ----- do	61,685	64,044	70,851
Lubricants ----- do	1,892	1,964	2,623
Other products ----- do	32,724	33,906	35,934
Refinery fuel and loss ----- do	27,328	27,563	29,262
Total ----- do	415,951	433,959	466,927

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 concentrates exported.

[3] Refined metal from domestic ores plus cadmium content of some exported ores and concentrates.

[4] All forms; excludes the cobalt in nickel sinter shipped to the United Kingdom by International Nickel Co., but includes cobalt in Falconbridge nickel-copper matte to Norway.

[5] Refined nickel and nickel in produced oxide and recoverable nickel in matte exported.

[6] Cement shipped or used by producers.

[7] Value including bentonite and products from common, stoneware, fire clay, and other types of clay.

[8] Includes crushed, building, ornamental, paving, and similar uses.

[9] Includes sulfur from natural gas, petroleum, tar sands, and from pyrite, pyrrhotite, and smelting of sulfide ores.

TRADE

In 1969, the latest year for which detailed trade data are available, crude minerals and fabricated mineral products exports with a total value of $3,759 million included: Metallic products—$2,569 million; nonmetallic materials—$477 million; and fuels—$713 million. The United States was the destination of 60 percent of these exports. United Kingdom took 11 percent and other countries 29 percent of the total. Total imports of minerals and mineral products during the same year were valued at $2,027. United States supplied over 52 percent of the imports; United Kingdom—4 percent; and numerous other countries—44 percent.

Table 2.—Canada: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Alumina, Al content	13,630	18,421	United States 12,210; France 2,166; Italy 1,993.
Scrap	47,232	47,099	United States 31,880; Italy 10,118; West Germany 2,577.
Pigs, ingots, wire, bars, etc	782,568	804,389	United States 370,967; Japan 118,154; United Kingdom 116,872; Republic of South Africa 35,876; West Germany 28,196.
Bars, rods, sheets, and castings	26,786	17,186	United States 6,837; New Zealand 3,428; Republic of South Africa 1,670.
Foil	253	200	United States 137; United Kingdom 32.
Fabricated materials, n.e.s	4,952	5,739	United States 3,485; Panama 513; United Kingdom 196.
Cadmium	818	765	United Kingdom 516; United States 239.
Calcium ----- kilograms	160,435	328,673	United States 300,369.
Cobalt:			
Metal	549	524	United States 357; Belgium-Luxembourg 127.
Oxides and salts, gross weight	747	544	Mainly to United Kingdom.
Columbium concentrate [1] ----- kilograms	134,211	412,113	All to United States.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Copper:			
Ore and matte, metal content	146,814	143,169	Japan 98,785; Norway 20,734; United States 11,347.
Scrap, slag, and sludge	61,368	36,547	West Germany 13,018; Spain 7,107; Belgium-Luxembourg 5,059.
Refinery shapes	250,944	190,539	United States 75,922; United Kingdom 73,313; France 13,891.
Semimanufactures:			
Bars, rods, shapes, etc	35,181	17,950	United States 8,735; Switzerland 2,262; Norway 1,300; United Kingdom 1,232.
Pipe and tubing	12,383	14,472	United States 10,489; New Zealand 737.
Wire and cable	5,057	3,171	Iran 674; Iraq 650; United States 615; Yugoslavia 363.
Iron and steel:			
Iron ore thousand tons	36,589	28,354	United States 18,451; United Kingdom 2,905; Japan 2,226; Netherlands 2,183.
Pig iron do	498	655	United States 313; Japan 128; Italy 87; West Germany 68.
Ferroalloys:			
Ferromanganese	924	5,000	United States 4,997.
Ferrosilicon	42,833	43,998	United Kingdom 25,555; United States 16,687.
Other n.e.s	581	2,921	United States 1,974; United Kingdom 503; Venezuela 377.
Steel:			
Ingots and other primary forms thousand tons	271	156	United States 115; United Kingdom 22; Japan 10.
Hot and cold rolled products do	896	629	United States 468; Mexico 25; Argentina 18.
Pipe and tubes, iron and steel do	259	157	United States 137; New Zealand 3.
Lead:			
Ore and concentrate, metal content	130,501	127,165	United States 56,437; Japan 34,299; West Germany 16,393.
Pigs, blocks, and shot	125,900	97,150	United States 41,361; United Kingdom 38,322; West Germany 6,447.
Alloys, scrap, and metal n.e.s	8,360	9,076	United States 7,940; United Kingdom 522.
Magnesium [e]	[r] 6,208	6,337	United States 2,203; United Kingdom 1,645; West Germany 606; France 491; Argentina 320.
Mercury [1] 76-pound flasks	5,625	15,546	All to United States.
Molybdenum ore and concentrate, content	10,299	11,645	United Kingdom 3,403; France 1,723; Japan 1,671; Netherlands 1,580; West Germany 1,404.
Nickel:			
Ore, matte, and speiss, metal content	86,661	69,831	Norway 32,504; United Kingdom 31,901; Japan 5,364.
Scrap	3,744	4,571	United States 2,059; West Germany 1,509; Netherlands 252; India 236.
Oxide, metal content	38,155	26,317	United States 17,681; United Kingdom 5,653.
Ingots and other refined forms	115,299	94,567	United States 78,714; United Kingdom 10,080.
Fabricated products n.e.s	3,538	2,983	United States 1,859; Netherlands 275.
Platinum group:			
Concentrates, residues and matte, content troy ounces	569,416	433,747	United Kingdom 418,832; Norway 10,108.
Scrap do	32,041	35,810	United States 15,938; United Kingdom 14,447; Japan 5,425.
Metals do	15,526	29,753	United States 21,237; Japan 4,125.
Selenium metal and salts, selenium content kilograms	357,022	395,668	United States 238,499; United Kingdom 121,064.
Silver:			
Ore and concentrate, metal content thousand troy ounces	21,502	21,883	United States 15,141; Belgium-Luxembourg 2,720; Japan 1,920.
Refined metal do	28,105	34,659	United States 33,400; Belgium-Luxembourg 825.
Tin ore and concentrate long tons	118	304	Mexico 188; United States 86.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Titanium:			
Ilmenite and ilmenite sand [1]	61,647	261,315	All to United States.
Titanium slag, 70 percent TiO_2 [1]	[r] 120,618	74,687	Do.
Uranium concentrates..value, thousands..	$24,112	$22,669	United Kingdom $13,872; West Germany $5,059; Japan $3,297.
Zinc:			
Ore and concentrate, metal content	776,384	729,979	United States 347,612; Belgium-Luxembourg 141,881; West Germany 100,656.
Blocks, pigs, and slabs	289,126	278,864	United States 133,978; United Kingdom 75,200.
Alloys, scrap, dross, etc	5,677	8,002	United States 5,733; Belgium-Luxembourg 1,552.
Fabricated materials n.e.s	6,005	5,236	United States 3,980; United Kingdom 930.
NONMETALS			
Abrasives:			
Fused alumina, crude and grains	143,895	167,789	United States 155,454; United Kingdom 12,272.
Silicon carbide, crude and grains	93,372	93,894	All to United States.
Asbestos:			
Crude	183	122	Japan 63; United States 20; Dominican Republic 18; West Germany 18.
Milled fiber, all grades thousand tons..	1,324	1,419	United States 583; Japan 142; West Germany 100; United Kingdom 92.
Barite, crude	105,679	98,529	All to United States.
Bentonite, earths and clays [1]	NA	18	Do.
Cement, portland	332,490	575,343	United States 575,266.
Clays and products....value, thousands..	$8,418	$10,339	United States $7,753; Chile $302; Sweden $195.
Fluorspar not over 97 percent CaF_2 [1]	11,284	2,091	All to United States.
Gypsum, crude..........thousand tons..	4,049	4,419	Mainly to United States.
Lime	77,350	177,046	United States 176,472.
Limestone, crude, crushed and refuse	1,548,482	1,499,068	All to United States.
Nepheline syenite	293,186	358,894	United States 330,223.
Potash materials, (muriate) [1]	2,911,269	3,364,430	All to United States.
Salt..................value, thousands..	$5,477	$4,724	United States $4,671.
Sand and gravel	450,440	415,416	United States 415,273.
Silica, quartzite	58,138	73,925	United States 73,909.
Sodium sulfate	98,869	109,238	United States 98,280; Japan 3,046.
Stone, rough building and crude, n.e.s	245,981	163,862	United States 162,977.
Sulfur, crude and refined	1,915,190	2,054,122	United States 937,898; Australia 233,123; India 219,269; New Zealand 141,116.
Talc and soapstone [1]	10,037	7,424	All to United States.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	1,312,708	1,249,985	Japan 1,048,359; United States 195,790.
Briquets, coal and coke	23,009	18,176	All to United States.
Coke, all types	138,080	250,023	United States 143,267; Netherlands 36,468; Italy 31,090.
Natural gas..........million cubic feet..	607,355	669,816	All to United States.
Petroleum:			
Crude...thousand 42-gallon barrels..	167,488	197,341	Do.
Refined products:			
Gasoline, total..........do....	412	441	United States 433.
Distillate fuel oil.........do....	2,651	3,379	United States 2,941; St. Pierre-Miquelon 433.
Residual fuel oil..........do....	2,231	2,879	United States 2,759.
Lubricants..............do....	27	19	United States 12; St. Pierre-Miquelon 4.
Liquefied gases..........do....	13,488	15,884	United States 12,606; Japan 3,274.
Other petroleum and coal products, n.e.s value, thousands..	$4,660	$3,439	United States $2,893; United Kingdom $301.

[e] Estimate. [r] Revised. NA Not available.
[1] Data given are from U.S. Imports Statistics.

Table 3.—Canada: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	2,277,397	2,259,940	Guyana 1,630,919; Surinam 483,067; Malaysia 105,694.
Alumina	771,552	964,358	Jamaica 533,471; United States 211,735; Guyana 129,449.
Scrap aluminum and alloys	14,772	14,133	All from United States.
Pigs, ingots, shot, slabs, etc	13,647	10,461	United States 7,811; United Kingdom 1,352.
Semimanufactured products	82,097	86,110	United States 79,099.
Pipe, tubes, wire, and cable	1,181	1,362	United States 1,270.
Manufactured materials value, thousands	$6,208	$5,066	United States $4,002.
Antimony oxide and salts, metal content	360	358	United Kingdom 263; United States 65.
Chromium ore and concentrate, metal content	20,323	38,034	United States 11,724; Philippines 8,291; Turkey 6,771; U.S.S.R. 5,893.
Copper:			
Ore, concentrate, and scrap, copper content	62,323	9,557	United States 9,089; Australia 229.
Blocks, pigs, and ingots	5,284	16,453	United States 16,330; United Kingdom 104.
Bars, rods, sheet, tubes, etc	1,561	2,301	United States 1,723; Japan 409.
Wire	81	482	United States 474.
Oxide and sulfate	523	1,420	United States 1,211; United Kingdom 188.
Alloys, primary and semimanufactured forms	5,014	7,941	United States 6,483; United Kingdom 713; West Germany 525.
Iron and steel:			
Iron ore thousand tons	2,794	2,297	United States 2,031; Brazil 177.
Scrap iron and steel	581,694	645,781	United States 645,733.
Pig iron	33,364	20,814	West Germany 14,727; United States 6,087.
Ferroalloys:			
Ferrochrome	13,649	22,791	Republic of South Africa 19,599; United States 2,500.
Ferromanganese	25,348	22,248	Republic of South Africa 20,552; United States 1,476.
Silicomanganese	1,219	4,136	Republic of South Africa 3,192; Norway 835.
Ferrosilicon	8,905	8,210	United States 7,252; Norway 835.
Ferrotungsten	54	95	All from United Kingdom.
Ferrovanadium	240	355	United States 107; U.S.S.R. 100; Austria 44; Netherlands Antilles 37.
Other	4,084	4,063	United States 2,595; France 699; West Germany 599.
Steel ingots and equivalent, primary forms	8,785	273,205	United States 271,920.
Iron and steel products:			
Castings and forgings	113,282	140,725	United States 123,997; United Kingdom 13,562.
Rolled steel including structurals and rails	973,411	1,444,417	United States 541,495; Japan 302,071; West Germany 138,614.
Pipes, tubes, wire, and cable	234,475	275,686	United States 98,320; Japan 65,027; United Kingdom 49,280.
Lead:			
Primary and fabricated forms	499	489	United States 357; United Kingdom 77.
Oxide	2,389	2,959	Mexico 2,144; United States 501.
Magnesium	2,180	1,835	All from United States.
Manganese:			
Ore and concentrate, manganese content	62,786	97,935	Brazil 55,291; Ghana 13,718; Congo (Kinshasa) 12,193.
Metallic manganese	2,969	2,799	Republic of South Africa 2,105; United States 482.
Mercury 76-pound flasks	2,604	1,758	Mexico 861; United States 497; Yugoslavia 208.
Molybdenum, molybdic oxide, gross weight	617	35	All from United States.
Nickel unwrought and semimanufactured including alloys	13,650	15,257	Norway 11,238; United States 3,525.
Platinum group troy ounces	207,961	118,946	United Kingdom 100,583; United States 18,363.
Silver thousand troy ounces	14,061	19,169	United States 19,131.
Sodium	7,971	8,561	United States 8,537.
Tin, blocks, pigs, and bars long tons	4,301	4,946	Malaysia 3,640; Nigeria 597; United States 574.
Titanium:			
Dioxide, pure and extended	10,913	10,121	United States 8,779; West Germany 732; United Kingdom 602.
Metallic titanium	211	344	United States 277; Japan 66.
Tungsten in ore and concentrate	60	193	United States 127; Republic of Korea 59.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Zinc:			
Pigs, slabs, blocks, anodes	1,377	700	United States 693.
Bars, plates, sheets, discs, shells	663	517	United States 309; West Germany 135; Belgium-Luxembourg 62.
Fabricated materials	525	671	United States 651.
Dust and granules	963	1,191	All from United States.
NONMETALS			
Barite, ground	7,168	5,664	United States 5,603.
Bentonite, clay and drilling mud	279,140	266,687	United States 223,307; Greece 43,380.
Cement, all types	46,721	48,440	United States 23,346; United Kingdom 9,288; Belgium-Luxembourg 7,745.
Clays ground or unground	262,642	338,429	United States 263,081; United Kingdom 75,336.
Cryolite, natural	4,117	3,474	Denmark 3,143; United States 240.
Diamond:			
Unset, thousand carats	80	90	Belgium-Luxembourg 34; Israel 27.
Industrial, do	1,070	1,252	United States 920; Belgium-Luxembourg 111.
Dust, do	344	445	United States 421; United Kingdom 12.
Diatomaceous earth	27,832	27,635	All from United States.
Fluorspar	104,748	94,694	Mexico 77,283; United Kingdom 14,524; United States 2,937.
Fuller's earth	8,210	8,842	United States 8,841.
Gypsum, crude	62,652	74,207	Mexico 71,493; United States 2,684.
Lime	22,471	37,400	United States 37,320.
Magnesium compounds:			
Dolomite, calcined	8,987	6,949	All from United States.
Magnesia, dead burned	38,485	42,891	United States 29,457; Yugoslavia 4,575; West Germany 4,395; Greece 3,056.
Mica unmanufactured	2,980	3,448	United States 3,420.
Phosphate rock, thousand tons	2,132	1,997	United States 1,992.
Phosphate fertilizers	40,461	56,842	United States 56,799.
Potash products, fertilizers	62,620	23,201	All from United States.
Salt and brine	584,366	631,072	Mexico 291,245; United States 263,691; Spain 36,617.
Sand and gravel, thousand tons	620	780	All from United States.
Silica sand, do	1,004	1,166	United States 1,146.
Sodium sulfate and Glauber's salt	22,697	26,871	United States 18,158; United Kingdom 5,085; Belgium-Luxembourg 3,599.
Stone:			
Crushed including stone refuse, thousand tons	1,252	55	United States 54.
Cut (granite, marble, slate, and other)	28,876	32,680	United States 20,715; Republic of South Africa 6,364; Italy 2,869.
Sulfur, elemental	68,778	41,284	United States 41,261.
Talc and soapstone	25,623	31,670	United States 31,255; Italy 363.
Vermiculite, crude	25,037	28,539	United States 24,412; Republic of South Africa 4,127.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bituminous materials, crude, value, thousands	$387	$252	United States $231; West Germany $14.
Coal:			
Anthracite, thousand tons	390	396	All from United States.
Bituminous and subbituminous, do	15,074	15,342	Do.
Briquets, coal and coke	5,499	5,498	Do.
Coke, all types (except briquets), thousand tons	741	893	United States 789; West Germany 55.
Natural gas, million cubic feet	88,228	37,732	All from United States.
Petroleum:			
Crude, thousand 42-gallon barrels	177,739	193,125	Venezuela 124,994; Iran 18,469; Saudi Arabia 15,638.
Refinery products:			
Gasoline, total, do	4,443	6,440	Netherlands Antilles 3,060; Italy 1,123; Panama 685.
Kerosine and jet fuel, do	10,946	8,585	Venezuela 4,012; Netherlands Antilles 3,398.
Distillate fuel oil, do	19,840	18,245	Venezuela 12,113; Netherlands Antilles 4,605.
Residual fuel oil, do	32,291	33,243	Venezuela 14,060; Netherlands Antilles 8,579; United States 8,527.
Lubricants, do	r 1,660	1,728	United States 1,334; Trinidad and Tobago 389.
Liquefied petroleum gases, do	411	772	Mainly from United States.
Other refinery products, do	r 534	717	United States 476; Panama 113; Netherlands Antilles 75.
Other petroleum and coal products, value, thousands	$6,929	$8,768	United States $6,466; United Kingdom $1,271; Netherlands Antilles $635.

r Revised.

COMMODITY REVIEW

METALS

Aluminum.—Smelter production of primary aluminum in 1970 dropped 10 percent below the record output of 1969. The loss in production, attributed to a strike at the Kitimat smelter of Aluminum Company of Canada, principal smelting subsidiary of Alcan Aluminum Limited, was partially offset by increased output at the Baie Comeau smelter of Canadian Reynolds Metals Co. Aluminum Company of Canada operated four smelters in Quebec and one in British Columbia which had a combined output of 819,000 metric tons, about 60,000 tons less than in 1969; Canadian Reynolds Metals Co. operated one smelter in Quebec and produced 152,000 tons.

Alcan's alumina plant at Arvida, which supplied the company's Quebec smelters, has an annual capacity of 1.12 million tons of alumina obtained by processing imported bauxite. Canadian Reynolds imported alumina for its Baie Comeau reduction plant largely from the Reynolds Metals Co. plant at Corpus Christi, Tex., which processes Jamaican bauxite.

Canadian imports of bauxite totaling 2.52 million tons in 1970 came largely from Guyana, Malaysia, and Surinam, which supplied 94 percent of the total. The United States and Jamaica supplied 71 percent of the 0.94 million tons of alumina imported in 1970.

Consumption of new aluminum by domestic fabricators was estimated at 242,000 tons in 1970, approximately the same as in 1969. Exports of primary and semifabricated aluminum totaled 843,514 tons, most of which went to the United States, United Kingdom, Japan, Republic of South Africa, and West Germany.

Columbium and Tantalum.—St. Lawrence Columbium and Metals Corporation's reported production of columbium pentoxide (Cb_2O_5) in pyrochlore concentrates from its mine near Oka, Quebec, was 2,272 metric tons in 1970 compared with 1,365 tons in 1969. St. Lawrence Columbium is the only Canadian producer of columbium and is one of only two mines in the world that produce columbium in pyrochlore concentrates as a primary product. The market for columbium continued favorable during 1970. The price of Canadian pyrochlore concentrates was advanced from US$1.00 to US$1.05 per pound of contained Cb_2O_5 at the beginning of the year to US$1.15 to US$1.20 per pound on July 1 and this remained the published price in the second half of the year.

St. Lawrence Columbium estimated its ore reserves at 4.7 million tons averaging 0.50 percent Cb_2O_5. Reserves based on diamond drilling at Quebec Mining Exploration Company's property near Chicoutimi, Quebec, were estimated to be on the order of 40,000 tons per vertical foot with an average grade of 0.48 percent Cb_2O_5.

Tantalum Mining Corporation of Canada Ltd. (TMCC) completed its first full year of production from its Bernic Lake, Manitoba, mine in 1970. About 270 metric tons of tantalum concentrates averaging 53 percent tantalum pentoxide were produced. Most of the concentrate was exported to the United States, supplying nearly one-half that country's tantalum requirements. Indicated ore reserves aggregated approximately 1.9 million tons averaging 0.23 percent tantalite. The company treated about 600 tons of ore per day.

Copper.—Canadian copper production, both mine and refinery, rose to record highs in 1970 following settlement of the long labor strikes late in 1969. Mine output increased 18 percent to 613,263 metric tons and refinery production was up 21 percent to 492,665 tons. The Canadian Government exercised control of the domestic price of copper during most of the year as a means of combating inflation. Prices ranged from Can$0.573 per pound in January to Can$0.590 in March, dropping to Can$0.537 in December.

Ontario continued as the leading copper-producing Province accounting for 264,813 tons, about 43 percent of the national total; Quebec contributed 26 percent; British Columbia, 16 percent; Manitoba, 8 percent; four other Provinces and two Territories accounted for the remaining 7 percent.

Nearly two-thirds of Ontario's copper output came from 11 mines operated by Inco and eight by Falconbridge. Sixteen other Ontario mines contributed about one-third of the Province's total. Quebec's copper production came from 30 mines, most of whom shipped concentrates to the Noranda smelter. Fourteen copper producers in British Columbia shipped concentrates to Japan and the United States for smelting and refining.

Several large new mine development and construction projects active in 1970 are expected to initiate production in the period 1971–73 thus assuring continued growth in Canada's copper output. Of particular significance are the expansion programs of Inco and Falconbridge in Ontario, described briefly under nickel.

In British Columbia six new large-scale open-cut mines under development in 1970 will come into production in 1971–72. The 30,000-ton-per-day operation of Gibraltar Mines Limited is scheduled for production in June 1972. Proven ore reserves at this mine were reported to be more than 200 million tons, averaging 0.39 percent copper and 0.016 percent molybdenum. Highmont Mining Corp. Ltd. with reserves exceeding 100 million tons at its Highland Valley property is scheduled for production in 1972 at a rate of 25,000 tons per day. About 68 million metric tons of 0.48 percent copper ore have been developed. Lornex Mining Corporation Ltd. continued development of its extensive Highland Valley ore body estimated to contain 293 million tons, grading 0.427 percent copper and 0.014 percent molybdenum. Production is scheduled to begin in 1972 at a daily ore milling rate of 38,000 tons per day, probably the largest single-base metal operation in Canada. Other large copper mines under development in 1970 and expected to come into production in 1971–72 include Newmont Mining Corp.'s Similkameen project at Princeton, British Columbia, scheduled for open pit mining at the rate of 15,000 tons of ore per day. Initial production of copper concentrates is expected late in 1972. Ore reserves are estimated at 69 million metric tons with an average grade of 0.53 percent copper. Noranda Mines Ltd. began construction of a 9,000-metric-ton-per-day mill and continued development of its Bell copper deposit at Babine Lake, British Columbia, for production in 1972. Ore reserves are estimated at 42 million tons, assaying 0.50 percent copper.

Refined copper shipments to domestic consumers totaled 215,760 metric tons in 1970 compared with 218,000 tons in 1969. According to 1968 data, consumption of primary copper in semimanufactured products, in percent, was: Copper sheet, strip, bars, pipe and tubes, 36 percent; brass mill products, 7 percent; wire and rod mill products, 56 percent; and miscellaneous, 1 percent.

Exports of copper in ore, concentrates and other unrefined materials, refined shapes, and semimanufactured products totaled 473,730 metric tons in 1970 about 67,730 tons more than in 1969. Nearly 70 percent of the copper contained in ore and concentrates went to Japan; about 102,000 tons of refinery shapes and semimanufactures was shipped to the United Kingdom and 99,000 tons of metal forms went to the United States.

Gold.—Production of gold continued to decline and three gold mines closed in 1970 as ore reserves were depleted. Twenty-nine lode gold mines were operating at yearend: Fifteen in Ontario, eight in Quebec, five in the Northwest Territories, and one in British Columbia. The output of these mines accounted for 78.5 percent of the total gold production; byproduct gold recovered from base metal operations accounted for 21.2 percent, and 0.3 percent came from placers.

Except for one producer (Campbell Red Lake Gold Mines Ltd.) in Ontario, which sold its gold on the free market, all gold mines that operated during the year were eligible for financial assistance under terms of the Emergency Gold Mining Assistance Act (EGMA) and sold the gold produced to the Canadian Mint. For the fiscal year ending March 31, 1970, assistance paid to 29 mines totaled Can$13.8 million. Sixteen mines received Can$10.27 per ounce, the maximum payable under the Act.

The average price paid by the Royal Canadian Mint to producers in 1970 was Can$36.57 compared with Can$37.69 in 1969. EGMA expired at yearend but the Act was later extended to June 30, 1973. Since enactment of EGMA in 1948 the number of lode mines receiving assistance declined from 87 to 29. Total payments through March 31, 1971, amounted to Can$289 million.

Iron Ore, Pig Iron, and Steel.—Reflecting stable labor conditions and a return to near-capacity operations following settlement of strikes in 1969 at mines in Eastern Canada, iron ore production (including concentrates and pellets) rose 33 percent in 1970 to a new record high. Ore shipments exceeded production by 1.7 million tons. Pig iron production (including ferroalloys) also established a new record in 1970, 21 percent greater than 1969 output.

Eighteen companies produced iron ore and byproduct iron from 19 operations in 1970, 10 of which were in Ontario, four in British Columbia, two in Quebec, two in Newfoundland (Labrador), and one in Quebec-Labrador. In Quebec and Labrador shipments by IOC totaled 18.5 million metric tons, comprising 9.8 million tons of pellets, 6.9 million tons of direct-shipping ore, and 1.8 million tons of concentrate. Quebec Cartier Mining Co. shipped about 8.0 million tons. Wabush Mines' shipments were reduced about 0.5 million tons to 4.9 million tons reflecting extensive modifications of equipment in its pellet plant. Among byproduct iron producers, Inco completed a 250,000-ton expansion of its pellet plant capacity. The company expects to increase its production rate to 950,000 tons in 1971 and attain maximum capacity rate by mid–1972. Falconbridge Nickel began tuneup operations at its new 300,000-ton-per-year reduced iron-nickel plant. The iron-nickel pellets containing 92 percent iron and 1.5 percent nickel will be used as feed for electric furnaces making alloy steels.

IOC announced plans for expansion of its iron ore pelletizing facilities at Labrador City by an additional 10 million tons per year to be completed by 1973. A new 6.0-million-ton concentrator and pellet plant at Sept Isles, Quebec, is scheduled for completion in 1974. The concentrator will upgrade 50- to 52-percent ore from the Schefferville area. Direct shipping ore may be reduced from 7.0 to 8.0 million tons to 5.0 million tons per year by 1974. IOC and the other two Quebec-Labrador producers, Quebec Cartier Mining, and Wabush Mines together accounted for 76 percent of Canada's total iron ore shipments in 1970. When IOC and Quebec Cartier's expansion plans are completed their combined annual productive capacity will be nearly 50 million tons. Adding Wabush capacity will bring total production capability to nearly 60 million tons. A large part of Canada's total known reserves of 125 billion tons of iron is in the Quebec-Labrador region.

Crude steel production comprising ingots and castings increased 1.85 million tons, nearly 20 percent more than in 1969. Steel Company of Canada Ltd. (STELCO) set a new record for steel production accounting for about 40 percent of the total Canadian output. The company reported substantial progress in its program to increase annual steelmaking and processing capacity at its Hilton Works from 4.3 to 5.4 million tons scheduled for completion in 1972. The major installations in the expansion program include; a three-furnace basic oxygen steelmaking shop, an additional bloom and billet mill, a third tinning line, and an additional battery of 83 coke ovens.

Algoma Steel Corp. Ltd. reported progress on installation of its 160-inch plate mill and expects to start trial rollings early in 1971. Construction was begun on a second basic oxygen plant scheduled for completion in 1972.

Dominion Foundries & Steel Ltd. (Dofasco) began construction of a new battery of coke ovens designed to supply coke to the company's new blast furnace. The new facilities scheduled for completion by mid–1971 will increase Dofasco's annual pig iron capacity 60 percent, to about 3 million tons. Additional steel pouring and related facilities will raise effective raw steel capacity by 35 percent.

Sydney Steel Corporation, the Crown Corporation that took over operations from Dominion Steel and Coal Corp. (DOSCO), began a $94 million modernization program at its Sydney, Nova Scotia, works which includes the replacement of open-hearth furnaces by basic oxygen steelmaking units and the installation of facilities for producing continuous cast blooms and billets.

Domestic consumption of iron ore in 1970 was estimated at 10.3 million tons, of which 8.4 came from domestic sources and 1.9 million tons came from imports. A consumption gain of about 22 percent was roughly proportional to the increase in iron and steel production over 1969. Shipments of rolled steel products to domestic consumers totaled 7.0 million tons in 1970 compared with 6.5 million in 1969. Canadian trade data for 1970 in metric tons (1969 data in parentheses) show: Imports of pig iron, 87 (20,814); steel ingots and castings, 227,251 (273,205); rolled forms, including pipe wire, rail and structural, 1,224,079 (1,720,103). Exports of pig iron, 583,000 (655,000); steel ingots and castings, 150,000 (156,000); and rolled products including pipe and tubes, 1,387,000 (786,000).

Following the pattern of preceding years the bulk of trade in iron and steel was with the United States followed by the United Kingdom.

Lead and Zinc.—Both mine production and refinery output of lead reached a new high in 1970, 19 and 9 percent, respectively, above figures recorded in 1969, thus continuing the rising trend since 1964. Zinc output continued its uninterrupted growth since 1960 as mine and smelter production again reached an alltime record. Canada ranked fourth among the world's lead-producing countries and retained its rank as the first country in zinc production. According to the Department of Energy, Mines, and Resources, 25 companies contributed to the year's output of lead while 40 were credited with zinc. Many of these companies produce both metals as well as other metals as byproducts or coproducts. A geographical percentage breakdown of mine production of lead and zinc (the latter in parenthesis) in 1970 is as follows: Newfoundland and Nova Scotia, 5.6 (2.6) percent; New Brunswick, 16.3 (12.9) percent; Quebec, 0.6 (16.4) percent; Manitoba and Saskatchewan 0.1, (5.0) percent; Ontario, 2.7 (27.4) percent; British Columbia, 28.2 (10.7) percent; Yukon Territory, 17.7 (6.4); and Northwest Territories, 28.7 (18.6) percent.

The 16-percent gain in lead production in 1970 was attributed mainly to increased output by Anvil Mining Corporation in the Yukon Territory which completed its first full year's operation. Increased output from Heath Steele Mines Ltd. in New Brunswick accounted for part of the increase. Operations were suspended by Canadian Exploration Ltd. at its zinc-lead mine and mill in British Columbia but productive operations were begun at three new base metal mines—Venus Mines Ltd. in the Yukon Territory and Silmonac Mines Ltd. and Copperline Mines Ltd. in British Columbia. Cominco Ltd. and East Coast Smelting and Chemical Co. Ltd. operating refineries at Trail, British Columbia, and Belladune, New Brunswick, respectively, were the only primary lead-metal producers in Canada. In addition to the new zinc-lead mines cited, five other new zinc-producing mines were opened: Columbia Metals (silver-lead-zinc) in British Columbia, D'Estrie and Weedon (copper-zinc) in Quebec, and Fox and Dickstone (copper-zinc) in Manitoba. Two mines, Zenmac and Canadian Exploration, closed during the year, and some production was lost because of labor disputes at Bathurst, New Brunswick, and Manitouwadge, Ontario, but these losses were more than offset by new mine production and ex-

Table 4.—Salient iron and steel statistics
(Thousand metric tons)

	1968	1969	1970
Blast furnace feed:			
Iron ore:			
From Canadian mines	280	274	159
Imported	637	456	227
Sinter, pellets, etc.:			
From Canadian mines	7,358	6,546	8,858
Imported	1,657	1,467	1,503
Made in iron and steel plants	1,223	806	1,060
Blast furnace output:			
Pig iron	7,605	6,769	8,243
Ferroalloys	151	185	190
Steel furnace feed:			
Pig iron	6,695	5,712	7,315
Scrap	4,874	4,658	5,389
Steel furnace output:			
Ingots	10,078	9,210	11,026
Castings	129	140	174
Total	10,207	9,350	11,200
Rolled steel products:			
Carbon steel:			
Hot rolled	5,923	5,287	6,250
Cold rolled and coated	2,240	2,007	2,157
Alloy steel	396	348	479
Total	8,559	7,642	8,886

panded production at a few established mines. Two large zinc-copper deposits, Nattaki in northwestern Ontario and Ruttan in northern Manitoba, were under development with production scheduled for 1972 and 1973.

Construction of an electrolytic zinc refinery adjacent to the Kidd Creek concentrator near Timmins, Ontario, was begun by Ecstall Mining Ltd. Production is scheduled to begin in 1972 at an annual rate of 110,000 tons of refined zinc, 210,000 tons of sulfuric acid and 450 tons of cadmium.

Consumption of primary refined lead in 1970 was estimated at 53,821 metric tons. Shipments of zinc to domestic consumers totaled 117,291 tons. Exports of lead in 1970 included 150,513 tons in concentrates, of which 37,213 tons went to the United States, 69,926 tons to Japan, and the remainder to West Germany and Belgium-Luxembourg; and 138,637 tons in refined forms of which 51,678 tons went to the United States and 50,999 tons to United Kingdom. Zinc exports totaled about 1,100, 200 tons, including 307,422 tons in concentrates and 110,048 tons in refined forms to the United States. About 248,000 tons in ores and concentrates went to West European countries and 94,000 tons to Japan. Nearly 96,000 tons of primary metal was shipped to United Kingdom, 9,200 tons to Greece, and 26,000 tons to India.

Mercury.—Reported production of mercury at the Pinchi Lake mine of Cominco Ltd. in British Columbia, Canada's only mercury producer, amounted to 24,400 flasks (76-pound each) from treating 354,000 tons of ore. This represented a gain of 15 percent in output of mercury in the second full year of operations. Cominco also announced that production at its Pinchi Lake property will be reduced by 25 percent in 1971.

Molybdenum.—Continuing the uninterrupted growth pattern of the 1960's, Canada's output of molybdenum in 1970 increased 19 percent to another new record. Canada continued to rank second among world producers of molybdenum, exceeded only by the United States.

Endako Mines Ltd. (N.P.L.), the leading molybdenum producer treated 9,179,000 tons of ore averaging 0.182 percent MoS_2 to produce 4,279 tons of molybdenum in molybdenum concentrate and 3,993 tons of molybdenum in molybdic oxide. Average daily milling rate was 27,858 tons per day, with a recovery of 82.4 percent. The company reported minable ore reserves at yearend of 185.0 million metric tons, averaging 0.144 percent MoS_2 in the Endako pit and 4.9 million tons averaging 0.232 percent MoS_2 in the Denak pit.

Brenda Mines in British Columbia reached full operating capacity of 22,000 metric tons of ore per day in the first half of 1970 and was a principal contributor to the gain in domestic output of molybdenum. Ore reserves were estimated at 160 million tons, averaging 0.18 percent copper and 0.05 percent molybdenum. In mid-1970 Mount Copeland mines near Revelstoke, British Columbia, came into production at a rate of 180 tons of molybdenum ore per day. Ore reserves were estimated at 163,000 metric tons, averaging 1.82 percent molybdenite. Other British Columbia producers were Brynnor Mines Ltd., which accounted for about 1,090 tons of molybdenum; British Columbia Molybdenum Ltd., with an output of about 2,490 tons; and Red Mountain Mines Ltd., near Rossland, which contributed about 320 tons. Three molybdenum producers in eastern Canada—Molydenite Corp. of Canada Ltd., Preissac Molybdenite Mines Ltd., and Gaspé Copper Mines Ltd. in Quebec—also contributed to the national total.

Lornex Mining Corporation continued construction and development work at its copper-molybdenum property near Ashcroft, British Columbia, scheduled for production early in 1972 at an annual rate of 49,000 metric tons of copper and 1,150 tons of molybdenum. Utah Construction & Mining Co. continued preproduction operations at its copper-molybdenum property near Port Hardy on Vancouver Island scheduled to treat 38,000 tons per day beginning late in 1971 or early in 1972. Ore reserves were estimated at 280 million tons, averaging 0.52 percent copper and 0.03 percent molybdenum. An annual output of 53,000 tons of copper and 860 tons of molybdenum is expected from this mine.

Exports of molybdenum in concentrates and other forms in 1970 totaled 13,759 metric tons and went to the United Kingdom (3,636 tons), the Netherlands (2,200 tons), France (2,160 tons), Japan (2,282 tons), and other countries (3,481 tons).

Nickel.—In contrast to 1969 when labor strikes cut off production from the Sudbury plants of Inco and Falconbridge

Nickel during part of the year, output of nickel in Canada was near capacity during most of 1970. With the additional production from new mines during the year total nickel production increased 43 percent reaching an alltime record. Inco opened two new mines in 1970, the Copper Cliff North and the Kirkwood and continued construction of the Clarabelle mill designed to treat 35,000 tons per day. This plant is scheduled to be operational by the end of 1971. Four mines in the Sudbury area, one at Shebandowan, and two in the Thompson area are expected to begin operations between 1971 and 1975. Falconbridge carried on development work at two mines in the Sudbury area and is preparing the Manibridge mine in Manitoba for production in 1971.

Twenty nickel-copper mines in Ontario accounted for 74 percent of Canada's nickel production in 1970. Except for Consolidated Canadian Faraday's mine at Gordon Lake in western Ontario all of Ontario's production came from the Sudbury District where Inco operated 11 mines and Falconbridge 8 mines. Manitoba accounted for 25.6 percent of the national total with most of the production coming from Inco's Thompson and Birchtree mines at Thompson. Sherritt Gordon Mines Ltd. mine at Lynn Lake produced about 16 percent of the Province's total.

Annual reports of the three integrated nickel producers disclosed the following data on shipments and ore reserves:

	1969	1970
Nickel production, deliveries (metric tons):		
Inco	r 173,319	235,315
Falconbridge	r 36,574	38,159
Sherritt Gordon	r 13,618	16,289
Ore reserves (million metric tons):		
Inco	344.3	347.6
Falconbridge	r 94.2	97.4
Sherritt Gordon	11.4	11.4

r Revised.

As part of Inco's expansion program, work continued on the design and construction of a new nickel refinery at Copper Cliff scheduled for completion in 1972. The new plant will have a capacity of 45,000 metric tons of nickel pellets and 11,000 tons of nickel powders per year. The plant will use the Inco Pressure Carbonyl process for nickel production.

Consumption of nickel in Canada increased 17 percent to about 15,400 metric tons in 1970.

Platinum-Group Metals.—The sharp gain in output of platinum-group metals reflected the return of nickel-copper producers to normal operations following settlement of labor strikes. The platinum metals are recovered as byproducts from the sludges and residues produced in the electrolytic refining of nickel and copper. Virtually all of the platinum-bearing nickel-copper ores are produced by Inco, operating 11 mines in the Sudbury District and two in Manitoba and by Falconbridge Nickel Mines operating eight mines in the Sudbury District. Inco shipped its platinum-metal sludges to its precious metals refinery at Acton, England, for extraction and separation of individual platinum-group metals. Falconbridge shipped nickel-copper matte containing precious metals to its refinery at Kristiansand, Norway. The platiniferous slimes from this refinery were shipped to Engelhard Industries, Inc. at Newark, N.J., for separation and refining of the metals.

The Canadian foreign trade pattern in platinum metals followed that of 1969 with exports contained in residues, scrap, and matte, amounting to 638,500 ounces. Nearly all of the exports went to the United Kingdom with relatively small quantities consigned to Norway and the United States. Imports of refined platinum metals totaling 60,700 ounces were received from the United Kingdom, Republic of South Africa, and the United States.

Silver.—A 2.5-percent gain in silver production, attributed to increased output of byproduct silver at base metal mines, brought Canadian silver production in 1970 to a level only 0.4 million ounces below the alltime high of 45.0 million ounces in 1968. Silver production from the silver-cobalt ores of the Cobalt-Gowganda area of Ontario decreased during the year. Canada ranked second among world silver-producing countries in 1970, exceeded only by the United States.

About 90 percent of Canada's silver production was recovered as a byproduct or coproduct from lead, zinc, and copper ores; 9 percent came from silver-cobalt ores, and the remaining 1 percent came from gold ores and placers. Of the total silver produced in 1970, Ontario accounted for 44 percent; British Columbia, 14 percent; Quebec, 12 percent; New Brunswick and

Yukon Territory contributed about 10 percent each; and virtually all of the remaining 10 percent came from five other Provinces. Significant production gains in the Yukon Territory, British Columbia, Quebec, and New Brunswick more than offset losses in Ontario, Saskatchewan, Newfoundland, and Nova Scotia.

Exports of refined silver in 1970 totaled 24.2 million ounces of which 96 percent went to the United States compared with 34.7 million ounces in 1969. In addition, Canada exported 21.0 million ounces in ores and concentrates, nearly all of which was consigned to smelters in the United States. Imports of refined silver, virtually all from the United States, totaled 4.3 million ounces, compared with 19.2 million ounces in 1969.

The Kidd Creek mine, near Timmins, Ontario, operated by Ecstall Mining, a subsidiary of Texas Gulf Sulphur Co., was again the world's largest silver producer with an output of 13.0 million ounces recovered from lead, copper, and zinc concentrates. Cominco Ltd., the country's second largest producer, reported a silver output of 6.0 million ounces, 60 percent of which came from company mines; the remaining 40 percent was recovered from ores smelted on toll.

Uranium.—The Canadian uranium mining industry continued to operate far below its potential. Production in 1970 was estimated at 3,639 metric tons of U_3O_8, about 4 percent more than in 1969. Three producers in the Elliot Lake area of Ontario—Denison Mines Ltd., Rio Algom Mines Ltd., and Stanrock Uranium Mines Ltd.—accounted for about 85 percent of the total output. Eldorado Nuclear Ltd. in the Uranium City area of Northern Saskatchewan, the fourth producer, accounted for the remainder of the 1970 production. Because current unfavorable market conditions are likely to continue, little change in Canada's uranium production is expected within the next 3 or 4 years.

Although the Federal Government's uranium stockpiling program was terminated at yearend, the Government announced that further assistance would be available to individual producers if justified by their circumstances. The Government also announced its intention to limit nonresident ownership of uranium production facilities, with certain exceptions, to 33 percent in the aggregate for established producers and to 10 percent for any single investor. Legislation to implement the new ownership policy was being prepared at yearend.

Denison operated its 6,000-ton-per-day mill near two-thirds capacity and continued to adopt measures to improve mining and milling efficiency and reduce costs. Although the company has built a surplus stock of uranium concentrates and could cease operations temporarily, it will continue to operate with government assistance during the interim period of oversupply in the market. Denison's agreement with the Goverment provides for a government expenditure of $29.5 million over 4 years and the purchase of 2,933 tons of U_3O_8 from Denison at a cost of $6.00 per pound of U_3O_8 to be shared 75 percent by the Government and 25 percent by Denison. Rio Algom operated its 4,500-ton Quirke mill near capacity on ore supplied from both the old and new Quirke mines. Mining methods were modified to increase output, reduce costs, and increase recoveries. Stanrock suspended its underground leaching operations at midyear when its sales contract was completed. Production facilities were placed on a standby basis. Eldorado continued to reduce the scale of its operations by operating its 2,000-ton-per-day mill at about 50 percent capacity treating ore from the Fay and Bolger mines. Eldorado continued to develop its Hab mine for production late in 1971. The company also installed a new agitation system in its mill that is expected to improve recovery significantly in treating the increasingly refractive ore encountered on deeper levels.

Three significant uranium sales were made in 1970 by Canadian producers. Denison's contract was extended with Toyko Electric Power Co. Inc. for 33.5 million pounds of U_3O_8 for delivery over a 10-year period, beginning in 1974. Rio Algom announced the sale of 955,000 pounds of U_3O_8 for delivery in 1972 to a West German utility. Gulf Minerals Co. announced that a market for 4 million pounds of U_3O_8 to a West German utility group was guaranteed by Uranerz-Bonn, its partner in developing the Rabbit Lake uranium deposit in Saskatchewan. Shipments will begin in 1974. Gulf also announced that construction and development work on the $50 million Rabbit Lake project was scheduled to begin in 1971. By mid-1970 about 130,000 feet of drilling had been completed. Indicated ore grades ranging from 0.18 to 0.65 percent U_3O_8 were reported but reserve data was not disclosed. Agnew Lake Mines Ltd. continued diamond drilling and underground development of its property in the Sudbury area throughout 1970 but at yearend the company announced the suspension of operations pending negotiation of a sales contract. Canuc Mines Ltd. near Denison in the Elliot Lake area completed two deep drill holes which indicated an estimated 7 million tons of material averaging 2 pounds of U_3O_8 per ton.

U.S. imports of uranium oxide from Canada during 1970 totaled 377 tons.

Canadian uranium reserves were reported by the Department of Energy, Mines, and Resources at 210,000 metric tons, an increase of 16 percent over its previous estimate in 1964.

NONMETALS

Asbestos.—Canadian asbestos mines continued to operate at peak production rates in response to strong demand. Output by 11 companies in Canada was 1.50 million metric tons, about 38,000 tons more than in 1969 and a new record. Eight mines in Quebec accounted for 82 percent of the national total.

Canadian Johns-Manville, Canada's largest producer, continued to expand production facilities at its Jeffrey open pit mine at Asbestos, Quebec, which will provide an additional 90,000 tons of fiber per year by 1975. Two mines operated by Cassiar Asbestos Corp. Ltd. in British Columbia and the Yukon Territory accounted for 12 percent. The Advocate Mines, Ltd. mine in Newfoundland and the Reeves and Hedman mines in Ontario accounted for the remaining 6 percent of Canada's asbestos production. Asbestos Corporation Ltd., operating the King-Beaver, British-Canadian, and Normandie mines and mills in southeastern Quebec has scheduled a 50-percent increase in productive capacity to 12,000 tons of ore per day in 1971. The company also is developing the Penhale ore body near Thetford mines, Quebec, and began to develop its Asbestos Hill property on Ungava Peninsula for production in 1972 at an annual rate of 90,000 tons of asbestos fiber. Cassiar Asbestos Corp. Ltd. continued to expand productive facilities at its Clinton Creek mine in the Yukon Territory which will raise fiber production 9,000 tons, to 90,000 metric tons per year. Production feasibility studies continued on the asbestos deposits of McAdam Mining Corp. at Chibougamau and Abitibi Asbestos Mining Co. near Amos, Quebec. Substantial reserves of fiber-bearing rock have been indicated on both properties.

Official trade statistics indicate that virtually all of Canada's production of asbestos was exported in 1970. The United States received 557,000 metric tons or 37 percent of the total. Among other principal destinations Japan received 218,000 tons; the United Kingdom, 91,000 tons; West Germany, 89,000 tons; and France, 66,000. Canada supplied 94 percent of United States imports of asbestos in 1970, representing about 84 percent of U.S. consumption.

Potash.—Although the basic oversupply of potash prevailing in recent years continued in 1970, the production and marketing controls established by the Saskatchewan Government late in 1969 and which became effective on January 1, 1970, brought increased prices and mine production more into line with requirements. A minimum price of Can$0.3375 per unit of K_2O equivalent was set thus establishing a price of Can$20.25 or about US$18.75 per ton for 60 percent K_2O with the Canadian dollar pegged at US$0.925. The minimum price rose after May 30 to US$19.85 after the pegged price was removed and the Canadian dollar was allowed to float. Canadian production of potash in 1970 was about 2 percent less than in 1969. Ten mines including one that started in September contributed to the 1970 potash production. Total allowable production of these mines under Provincial Government control regulations was about 45 percent of the industry's rated production capacity of 7.5 million tons per year.

Cominco Ltd. was forced to suspend mining operations at its new potash mine near Vanscoy as a result of a sudden inflow of water in one of its shafts which resulted in flooding the mine. The company was unwatering the mine at yearend and reported satisfactory progress in its rehabilitation program. Noranda Mines Ltd. reported that production at Central Canada Potash Co.'s mine near Viscount increased progressively during the year. The mill treated 1.86 million tons of ore, averaging

27.5 percent K_2O equivalent and produced 569,000 tons of products.

Hudson Bay Mining and Smelting Co. Ltd. reported that its Sylvite of Canada Ltd. division began production in September at its potash mine near Rocanville. The mine has a designed productive capacity of 664,000 tons of K_2O equivalent yearly.

Potash shipments in 1970 totaled 4.96 million tons, of which 3.84 million tons went to the United States and 1.12 million tons to offshore markets.

Sulfur.—Canadian production of sulfur in all forms reached a record in 1970, 16-percent higher than in 1969. More than 80 percent of Canada's sulfur production is recovered in the form of elemental sulfur from the processing of sour gas and is therefore a byproduct of the natural gas industry. Elemental sulfur was produced by 34 sulfur recovery plants in Alberta and one plant each in British Columbia and Saskatchewan having a combined annual capacity of 5.89 million metric tons. Four new sour gas plants in Alberta came on stream in 1970 including two which were scheduled for completion in December. Two other plants in Alberta increased capacity in 1970. Actual recovery of elemental sulfur in 1970 from sour gas was approximately 4.4 million tons, an increase of about 15 percent over 1969. Production of pyrite and pyrrhotite concentrate from mines in Quebec and British Columbia contained about 163,000 tons of recoverable sulfur. In addition, about 643,000 tons of sulfur was recovered from base metal smelter gases in the form of sulfuric acid.

The rapid increase in Canada's output of elemental sulfur in recent years has led to an oversupply situation and buildup of producers' stocks which at yearend may have exceeded 3 million tons. Reflecting the oversupply in world markets, resulting from rapid growth in output in Canada and Poland, sulfur prices f.o.b. Alberta gas-processing plants declined from $12.15 per ton in January to $7.88 per ton in August 1970.

Continued growth in demand for natural gas will bring a corresponding increase in Canada's output of involuntary byproduct elemental sulfur which could augment sulfur stockpiles and further depress prices. Five proposed new gas-processing plants and expansion of three existing plants could, when completed, bring annual production up to 6.0 million tons of sulfur by the end of 1971.

Canada's consumption of sulfur in 1969 was estimated at 1.34 million metric tons, distributed according to the industry pattern of 1968: Pulp and paper, 51 percent; chemicals, 23 percent; fertilizers, 22 percent; and 4 percent to rubber, foundry, and various other products. Exports of crude and refined sulfur to countries totaled 2,711,000 metric tons valued at $43 million. Principal destinations were United States, 1,071,000 tons; India, 347,000 tons; Taiwan, 213,000 tons, and Australia, 200,000 tons.

MINERAL FUELS

Coal.—Reversing the declining trend of the preceding 4 years, Canada's total coal (bituminous, subbituminous, and lignite) production rose sharply in 1970 to the highest level in 17 years. The 55-percent gain in output (5.38 million tons) was attributed to increased exports of coking coal to meet requirements of Japan's steel industry and to increased consumption of lignite and subbituminous coal for thermoelectric power generation. Production gains aggregating 84 percent in Saskatchewan, Alberta, and British Columbia more than offset a 24-percent loss in combined production from Nova Scotia and New Brunswick.

Kaiser Resources began full-scale production at its Sparwood mine and accounted for most of British Columbia's 1970 coal output. Because of startup and other problems in the coal preparation plant which curtailed production, Kaiser's coal shipments to Japan were about 900,000 tons below its contract requirements. In addition to its open pit operations, Kaiser began underground hydraulic mining tests and plans to mine an additional 2 to 3 million underground, if the tests are successful.

Planned modifications to the coal preparation plant to solve processing problems were begun. The company began negotiations with its Japanese customers to adjust contract prices and modify specifications. Significant additional reserves of high-quality, economically minable coal were confirmed by exploration work in the present mining area. The company's 15-year contract calls for shipments of 5 million tons per year. Kaiser entered into a contract to deliver 190,000 tons of coking coal to STELCO's plant at Hamilton marking the first movement of coking coal from western mines to an eastern market.

Fording Coal Ltd. controlled by Canadian Pacific Railroad concluded a 15-year contract with Japanese steel interests to supply 3 million tons of coking coal annually to Japan beginning in 1972. The company's new surface mining operation near Elkford, British Columbia, in the East Kootenay region will become the second largest coal mining operation in British Columbia.

McIntyre Porcupine Mines Ltd. began shipments to Japan from its Smokey River Mine at Grand Cache, Alberta, under terms of its 15-year contract covering 30 million tons of coking coal. The company plans to construct a bulk loading facility at Prince Rupert, British Columbia, subject to the firm's acquiring a contract to export 45 million tons of coking coal to Japan. McIntyre's initial coal production at Smokey River came from underground mining using longwall methods. Negotiations were begun with Japanese interests for the sale of an additional 3 million tons per year from nearby surface mining. Elsewhere in Alberta, Coleman Collieries, Ltd. increased its annual production of coking coal to 720,000 tons and announced that it had negotiated a new export contract for an additional 5 million tons for delivery over a 10-year period beginning in 1972. This will bring total coal production to about 1.7 million tons per year all for export by 1972. Cardinal River Coals Ltd. began production at its new surface mine in the Coal Branch area of Alberta and began coal shipments to Japan. Production in 1970 of about 540,000 tons was somewhat below schedule because of startup problems. The mine's production capacity is estimated at 900,000 tons per year. Several companies were actively exploring coal properties in the inner foothills belt of Alberta and major producing mines expanded operations in the plains region to meet increased demand for subbituminous coal by the electric utilities industry. Alberta Coal Ltd. began production at its Highvale mine adjacent to Calgary Power Ltd.'s new Sundance thermoelectric powerplant on Lake Wabamun. About 1.3 million tons of coal per year will be required to supply the plant's first 300-megawatt unit.

N.B. Coal Ltd., the provincially owned corporation which acquired the four remaining mines in New Brunswick, will continue a gradual phaseout of the coal mining industry in the Province. In Nova Scotia the four remaining independent coal mines received financial assistance from the Provincial Government. Cape Breton Development Corp., operating four collieries in the Sydney region on Cape Breton Island, and one at Thorburn in the Pictou area accounted for most of the Province's coal production.

Canada's national coal balance for recent years is summarized as follows:

	(million metric tons)		
	1968	1969	1970 [e]
Production	10.0	9.7	15.0
Imports:			
Anthracite	.4	.4	.4
Bituminous	15.3	15.1	16.0
Total supply	25.7	25.2	31.4
Consumption	24.5	23.6	24.9
Exports	1.3	1.3	6.2

[e] Estimate.

Source: Dominion Coal Board.

Principal statistics for the Canadian coal mining industry in 1969, as compiled by Dominion Bureau of Statistics [4] (corresponding data for 1968 in parentheses), were as follows: Number of mines 42 (49); average number of employees 6,670 (7,669); average productivity in metric tons per man-day, total 6.20 (5.57); from strip mines 26.42 (22.60); from underground mines 2.89 (2.78).

Subvention payments for the 1969–70 fiscal year, April 1 to March 31 (1968–69 in parentheses) were reported by the Dominion Coal Board [5] as follows: Total tonnage, 1.32 million (1.31 million) metric tons; total cost, $4.35 million ($3.43 million); cost per ton, $3.45 ($2.99).

According to data compiled by the Dominion Coal Board, estimated domestic comsumption of coal in 1970 was 24,892 metric tons. Approximately 66 percent of the total was used for power generation and industrial use; 29 percent for manufacture of coke and gas; 4 percent for domestic use; and 1 percent for miscellaneous

[4] Dominion Bureau of Statistics. The Coal Mining Industry for the Calendar Year 1969. Cat. No. 26–206 (annual), April 1971, pp. 18, 33.

[5] Dominion Coal Board. Annual Report 1969–70. Ottawa, Canada, 1970, p. 19.

uses. Imports, all from the United States, totaled 17.1 million tons. Exports amounted to 4.0 million tons, 3.7 million tons of which was shipped to Japan.

Petroleum and Natural Gas.—Canadian production of crude petroleum, natural gas liquids, and marketable gas, continuing its remarkable growth of the 1960's, reached new records in 1970 in response to increased demand from energy markets in Canada and the United States. Daily output of crude oil and natural gas liquids averaged 1.46 million barrels during 1970, a gain of 11.5 percent over 1969. Net withdrawals of natural gas amounted to 6.28 billion cubic feet daily, 16 percent more than in 1969. Alberta and adjoining Provinces, Saskatchewan and British Columbia, accounted for about 99 percent of Canada's oil and gas production. Alberta accounted for 79 percent of the estimated $1.6 billion total value of Canada's crude oil and gas output in 1970; Saskatchewan and British Columbia contributed 13 and 6 percent, respectively.

Exploration and development activity for oil and gas in Western Canada in terms of the number of wells drilled declined approximately 7 percent from 1969. Exploratory wells totaled 1,447, down 8 percent, and development wells totaled 1,473, down 1 percent from 1969. Exploratory success declined slightly to 26 percent, whereas development success increased about 4 percent, to 79 percent.

Of the total 6.0 million feet of exploratory drilling in 1970, about 70 percent was in Alberta. Although no major oil discoveries were made in producing areas, significant quantities of gas were discovered in the Milk River formation in Alberta and Saskatchewan.

The first oil discovery in the Canadian Arctic was made on Atkinson Point near the Mackenzie River Delta early in 1970 but subsequent drilling failed to disclose a reservoir of major proportions. Exploration drilling on the Arctic islands by Panarctic Oils, an industry-Government consortium, confirmed a gas discovery made in 1969 on Melville Island and discovered what may be a major gas reservoir on King Christian Island. Several other new drilling projects were begun on the Arctic islands during the year. Offshore exploratory drilling continued in Eastern Canada but no economic discoveries of oil or gas have yet been made.

According to data compiled by the Canadian Petroleum Association proved liquid hydrocarbon reserves in Canada at yearend, excluding nonconventional crude oil reserves in oil sands, amounted to 10,439 million barrels, 77 million barrels less than a year earlier. Proved marketable reserves of natural gas increased 1,425 billion cubic feet during 1970 to a new high of 53,376 billion cubic feet.

Nonconventional crude oil production in 1970 from the Athabaska oil sands was estimated at 12 million barrels, an average of 33,100 barrels per day. Crude oil reserves recoverable by the existing oil sands plant are estimated at 6,322 million barrels.

Mackenzie Valley Pipe Line Research, Ltd., comprised of several oil and pipeline companies, was formed to investigate problems unique to pipeline construction in Arctic regions. Tests to determine the effects of permafrost on pipelines were carried out using a 2,000-foot section of 48-inch pipeline laid in an area near Inuvik, Northwest Territories. Research studies also were initiated by a consortium comprising Trans-Canada Pipe Lines and five U.S. companies to determine the feasibility of building a 2,500-mile gas pipeline from the Prudhoe Bay area in Alaska to connect with existing pipelines near Emerson, Manitoba. The Government of Canada established guidelines governing pipeline construction in northern areas for companies planning major oil and gas transmission lines. The guidelines encompass such questions as ownership, operations, and environmental safeguards.

Exports of crude oil and natural gas, all of which went to the United States, increased about 22 and 16 percent, respectively, over 1969 exports. The Canadian Government approved additional shipments of 6,300 billion cubic feet over the next 25 years beginning in November 1970.

The Mineral Industry of Chile

By John W. Cole [1]

Political issues continued to play a major role in shaping Chilean mineral policies during 1970. After winning the September presidential election, Dr. Salvador Allende Gossans, candidate of the Popular Unity Party was inaugurated as President of Chile in October for a 6-year term. On December 22, in accord with pledges made during the election campaign, a proposed constitutional amendment was submitted to the legislature of Chile that would be the basis for expropriating all of the large copper mines.

In accordance with the agreement negotiated in 1969 between the Chilean Government and The Anaconda Company, on January 1, 1970, Anaconda exchanged a 51-percent interest in Chile Exploration Co. (Chilex) and Andes Mining Co. for dollar-repayable bonds that represent a corresponding percent of the book value of the two companies. The bonds bear 6 percent nontaxable interest and are repayable over a maximum period of 12 years, commencing June 1, 1970. Two new Chilean corporations, Cía. de Cobre Chuquicamata, S.A. and Cía. de Cobre Salvador, S.A., assumed the management of the Chilex and Andes operations.

Although the political developments portend complete take over of the mines by the Chilean Government, the Chuquicamata, Exótica, and El Salvador mines continued to operate under the management of Anaconda, under terms of a 3-year operating contract; and the El Teniente mine continued to operate under the management of Kennecott Copper Corp.

PRODUCTION

Record production levels were registered for molybdenum, and manganese. On the other hand, mine copper production decreased 1.9 percent, crude petroleum production decreased 6.9 percent and output of iron ore and rock salt decreased. Of the major copper mining companies only Cía. Minera El Salvador, S.A., achieved a significant increase in production. However, the small- and medium-sized copper producers achieved a 10-percent increase in production of copper to a record 137,700 tons.

[1] Physical scientist, Division of Nonferrous Metals.

Table 1.—Chile: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Copper:			
Mine output, metal content [2]	666,664	699,071	685,600
Metal, copper content:			
Smelter [3]	627,452	661,788	647,200
Refined: [4]			
Fire	83,181	95,819	93,200
Electrolytic	313,169	355,477	368,100
Gold mine output, metal content ... troy ounces	57,743	58,736	50,718
Iron and steel:			
Iron ore and concentrate ... thousand tons	11,916	11,534	11,265
Pig iron ... do	[r] 442	485	456
Ferroalloys ... do	10	NA	NA
Crude steel [5] ... do	570	647	547
Semimanufactures (hot rolled) ... do	432	504	NA
Lead mine output, metal content	990	832	803
Manganese ore and concentrate	23,844	23,699	26,723
Mercury ... 76-pound flasks	513	286	388

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS—Continued			
Molybdenum mine output, metal content	3,853	4,841	5,700
Silver mine output, metal content ... thousand troy ounces	3,739	3,075	2,393
Zinc mine output, metal content	1,255	1,478	1,321
NONMETALS			
Barite	3,677	8,009	4,318
Cement, hydraulic ... thousand tons	1,251	1,436	1,349
Clays:			
Kaolin	26,134	44,428	48,533
Other (unspecified)	86,202	91,636	105,461
Feldspar	975	1,304	3,600
Fertilizer materials, crude:			
Nitrates:			
Sodium	622,881	656,939	515,615
Potassium enriched	55,976	124,727	158,235
Phosphates, guano	22,612	15,269	14,894
Gem stones, lapis lazuli ... kilograms	8,200	3,151	7,800
Gypsum:			
Crude	103,063	125,038	127,267
Calcined	55,472	52,781	58,538
Iodine, elemental	1,964	2,449	2,223
Pigments, natural mineral, iron oxide	17,761	18,516	19,045
Pozzolan	156,391	175,215	161,944
Quartz:			
Common quartz	121,248	99,141	141,286
Glass sand	33,718	38,350	31,197
Salt, all types ... thousand tons	853	1,382	516
Stone, not further described:			
Limestone ... do	2,031	2,304	2,412
Marble	3,573	2,400	2,677
Sulfates, sodium:			
Natural, mined	19,391	29,383	58,330
Anhydrous, coproduct of nitrate industry	31,093	47,618	
Sulfur:			
Native, other than Frasch:			
Refined, sulfur content	41,358	46,717	47,188
Unrefined, sulfur content	21,615	51,943	60,712
Sulfur content of acid derived from pyrite and industrial gases	12,122	13,535	9,281
Talc	2,813	809	640
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous and lignite ... thousand tons	1,611	1,704	1,514
Coke, coke oven ... do	304	317	[e] 320
Gas, natural:			
Gross production ... million cubic feet	246,784	263,790	269,392
Marketed ... do	68,298	79,952	94,325
Natural gas liquids, gross production:			
Condensate ... thousand 42-gallon barrels	1,216	1,185	1,087
Natural gasoline ... do	499	444	395
Liquefied petroleum gases [6] ... do	1,468	1,408	1,288
Petroleum:			
Crude ... do	13,696	13,350	12,432
Refinery products:			
Aviation gasoline ... do	[r] 289	225	178
Motor gasoline ... do	[r] 8,465	9,583	9,676
Jet fuel ... do	--	136	481
Kerosine ... do	[r] 2,457	2,543	2,727
Distillate fuel oil ... do	[r] 4,582	4,477	4,461
Residual fuel oil ... do	[r] 7,473	7,748	6,131
Liquefied petroleum gas ... do	[r] 1,685	1,973	1,503
Asphalt, refinery ... do	[r] 40	56	45
Solvents ... do	[r] 26	26	24
Other ... do	398	474	492
Refinery fuel and losses ... do	1,021	1,171	1,493
Total ... do	26,436	28,412	27,211

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

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 Series revised from that given in previous editions; 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 Series revised from that given in previous editions; 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: 1968–19; 1969–20; 1970–60.

TRADE

Customs data indicated that the value of Chile's trade in mineral commodities during 1969 increased considerably compared with that of 1968 because of the higher value of copper. Trade in all commodities also increased. The net trade balance for mineral commodities was favorable, as the relatively large net increases in dollar value of exports compensated for the increase in imports.

Mineral commodities continued to dominate the country's export trade, accounting for almost 90 percent of the total value. The customs value for all forms of unmanufactured copper and copper-bearing raw materials exported totaled $772.2 million [2] compared with $716.4 million in 1968, and represented 72 percent of total exports.

A tabulation comparing 1968–69 trade in mineral commodities and total trade follows:

	Value (million dollars)	
	1968	1969
Exports:		
Mineral commodities:		
Metals	816.1	924.0
Nonmetals	25.0	36.5
Mineral fuels	.9	.7
Total	842.0	961.2
All commodities	940.8	1,075.4
Imports:		
Mineral commodities:		
Metals	22.9	38.8
Nonmetals	25.6	34.6
Mineral fuels	47.3	65.5
Total	95.8	138.9
All commodities	742.7	907.1
Net trade balance:		
Mineral commodities	+746.2	+822.3
All commodities	+198.1	+168.3

[2] Where necessary, values have been converted from Chile Escudo (CEsc) to U.S. dollars at the rate of CEsc 12.21=US$1.00.

Table 2.—Chile: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum including alloys, all forms	5	13	Mainly to Netherlands.
Copper:			
Ore and concentrate	11,251	12,399	West Germany 5,967; Japan 3,500.
Precipitate	--	1,065	All to Japan.
Slag, ash and residues	854	227	Japan 117; Spain 109.
Copper sulfate	518	1,279	Mainly to Brazil.
Metal including alloys:			
Unwrought:			
Unrefined:			
Precipitates including cement	21,630	21,304	Spain 11,047; Japan 10,155.
Blister	224,931	188,930	United States 83,718; United Kingdom 36,944; Japan 28,151.
Refined	382,288	374,843	United Kingdom 72,881; Netherlands 63,625; Italy 43,223; France 42,921.
Semimanufactures	10,747	25,715	Argentina 13,539; United States 4,729.
Gold ore and concentrate	29,683	36,913	Mainly to West Germany.
Iron and steel:			
Ore and concentrate ______thousand tons	10,497	9,645	Japan 7,374; United States 1,887.
Roasted pyrites	--	10,063	All to Argentina.
Slag	4,509	18,252	All to United States.
Metal:			
Ferroalloys	1,482	1,090	Mainly to Republic of South Africa.
Steel, primary forms	18,305	3,479	Mainly to Ecuador.
Semimanufactures	13,574	2,182	Peru 775; Bolivia 616; Argentina 423.
Lead ore and concentrate	--	383	All to Netherlands.
Manganese ore and concentrate	2,540	1,709	All to West Germany.
Mercury ______76-pound flasks	44	--	
Molybdenum:			
Concentrate	5,822	2,736	West Germany 858; United Kingdom 588; Netherlands 421.
Oxide, all grades	1,162	1,240	Mainly to Austria.
Nickel scrap	--	23	Mainly to Netherlands.
Silver:			
Ore and concentrate	43,666	50,216	Mainly to West Germany.
Metal ______troy ounces	--	193	All to Belgium-Luxembourg.
Zinc scrap, ash, residues	637	240	Do.
Other:			
Ore and concentrate	--	18,057	Mainly to United States.
Metal bearing slag, n.e.s	1,883	114	Japan 87; Spain 27.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS			
Boron materials, crude natural borates	410	96	Brazil 50; Uruguay 46.
Cement	5,032	65,586	Argentina 49,396; Brazil 13,699.
Fertilizer materials, crude natural nitrates:			
Sodium	458,242	462,288	United States 162,799; Netherlands 97,310; Spain 79,646.
Potassium enriched	58,350	75,517	United States 45,780; Brazil 12,166; Netherlands 10,300.
Iodine	2,028	2,603	United States 1,177; Netherlands 842; West Germany 211.
Precious and semiprecious stones, lapis lazuli kilograms	5,110	8,619	West Germany 5,232; Italy 1,903.
Salt	681,304	855,553	United States 538,250; Japan 317,303.
Sulfur, elemental	--	100	All to United States.
Other, n.e.s value	$1,525	$1,259	Mainly to Venezuela.
MINERAL FUELS AND RELATED MATERIALS			
Coal	1,111	1,018	All to Bolivia.
Natural gas liquids thousand 42-gallon barrels	336	254	Mainly to Argentina.
Other, n.e.s value	$6,312	$4,557	All to Argentina.

Source: Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile, 1968 and 1969.

Table 3.—Chile: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	852	2,033
Oxide (alumina) and hydroxide	111	407
Metal including alloys:		
Scrap	15	19
Unwrought	3,178	3,816
Semimanufactures	1,139	274
Antimony	80	140
Arsenic:		
Trioxide, pentoxide, and acids	46	100
Metal	15	--
Cadmium	3	7
Chromium:		
Chromite	168	527
Oxides and hydroxides	78	43
Copper including alloys, all forms	151	257
Gold unworked and partly worked troy ounces	r 815	7,443
Iron and steel:		
Metal:		
Scrap	(1)	3,719
Pig iron including spiegeleisen	2,760	624
Sponge iron, powder and shot	132	320
Ferroalloys:		
Ferromanganese	2	--
Other	299	709
Ingots and other primary forms	r 44	26,729
Semimanufactures:		
Bars and rods	2,674	4,769
Angles, shapes, sections	7,076	9,244
Universals, plates, sheets	4,360	27,688
Hoop and strip	636	337
Rails and accessories	r 6,222	12,068
Wire	750	477
Tubes, pipes, fittings	r 8,089	13,455
Alloy and high-carbon steel	4,742	10,541
Lead:		
Oxides	21	6
Metals including alloys:		
Scrap	47	177
Unwrought	1,941	2,414
Semimanufactures	1,050	697
Mercury 76-pound flasks	23	1
Nickel:		
Matte, speiss and similar materials	5	7
Metal including alloys, all forms	204	111
Platinum group including alloys troy ounces	--	1,051

See footnotes at end of table.

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

Commodity	1968	1969
METALS—Continued		
Selenium, elemental ... kilograms	3,375	458
Silver including alloys ... troy ounces	10,836	25,232
Tin:		
Oxides ... long tons	4	4
Metal including alloys, long tons ... do	689	720
Titanium oxides	2,542	2,845
Zinc including alloys:		
Scrap and blue powder	39	41
Unwrought	2,924	5,291
Semimanufactures	76	115
Zirconium:		
Ore and concentrate	162	714
Zirconium silicate	--	20
Other:		
Ore and concentrate ... value	$4,683	$7,803
Ash and residue containing nonferrous metal ... do	$3,439	$151,729
Oxides, hydroxides and peroxides of metals n.e.s ... do	$100,261	$341,255
Metals including alloys, all forms n.e.s ... do	$45,719	$180,342
NONMETALS		
Abrasive stone, powder, and grain n.e.s	441	484
Asbestos	8,657	10,815
Barite and witherite	27	16
Cement	16,334	34,248
Chalk	2	2
Clays and products (including all refractory brick):		
Crude n.e.s.:		
Bentonite	8,943	3,701
Fuller's earth	105	12
Kaolin	203	411
Other	277	513
Products:		
Refractory (including nonclay brick and cement)	10,822	18,933
Nonrefractory	152	40
Cryolite	17	13
Diamond, industrial ... carats	r 20,800	18,050
Diatomite and other infusorial earths	362	408
Feldspar	12	20
Fertilizer materials crude and manufactured:		
Nitrogenous	45,506	48,688
Phosphatic	186,877	197,668
Potassic	29,014	47,834
Other including mixed	2,001	289
Ammonia	70	343
Fluorspar	495	2,966
Graphite, natural	68	98
Lime	34	50
Magnesite	6,998	2,823
Mica, all forms	198	114
Pigments, mineral including processed iron oxides	123	156
Pyrite	122	--
Salt	r 56	24
Sodium and potassium compounds, n.e.s.:		
Caustic soda	15,059	17,778
Caustic potash, sodic and potassic peroxides	126	198
Stone, sand and gravel:		
Dimension stone	46	48
Dolomite	86,629	29,497
Other	109	251
Sulfur:		
Elemental, all forms	38,586	50,763
Sulfuric acid	18	21
Talc, steatite, soapstone, and pyrophyllite	135	603
Other:		
Oxides and hydroxides of magnesium, strontium and barium	104	87
Other n.e.s ... value	$103,044	$151,729
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	201	227
Carbon black and gas carbon	3,391	4,854
Coal, all grades including briquets	208,643	582,784
Coke and semicoke	--	61
Hydrogen, helium, and rare gases	89	134
Natural gas liquids ... thousand 42-gallon barrels	169	290
Peat including peat briquets and litter	17	24
Petroleum:		
Crude ... thousand 42-gallon barrels	12,109	14,464

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS—Continued		
Petroleum—Continued		
Refinery products:		
Gasoline	r 225	192
Kerosine and jet fuel	r 639	801
Distillate fuel oil	r 340	563
Residual fuel oil	r 1,634	1,326
Lubricants	r 301	334
Mineral jelly and wax	r 57	232
Other	r 141	73
Mineral tar and crude chemicals, from coal, petroleum, and natural gas	r 533	445

r Revised.

1 Less than ½ unit.

Source: Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile, 1968 and 1969.

COMMODITY REVIEW

METALS

Copper.—Mechanical failures, particularly in the smelting divisions of Chuquicamata and El Teniente, contributed to the failure of the major mines to increase production. Because of difficulties with smelting furnaces at Chuquicamata, The Anaconda Company was not able to meet its commitments for delivery of Chilean copper during the early part of the year.

El Teniente operations were closed by a 19-day labor strike ending April 10. The company mined and milled a record 13.6 million metric tons of ore with an average copper content of 1.695 percent. Although the tonnage milled was higher than in 1969, the grade was lower, and the total copper output, according to preliminary official data, was 108,458 metric tons of blister copper and 65,364 tons of fire-refined copper for a total of 173,822 tons. This was a decrease of 12,395 tons,[3] or 7 percent, from the record output in 1969.

In 1970, Chuquicamata produced 209,924 metric tons of electrolytic copper and 57,806 tons of blister copper, compared with 207,200 and 73,712 tons, respectively, in 1969. Apparently the decrease in blister copper output was caused by malfunctions of two of the smelting furnaces that were closed down for 2 months for repairs early in 1970.

Cía. de Cobre El Salvador operated without significant interruptions and produced 23,610 metric tons of blister copper and 69,476 tons of electrolytic copper, for a total of 93,086, compared with 1969 production of 18,451 and 58,740 tons, respectively, for a total of 77,191 tons.

Although production of copper began at the new Rio Blanco mine of Cía. Minera Andina, S.A., owned 70 percent by Cerro Corp. and 30 percent by the Chilean Government, difficulties connected with block caving prevented output from achieving capacity proportions, and the mine did not contribute significantly to output of copper in Chile.

On June 30, 1970, Continental Copper and Steel Industries, Inc., reported that its subsidiary Minera Sagasca S.A. had contracted with Ralph M. Parsons Co. (Chile) S.A. and Parsons-Jurden Corp. to complete design and engineering, and to proceed with construction of mining and leaching facilities at the Sagasca copper property, 105 kilometers east of Iquique, in Tarapacá. A 37-kilometer, heavy-duty road has been completed from the mine to the public highway. Construction has begun on a town site adjacent to Pozo Almonte, midway between the mine and Iquique, to house Sagasca employees and their families. A large storage area is being prepared at the port of Iquique with a railroad siding to facilitate rapid loading and unloading of bulk cargoes of sulfur and iron scrap, which will be used in production of copper precipitates.

Stripping of the ore body and construction of leaching facilities, including a 400-ton-per-day sulfuric acid plant, have begun. The mine should have started production at the rate of 23,000 tons per day of copper in precipitates by November 1971. Sagasca is owned by Continental

[3] Quantities of copper given here and elsewhere in this review represent fine copper content of the product indicated.

Copper and Steel Industries, Inc., 59 percent; Corporación del Cobre (CODELCO), 25 percent; International Finance Corp. (IFC), 15 percent; and various individuals, 1 percent. The $32.5 million cost of the project is being financed by Continental, CODELCO, IFC, and a consortium of Japanese smelting companies which have contracted to purchase the output of the mine.

The Chilean Government's development corporation, Corporación de Fomento de la Producción (CORFO), recently announced that it will invest in the development of the Maria Soledad copper property in Atacama, covering 21 square kilometers. Incomplete exploration indicated an ore body 50 meters down, containing 1 to 1.5 percent copper. Production is expected to reach 20,000 metric tons of copper per year. An additional report on January 30, 1970, announced that a 5-year mapping and exploration plan of mineral resources of Tarapaca and Antofagasta will be undertaken by CORFO's Departamento de Investigaciones Geologicas.

At the end of 1969, the status of completion of production expansion at the five large copper mines was as follows: The $247 million expansion of El Teniente mine, 66 percent complete; the $114 million expansion of the Chuquicamata mine, 75 percent complete; the $157 million new Río Blanco (Andina) mine, 77 percent complete; the new $44 million La Exótica mine, 83 percent complete; and the $12 million expansion of the El Salvador mine, 95 percent complete.

On April 7, 1970, the Government of Chile announced a new 3-year plan (1970-72) for Empresa Nacional de Mineria (ENAMI) to increase the output of small-and medium-size copper producers. The investment of $85 million on existing and new facilities is expected to create 5,000 new jobs and contribute $31 million yearly to the balance of payments in copper exports after 1972. Financing will come from private and public domestic sources and foreign credits. Banks and financial institutions from the United Kingdom, Germany, and Belgium will provide ENAMI with $40,661,000 in credits repayable in 13 years (with a 3-year grace period) at 5.5 percent interest. The 3-year plan includes the following goals:

1. Increasing ENAMI's annual blister copper production from 60,000 to 100,000 tons through the expansion of smelting facilities at Las Ventanas and Paipote.

2. Increasing annual production at Las Ventanas electrolytic refinery from 34,000 to 112,000 tons.

3. Building a sulfuric acid plant with a capacity of 180 tons per day at Las Ventanas and another plant at Paipote with a 120-ton-per-day capacity.

4. Building treatment plants at—

Baquedano (Antofagasta) to treat copper oxides and produce 11,720 tons of fine copper yearly, mostly as precipitates.

Calama to treat copper oxides and produce 4,000 tons of fine copper yearly as precipitates.

El Salado (Chañaral) to produce 11,950 tons of fine copper per year, primarily as precipitates.

Rio Salado to concentrate the tailings from El Salvador copper mine and produce 7,200 tons of fine copper per year as concentrates.

Paipote to treat 500 (later 1,000) tons of oxide and mixed minerals per day.

Vallenar to produce 2,000 tons of fine copper per year as precipitates and 2,200 tons as concentrates.

Combarbalá to produce 1,120 tons fine copper per year as precipitates and 1,250 tons as concentrates.

5. Expanding and improving ENAMI's treatment plant at Mantos de la Luna (Tocopilla), and increasing the production capacity of the Manuel A Matta, Domeyko, and Cabildo plants for sulfurous minerals from 13,740 to 21,500 tons of fine copper per year.

6. Improving facilities at ENAMI's mineral-purchasing centers.

7. Financing the installation of privately owned treatment plants to produce 5,900 tons of fine copper per year.

8. Continuing with plans to form joint ventures between ENAMI and private mine owners to finance the building of treatment plants at Tambillos (Coquimbo) and Cutter Cove (Magallanes), each treating 400 tons of minerals per day.

Since ENAMI's 5 year development plan in 1966, the organization has expanded and improved its facilities and invested over $29 million from 1966 to 1969. Blister copper production almost doubled from 1964 to 1965 and grew at the rates of 20 percent in 1966, 9.7 percent in 1967, 8.2 percent in 1968, and 10.7 percent in 1969.

Electrolytic copper was first produced in 1966 at the Las Ventanas electrolytic refinery, but production had already exceeded the refinery's rated capacity of 84,000 tons per year by 1969. The new 3-year plan is expected to strengthen ENAMI's present position as the most important copper producer outside the Gran Mineria.[4]

Iron Ore.—Production of iron ore continued during 1970 at about the same level as in 1969. Development of the Cerro Negro Norte mine near Caldera, owned by Cía. Minera Santa Bárbara, S.A., and the Santa Clara deposits in the departments of Chañaral and Copiapó, owned by Cía. Minera Santa Clara S.A., a 50–50 joint venture of Ataka & Co. Ltd. and Mitsubishi Mining Co., Ltd. of Japan, was delayed. Nevertheless, plans are being made for shipment of 1 million tons of Cerro Negro Norte ore to Japan in 1974, and 1.6 million tons of Santa Clara ore to Japan in 1972, to be increased to 2.4 million tons in 1973, and thereafter.

Iron ore shipments during 1970 by Bethlehem-Chile Iron Mines Co. through the ports of Guayacán (El Romeral ore) and Cruz Grande (El Tofo ore) were reported as follows, in metric tons:

Romeral Division:	
Furnace ore to United States	457,434
Furnace ore to Japan	974,494
Furnace ore to CAP steel mill	838,297
Local sales	18
Total	2,270,243
Tofo Division:	
Furnace ore to United States	265,544
Fines to United States	154,616
Local sales of fines	516
Total	420,676

Source: Skillings' Mining Review. V. 60, No. 11, Mar. 13, 1971, p. 11. (Original data in short tons converted at factor of 1 short ton equals 0.907185 metric tons.)

During 1970, Cía. de Acero del Pacífico, S.A., (CAP) produced 3,215,386 metric tons of ore at the Algarrobo mine, compared with 3,225,944 tons in 1969. Cía. Minera Santa Fe and Cía. Minera Santa Bárbara shipped a combined total of 4,675,000 metric tons of iron ore produced at their Chilean operations. The major part was shipped to Japan, but shipments also were made to the United States, Europe, and Argentina. Cía. Minera de Atacama Ltda. shipped a total of 454,930 metric tons of iron ore from the port of Calderilla. The 12 cargoes of ore were shipped to Japan in a 37,000-ton vessel.

Iron and Steel.—On December 22, the Government of Chile, represented by CORFO, and the stockholders of CAP, reached an agreement by which CORFO bought 37 million shares (almost 48 percent of the company's total) owned by private shareholders. As a result of the transaction, CORFO acquired 100-percent ownership of CAP. The cost to CORFO was estimated to be $7.6 million. The shareholders (11,799) were compensated according to the size of their holding. Those holding less than 1,000 shares were paid immediately at Esc. 3.20 per share ($0.26). Terms became progressively less favorable, so that for the largest stockholders (those owning more than 60,000 shares) payment will be made at Esc. 2.20 per share ($0.18) in 7 percent interest paying readjustable CORFO bonds over an 8-year period.

CAP announced that expansion plans to cost about $170 million are expected to lift the capacity of the Huachipato steel plant from its present 650,000 tons of steel to about 1 million tons in 1974.

CAP produced 456,000 metric tons of pig iron in 1970, compared with 485,000 tons in 1969, and 547,000 tons, of ingot steel compared with 647,000 tons in 1969.

NONMETALS

Nitrates.—Total nitrate production was 673,850 metric tons, down from 781,666 tons in 1969. However, production of the higher value potassium-enriched product increased from 124,727 tons in 1969, to 158,235 tons in 1970. At the end of 1970 the only producer, Sociedad Química y Minera de Chile, S.A. (SOQUIM), was owned 62.5 percent, by Compañía Salitrera Anglo-Lautaro and 37.5 percent by CORFO. Notwithstanding continued losses in 1969 and 1970 of $9.5 million and $11.5

[4] The Anaconda Company. 1970 Annual Report, 32 pp.
Cerro Corp. 1970 Annual Report, 20 pp.
Continental Copper and Steel Industries, Inc. 1970 Annual Report, pp. 5–6.
International Finance Corp. (IFC). 1970 Annual Report, 19 pp.
Kennecott Copper Corp. 1970 Annual Report, 37 pp.
U.S. Embassy, Santiago, Chile. State Department Airgram A–182, Apr. 29, 1970, 3 pp.
———. State Department Airgram A–258, July 1, 1970, 10 pp.
———. State Department Telegram 329, Jan. 26, 1970, 1 p.

million, respectively, SOQUIM has proceeded with its $25.5 million improvement program began in 1968.

Salt.—Production of salt declined to 516,000 tons from the record 1,382,000 tons produced in 1969. The decline was attributed to a decrease in output by Cía. Minera Santa Andriana S.A. (COMISA). An increase in ocean freight charges from $3 to $7 per ton had made it impossible to cover operating costs. It was announced late in 1969 that Diamond Crystal Salt Co. had purchased 42.5 percent of the stock of COMISA. The remainder is owned by Marcona Corp. (42.5 percent) and Chilean investors (15 percent). The easing in demand for ocean freight space in 1971 may allow Diamond Crystal to proceed with plans to stockpile Chilean rock salt at selected locations on the east coast of the United States for winter deicing use.[5]

MINERAL FUELS

Coal.—As a result of decreased demand for coal for production of electric power, coal stockpiles continued to increase during 1970, and production of coal decreased 11 percent from that of 1969.

Petroleum and Natural Gas.—Chile's crude petroleum production is entirely from onshore pools in Magallanes Province. Annual output from these fields apparently attained a maximum in 1968 and has fallen more than 9 percent in the last 2 years. Exploration in other parts of the country have thus far failed to locate other potential onshore sources. In 1970 a cooperative project was approved between the United Nations Development Program (special fund) and the Chilean Government to explore for offshore petroleum deposits off south-central Chile and the eastern part of the Strait of Magellan, between producing fields on the continent and Tierra del Fuego.

During 1970, Empresa National del Petróleo (ENAP) continued its drilling and other exploratory work in Magallanes and the central part of Chile. Seismic crews working in Magallanes logged 246 kilometers of reflectivity profiles and 107 kilometers of refractivity profiles. Drilling activity again declined with completion of 66 wells totaling 147,220 meters, compared with 75 wells and 158,390 meters in 1969. Drilling completed in 1970 is tabulated as follows:

Type of well	Number of completions			
	Petroleum	Gas	Dry	Total
1969:				
Exploration	2	2	15	19
Extension	1	3	8	12
Development	22	5	17	44
Total	25	10	40	75
1970:				
Exploration	1	1	16	18
Extension	--	--	6	6
Development	17	9	16	42
Total	18	10	38	66

ENAP reported gross withdrawal of natural gas increased 2.1 percent to a record of 269,392 million cubic feet: 51.9 percent was produced from fields on the mainland and the remainder, from fields on Tierra del Fuego. Posesión field (mainland) remained the largest producer, yielding 27.6 percent of the total; followed by Cullen (Tierra del Fuego), 12.4 percent; and Daniel (mainland) 8.0 percent. Approximately 89.4 percent of the gas withdrawn at Posesión was reinjected, 90.5 percent was reinjected at Cullen and 70.0 percent was reinjected at Daniel. Sixty-five percent of gross withdrawals was reinjected into all fields.

The total volume of gas treated at gas-processing plants at Posesión, Cullen, and Manantiales (Tierra del Fuego) declined 4.9 percent, accompanied by a 6.7-percent decrease in the recovery of natural gas liquids. Exports of liquefied propane and butane (to Argentina) amounted to 155,861 barrels, a decrease of 30.2 percent from revised 1969 exports. Imports of liquefied petroleum gas increased to 1,000,000 barrels, compared with 290,000 barrels in 1969.

During 1970, 677 million cubic feet of natural gas was delivered to the ENDESA powerplant and other users in Punta Arenas.

Work continued on construction of the two-plant, gas-processing complex at Posesión and Cabo Negro. Both were expected to be operating at the end of 1970. The plant at Posesión will have the capacity to extract the LPG fractions from 8.5 million cubic meters per day of natural gas. The LPG will be transported to Cabo Negro by pipeline where it will be treated in a new fractionation plant and the products

[5] Cyprus Mines Corp. 1970 Annual Report, 31 pp. Diamond Crystal Salt Co. Annual Report, Mar. 31, 1971, 2 pp.

shipped from port facilities equipped to handle ships up to 50,000-ton capacity.

Crude petroleum production declined 6.9 percent, to 12,432,000 barrels. Daily production averaged 34,059 barrels. Three major fields registered increases as follows: Calafate, 8 percent; on Tierra del Fuego and Daniel 13 percent; and Daniel Este, 3 percent; on the mainland. However, the increases were offset by decreases at Cañadón, 30 percent; Catalina Sur, 33 percent; Cullen, 17 percent; and other smaller fields. A comparative table of production by field for 1969–70 follows:

Location and field	Production (thousand 42-gallon barrels)	
	1969	1970
Mainland:		
Daniel	1,765	1,995
Daniel Este	1,391	1,432
Cañadón	1,323	922
Posesión	1,185	1,087
Others	593	507
Total	6,257	5,943
Tierra del Fuego:		
Calafate	2,043	2,209
Cullen	1,597	1,322
Catalina Sur	854	564
Tres Lagos	719	729
Others	1,880	1,665
Total	7,093	6,489
Grand total	13,350	12,432

ENAP refineries continued to supply the major part of the liquid fuels consumed by Chile. The total volume of crude processed was 4.2 percent less than in 1969. Imported crude accounted for 55 percent of the 1970 total, slightly more than in 1969. The Conoón refinery near Valparaiso processed 16,569,400 barrels, of which 77 percent was of foreign origin. The Concepción refinery processed 10,531,400 barrels, of which 20.7 percent was of foreign origin. The small topping plant at Manantiales processed 492,139 barrels of Chilean crude.[6] The net production for sale of the two large refineries for 1970 is shown in the following tabulation.

[6] Empressa National del Petroleo (ENAP). 1969 Annual Report, 16 pp.

Production	Net production (thousand 42-gallon barrels)	
	Concón	Concepción
Aviation gasoline	178	--
Other gasoline and naphtha	5,722	4,173
Jet fuel	481	--
Kerosine	1,392	1,335
Distillate fuel oil	2,795	1,657
Residual fuel oil	4,094	2,037
Liquefied petroleum gas	543	960
Other	345	9
Total	15,550	10,171

The Mineral Industry of Mainland China

By K. P. Wang [1]

Mainland China continued to be an important mineral producer by world standards, with the overall 1970 mineral output value surpassing that of any single year during the 1960's. At yearend 1970, the trend was up and the Chinese Communists were forecasting an even better year for 1971. The disastrous economic setback created by the Cultural Revolution was fully overcome, and China was once again making significant headway in capital construction and in mine and industrial development. It was also evident that the country was at least starting to establish more economic ties abroad.

The People's Liberation Army (PLA) continued to play a vital role in maintaining law and order, which had a profound effect on the economy, transportation, and mineral production. In a new constitution soon to be ratified, there is a provision that calls the PLA "forever a fighting force, and at the same time both a work team and a productive team."[2] The Revolutionary Committees and Alliances organized with the help of PLA during the Cultural Revolution were institutionalized as a long-term part of the state structure. PLA's unprecedented access to management of the economy had shown considerable success, particularly in the second half of 1969, when factionism and anarchism were brought under control. To spur industrial production, a national emulation campaign was initiated at the Peking steelworks in September 1969, with the thought to use this enterprise as a success model for other industries and mines to emulate. Such factors contributed towards optimism with regard to the state of the economy, and the third 5-year plan, initiated in 1966, was said to have been successfully concluded. The fourth 5-year plan was to commence in 1971.

China's economic policy in 1970 embodied the basic concept that agriculture should be considered as the foundation and industry an indispensable factor of the economy. Accordingly, large amounts of fertilizers were used to make 1970 a very good crop year. The industrial policy of developing small and medium enterprises along with large enterprises continued in 1970. The Chinese claim that roughly a third of the national industrial capacity is within the small and medium enterprise sector. The policies of 1969 were continued in 1970, and the fourth 5-year plan is scheduled to embrace the same concepts. The tempo of economic development under the new plan, however, is due to accelerate.

Concern over confrontation with the Soviets eased somewhat during the year, although the apparent policy to stockpile materials and decentralize industries continued. In fact, under the fourth 5-year plan, it is evident that the timetable for decentralization and industrialization of the interior will be moved up. In this regard the old Penhsi Steelworks in Manchuria, for example, reportedly dispatched 10,000 workers to help develop new inland iron and steel plants.

Viewing the Chinese economy from a regional standpoint, there were many claims of industrial achievements in specific provinces and cities. Almost all claims show great increases over 1969 in industrial output value. Large parts of the added value

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[1] Supervisory physical scientist, Division of Nonmetallic Minerals.

[2] Far Eastern Economic Review (Hong Kong). Dec. 12, 1970, p. 15.

were related to greater sophistication of industry and wider variety of products, but there were also sizable increases in tonnages of basic materials. According to the Chinese Communists, Liaoning Province's industrial output value was up more than 20 percent over 1969; this encompasses China's Ruhr with its many large industrial and mineral enterprises. Heilungkiang, with modern and large coal mines and the country's premium oilfield, showed an advance of about 15 percent. The capital and municipality of Peking, with the steelworks of the same name and the famous anthracite fields, was said to have topped its previous industrial output peak by a third. Tientsin, a center for light and heavy industries, reportedly surpassed the 1969 level by 20 percent. In 1970, Shanghai, one of the major industrial and commercial cities of China, more than achieved state plans. Hopeh Province with big coal mines and other industrial installations also made significant advances. Kansu Province with its oilfields, refineries, and nuclear plants, established a record. It is evident that 1970 was a much better industrial year than 1969 for China with output value establishing an historic high.

Petroleum spearheaded mainland China's industrial advancement. The Taching oilfield in Heilungkiang, Manchuria, by far the largest in the country, pushed both crude and refined output up by possibly 1 to 2 million tons over the corresponding levels in 1969. Although Taching's growth may be tapering off, the Chinese Communists were still hopeful that additional potential could be developed. The Karamai oil complex in Sinkiang reportedly fulfilled production targets 44 days ahead of schedule.[3] Even the old Yumen oilfield in Kansu Province may have registered up to a 20-percent gain in crude output. The Tsaidam oilfield in Tsinghai Province was being expanded. In shale oil, the old Fushun operations in Manchuria were being worked at capacity, and the new Maoming (or Mowming) operations in Kwangtung Province have been built up to a size rivaling Fushun. New refinery capacity was being installed to handle the additional crude produced. Despite the growth, China was still one of the lesser of the medium rank oil producers of the world. At yearend, the Chinese Communists staked a claim for the Senkaku Islands, and their oil potential, as part of China's Continental Shelf.

China's coal industry, third ranking in the world, achieved a substantial gain in production over that in 1969, which was already a record for the 1960's. Most big mines were mentioned in the press as having fulfilled their 1970 targets, including seven combines which topped 13 million tons—Fushun, Fuhsin, Kailan, Tatung, Huainan, Chihsi, and Hokang. Substantial reserves of coal have been found in South China to complement the known potential in the north. In addition to enlarging existing operations, the policy has been to build more beneficiation plants, particularly for coking coal, and to develop small and medium coal mines.

The steel industry made slight gains in output and significant advances in sophistication of products during the year. Performance at Anshan in Manchuria, a large steelworks by world standards, clearly reflected this trend. The Penhsi complex near Anshan, best known for mines and smelters, added many mills and special steel furnaces in recent years. Wuhan in Hupeh Province started to construct a fourth large blast furnace, together with additional rolling and processing facilities. The Peking combine spearheaded the emulation drive, as mentioned. The Taiyuan steelworks was making good use of its Austrian oxygen converters (BOF's). Paotou has built up integrated operations around a single large blast furnace. Maanshan completed a second rolling mill shop. For most steel centers, there was news about developing additional iron and coal mines to feed the furnaces.

In nonferrous metals during the last 2 years aluminum output has gained, from however a small production base. In copper, lead, and zinc increased demand was satisfied by purchases from abroad rather than by expansions in output. China also imported considerable platinum for use in constructing oil refineries. The well-known export metals like tin, tungsten, antimony, and mercury were not available for sale in large quantities, which might suggest stockpiling. Most of the fluorspar and talc still found their way to world markets. Construction industries resumed full-scale

[3] New China News Agency (Peiping). Dec. 10, 1970, p. 1.

production. The shortage of fertilizers and raw materials was met by expanding production together with increasing imports. The trend toward building small fertilizer plants, cement plants, and hydroelectric plants, continued. In 1970 China exploded its 11th nuclear device and launched its first earth satellite.

PRODUCTION

Mainland China's industrial production in 1970 may have surpassed the 1969 level by as much as 15 to 20 percent, in terms of value. The overall gain in mineral production is estimated at approximately 10 percent. Numerous claims were made for individual areas and enterprises. In March 1971, in an interview with the American journalist Edgar Snow, Premier Chou En-lai was quoted as saying that China produced over 20 million metric tons of petroleum and 14 million tons of fertilizer in 1970 and 10 to 18 million tons of steel during the last 5 years. The oil figure presumably does not cover shale oil. An earlier claim covering January to August 1970 was that national crude oil output showed a 34-percent increase over the corresponding period of 1969 and that national coal output registered a 24-percent rise. One claim for the leading oilfield Taching states that "production in the 4 years since 1966 was double that of the previous 4-year period." Many large coal mines reportedly overfulfilled their 1970 targets and for quite a number the days ahead of schedule were also given. Overall coal output can thus be judged from components.

In steel, Anshan has nearly the same predominant position as Taching in oil. This steel center topped its 1970 targets and reportedly established a historic output record. Several major salt fields were said to have fulfilled output goals before the fall, leading to the conclusion that a very high level was achieved nationwide. There was sufficient news on construction trends and specific plants to suggest a fairly good year for cement production. The fact that so little of China's famous export metals was sold in world markets makes it difficult to substantiate estimates, except on the basis of previous performance.

Table 1.—Mainland China: Estimated production of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969	1970
METALS			
Aluminum:			
Bauxite [1]	380,000	450,000	500,000
Alumina	190,000	230,000	250,000
Metal, refined	90,000	120,000	130,000
Antimony, mine	12,000	12,000	12,000
Bismuth, mine	250	250	250
Copper:			
Mine	90,000	100,000	100,000
Metal, refined	100,000	100,000	100,000
Gold troy ounces	50,000	50,000	50,000
Iron and steel:			
Iron ore [2] thousand tons	38,000	40,000	44,000
Pig iron do	19,000	20,000	22,000
Steel ingot do	15,000	16,000	17,000
Rolled steel do	12,000	13,000	14,000
Lead:			
Mine	100,000	100,000	100,000
Metal, refined	100,000	100,000	100,000
Magnesium	1,000	1,000	1,000
Manganese ore thousand tons	900	1,000	1,000
Mercury 76-pound flasks	20,000	20,000	20,000
Molybdenum, mine	1,500	1,500	1,500
Silver troy ounces	700,000	800,000	800,000
Tin, refined long tons	20,000	20,000	20,000
Tungsten concentrate, about 68 percent WO_3	15,000	15,000	15,000
Zinc:			
Mine	100,000	100,000	100,000
Metal, refined	90,000	90,000	100,000
NONMETALS			
Asbestos	150,000	160,000	170,000
Barite	120,000	140,000	150,000
Cement thousand tons	9,000	10,000	10,000
Fluorspar	250,000	250,000	270,000
Graphite	30,000	30,000	30,000
Gypsum	500,000	550,000	550,000
Magnesite thousand tons	900	1,000	1,000
Phosphate rock do	1,000	1,100	1,200
Pyrite do	1,500	1,800	2,000
Salt do	15,000	15,000	16,000
Sulfur	250,000	250,000	250,000
Talc	150,000	150,000	150,000
MINERAL FUELS AND RELATED MATERIALS			
Coal thousand tons	300,000	330,000	360,000
Coke do	15,000	17,000	18,000
Petroleum:			
Crude do	15,000	20,000	24,000
Refinery products do	14,000	19,000	23,000

[1] 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.
[2] Converted to equivalent 50 percent Fe ore.

TRADE

Overall trade of mainland China, never much of a trading country, showed an increase of roughly 10 percent over 1969, with exports holding steady and imports up a good 20 percent. Most of the trade was with the free world, headed by Japan, Hong Kong, and Western Europe. For 20 free world countries covering the months available for 1970,[4] total imports were about $1.2 billion and total exports were about $1.1 billion. Half of the above imports were from Japan, and roughly a tenth each or slightly more from West Germany, Canada, and the United Kingdom. A third and a quarter of the overall exports went to Hong Kong and Japan, respectively.

Business transactions with the Soviet bloc remained at low levels. However, important trade agreements were concluded with the Soviet Union on November 22, 1970, Bulgaria on August 31, North Korea on October 17, and North Vietnam on October 31. The Chinese have had longstanding agreements with Albania. On the other hand the last agreement with the Soviet Union was in July 1967. The Chinese

[4] Mostly January to August, but 10 months for Hong Kong, 11 months for Japan, and 12 months for the United Kingdom.

were apparently aiming at 200 million rubles ($220 million) of trade with the U.S.S.R., for imports plus exports in 1971.

There were also significant developments in economic aid allied to trade. China concluded a $400 million no-interest loan in February 1970 to build 1,200 miles of railroads for the Tanzania-Zambia railway project. Sizable long-term loans were negotiated or offered to Pakistan, Romania, and South Yemen. Technical assistance agreements were concluded with Albania, North Korea, and North Vietnam.

Minerals and metals remained rather significant in total trade, with exports down and imports up. Much of the mineral-related trade with the outside world involved export of traditional surplus commodities, such as coal, salt, fluorspar, and other nonmetals, and import of large quantities of fertilizers, sizable tonnages of metals and metal products, and some industrial and mining equipment. Business at the Canton trade fairs picked up as compared with the previous year, with imports surpassing exports considerably. The Chinese were very interested in steels, nonferrous metals (particularly copper, lead, zinc, aluminum, nickel, and platinum), fertilizers, chemicals, machinery, and trucks and bulldozers. The Chinese export availabilities remained low, and sales of antimony, tungsten, tin, and mercury were smaller than anticipated. Apparently the Chinese were trying to barter tungsten and antimony for Soviet nickel. Japan showed renewed interest in Chinese coking coal during the year.

The Chinese imported 1.57 million metric tons of steel products from the Japanese in 1970, valued at $247 million. Fertilizers were next in importance and, as mentioned, contracts signed with Japan for the year starting from July 1970 totaled about $135 million, including transport. Steel and fertilizer imports from Western Europe were also substantial, although in total somewhat lower than those from Japan.

In base metals, countries other than Japan were more prominent as suppliers. For example, the United Kingdom exported $52 million worth of nonferrous metals to China in 1970, including $31 million for copper and $8 million each for lead and platinum. China's nonferrous metal imports from the United Kingdom represented less than half of all nonferrous imports. Copper, lead, and aluminum are needed by the electrical industry, and platinum by the oil refining industry. Canada also furnished significant quantities of nonferrous metals, worth nearly $20 million in 1970, mainly nickel (more than two-thirds), aluminum, and zinc. Now that the Canadians have recognized China, they hope to sell more nonferrous metals. Chile probably will be selling more copper and nitrates to China in the future. In 1968 about $33 million worth of platinum was exported to China, including $18 million from West Germany and $11 million from the United Kingdom. Subsequent data show that Germany shipped $19 million worth of platinum to China in 1969. The large imports of metal and nonmetal products represent, in a way, a stopgap measure intended as a substitute for the purchase of tools and technology abroad.

Table 2.–Mainland China: Apparent exports of selected major mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum, bauxite	9,736	10,714	Japan 5,100; Italy 4,470.
Arsenic oxide and acids	474	1,428	Italy 628; Japan 570; Australia 230.
Iron ore	69,018	14,639	All to Japan.
Manganese ore	72,625	26,555	Japan 19,044; Italy 3,490.
Mercury ... 76-pound flasks	3,277	1,363	United Kingdom 435; France 290; Poland 290; Italy 232.
Molybdenum concentrate	190	235	U.S.S.R. 134; Poland 101.
Tin:			
Ore and concentrate ... long tons	54	------	
Metal, unwrought and semimanufactures ... do	3,999	3,483	France 1,377; Denmark 510; Netherlands 491; West Germany 438.
Tungsten ore and concentrate	4,601	5,252	Austria 1,926; West Germany 1,200; Sweden 745.
Other: [2]			
Ores and concentrates n.e s	2,707	4,222	Japan 2,845; West Germany 575; United Kingdom 350.
Metals and alloys n.e.s	1,916	1,508	West Germany 454; Canada 310; France 241.
NONMETALS			
Barite and witherite	31,511	41,853	Japan 16,080; West Germany 10,132; Poland 4,471; France 4,109.
Boron compounds, oxide and acid	812	1,809	All to Japan.
Clays, crude not further specified	53,443	53,820	Japan 44,727; Italy 6,740.
Diamond:			
Gem ... value, thousands	$4,124	$8,082	All to United Kingdom.
Industrial ... do	$330	$1,456	All to Belgium-Luxembourg.
Fluorspar	207,912	[3] 164,673	Japan 121,944; U.S.S.R. 17,600; Poland 17,522.
Graphite	4,610	6,677	West Germany 3,290; United Kingdom 1,367; Japan 896.
Magnesite	19,155	18,857	Japan 5,105; West Germany 4,675; Norway 3,640.
Mica	1,922	1,320	All to United Kingdom.
Quartz and quartzite	5,477	4,060	All to Japan.
Salt ... thousand tons	719	1,022	Do.
Talc, soapstone, and pyrophyllite	81,859	75,362	Japan 48,379; United Kingdom 8,062; West Germany 8,051.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products, petroleum coke	46,277	47,223	All to Japan.

[1] Compiled from import data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, 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] Excludes receipts by West Germany and Netherlands, which were 28,654 tons and 7,819 tons respectively in 1968, and not reported separately in 1969.

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, 1968 Supplement to the World Trade Annual., Walker and Co., New York, 1970, pp. 35–53; 1969 Supplement to the World Trade Annual. Walker and Company, New York, 1971, pp. 25–37.

Table 3.—Mainland China: Apparent imports of selected major mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum including alloys, unwrought and semimanufactures	35,123	6,781	France 4,018; West Germany 1,035; Japan 994.
Copper including alloys, unwrought and semimanufactures	31,535	63,202	United Kingdom 22,143; West Germany 18,161; Zambia 11,402; Japan 10,402.
Iron and steel:			
Pig iron and ferroalloys thousand tons	1	4	Mainly from West Germany.
Scrap do	44	86	Canada 60; West Germany 13; Australia 13.
Steel:			
Primary forms do	NA	11	France 4; Japan 3.
Semimanufactures:			
Bars, rods, angles, shapes, and sections do	549	644	Japan 507; West Germany 55; Italy 30.
Plates and sheets do	608	879	Japan 606; West Germany 181; Italy 29.
Hoop and strip do	50	35	Japan 15; West Germany 13; Belgium-Luxembourg 7.
Rails and accessories do	22	9	Japan 7.
Wire do	39	88	Japan 78; West Germany 5.
Pipes, tubes, and fittings do	369	344	Japan 291; West Germany 47; U.S.S.R. 5.
Castings and forgings do	2	1	Mainly from West Germany.
Lead including alloys, unwrought and semimanufactures	19,190	44,715	United Kingdom 43,191; West Germany 1,524.
Magnesium, unwrought	------	491	Japan 441; Netherlands 50.
Nickel including alloys, all forms	2,574	1,383	France 700; West Germany 416; Canada 92.
Platinum-group metals, all forms value, thousands	$33,097	$48,480	United Kingdom $26,106; West Germany $17,774; Japan $4,354.
Titanium oxides	3,207	525	All from Japan.
Zinc, unwrought and semimanufactures	21,099	20,335	Australia 12,193; Japan 6,971; West Germany 1,171.
Other:			
Scrap, nonferrous n.e.s	508	------	
Unwrought and semimanufactures	186	507	Belgium-Luxembourg 400; France 100.
Radioactive metals n.e.s. value, thousands	$70	------	
NONMETALS			
Diamond:			
Gem do	$12,306	$22,764	United Kingdom $22,760.
Industrial do	$5,709	$3,633	Belgium-Luxembourg $2,950; West Germany $683.
Fertilizers manufactured:			
Nitrogenous thousand tons	3,733	3,573	Japan 1,917; Italy 599; Netherlands 495; West Germany 340; Belgium-Luxembourg 206.
Phosphatic	------	700	All from Japan.
Potassic	5,000	2,000	All from West Germany.
Other, including mixed and unspecified	24,819	54,752	All from Norway.

NA Not available.

[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Bulgaria, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the U.S.S.R., the United Kingdom, Yugoslavia, and Zambia.

Sources: For Bulgaria, Poland, and the U.S.S.R.: Official export Statistics of the respective country; for all other countries: Statistical Office of the United Nations, 1968 Supplement to the World Trade Annual, Walker and Co., New York, 1970, pp. 54–67; 1969 Supplement to the World Trade Annual. Walker and Co., New York, 1971, pp. 38–46. Data from the latter source on Japan were supplemented from official export statistics of Japan.

COMMODITY REVIEW

METALS

Aluminum.—Expansion of power generation and transmission facilities, both in the coastal industrial areas and in rural districts around the country, has greatly increased demand for aluminum. In addition to expanding production, China was trying to buy more aluminum abroad to meet requirements. Japanese trade circles reported that the Chinese were looking for 120,000 to 150,000 tons of aluminum early in the year and that the Japanese were not able to furnish much. This is about the tonnage China produced in 1970. Various new plants have been commissioned to supplement Fushun in Manchuria, previously the only reduction plant of consequence. At the new Sanmen Gorge plant, 66 sets of electrodes were reportedly repaired in the first 3 months of 1970 without disrupting production and 34 new sets were built.[5] This suggests a plant of 20,000- to 30,000-ton size. There is another sizable aluminum plant located in Changling County in Kirin Province, about 100 miles west of Changchun.

Antimony.—China retained its position as the world's leading antimony producer with an estimated output level on a par with that of 1969. The Hsikwangshan district in Hunan Province was still the main source, followed by Kwangsi Province in distant second place.

Increased demand for use in electric vehicles and by the atomic energy program and the overall policy of stockpiling raw materials resulted in the Chinese not selling much antimony during the Canton Fairs of 1969 and 1970. World prices fluctuated radically, with the high of $4 per pound early in April 1970 and a low of about 70 cents at yearend. Shortage of Chinese material contributed towards the high price, whereas the downward revision of U.S. stockpile objectives reversed the price trend. Japan was a major importer, but during the first 11 months of 1970, it imported only 1,232 metric tons of 60 to 65 percent antimony concentrates from China valued at approximately $1.4 million. This compares with 2,628 tons of antimony concentrates for the corresponding months of 1969. Hibino Metal Industries, the sole Japanese contractor for Chinese antimony, was hoping to buy 2,000 tons of antimony concentrates from China during the Spring Canton Fair of 1971. There was speculation in early 1970 that China may try to barter Chinese antimony and tungsten for Soviet nickel.

Bismuth.—Mainland China maintained its somewhat important position as a world producer of bismuth which locally is extracted as a byproduct of tungsten and nonferrous metals. At the 1970 Canton Fairs, only small amounts of Chinese bismuth were offered for sale.

Copper.—The acute shortage in copper continued because of large demands by the power industry and for stockpiling. During 1969 and 1970 the United Kingdom exported, respectively, 25,157 and 19,700 metric tons of refined copper to China. Another major supplier was Zambia, which shipped 11,402 tons in 1969 and 20,815 tons in the first 9 months of 1970. The establishment of diplomatic relations with Chile might well mean that China would obtain more copper from this country in the future. Meanwhile, copper output probably remained at about the 100,000-ton annual level.

The Chinese recently reported discovery of various large deposits of siliceous copper ores, one with an orebody several tens of meters thick.[6] Discovery of porphyry deposits in the north had also been claimed. One possible reason why the numerous new copper deposits in China have not yet been developed may be the inability to build necessary smelting facilities. Out at Hungtoushan, a medium-sized copper mine near Fushun, was said to have increased considerably over that in 1969. An old copper mine in Chingyuan, Liaoning Province —Huatung—apparently has been rejuvenated and greatly expanded. The Tung-hua copper mine in Kirin Province reportedly fulfilled the 1970 target, as did the Yashan copper mine in Shantung Province. The No. 3 mine in Yunnan Province, a large mechanized mine probably extracting copper, did very well in 1970, with the installation of an aerial tramway. The small Shenyang nonferrous smelter in Manchuria, mainly a refiner of copper, was operating normally again.

Iron and Steel.—Output clearly topped 1969 levels, the high point in the 1960's. Ill effects of the Cultural Revolution were finally surmounted, although some bias favoring small-scale operations lingers on in policy considerations. The stress has been on the major enterprises, however, despite the hope of decentralizing as much as possible. A number of BOF's were built, including some that could well have been copied from the two Austrian converters at the Taiyuan steelworks. An easing of relationships with the international community in 1970 was not yet translated into larger purchases of foreign steelmaking equipment.

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[5] Chengchow Honan Provincial Service (in Chinese; Chengchow). Mar. 30, 1970, p. 1.
[6] Ta-kung-pao (Peiping). Dec. 11, 1969, p. 1.

The policy of buying finished steel products from abroad continued. Mainland China imported (or rather Japan exported) 1.57 million metric tons of steel products from Japan in 1970, mostly the difficult-to-make types, such as large tubes and pipes, tinplate, hot- and cold-rolled sheet and coil, and special steels. The Japanese are hoping to sell 2 million tons to China a few years hence. Smaller but similar imports also came from Western Europe. Thus, perhaps a sixth of the steel product supply of mainland China came from abroad in 1970.

In recent years, emphasis has been placed on strengthening the raw material base, through exploration for more ores and beneficiating and conditioning what is available. There has also been some stress on building small and medium-size mines and plants to better utilize local resources. Significant additional reserves of coal and iron were found for the large enterprises in 1970.

Anshan in Liaoning Province, Manchuria, with 10 blast furnaces ranging in size from 585 to 1,513 cubic meters and 25 open hearths, reportedly fulfilled the 1970 output targets for pig iron, steel, rolled steel, iron ore, and coke.[7] Crude steel production may have been as high as 6.8 million metric tons. Many new products were produced, including various kinds of large structural shapes. The seamless tube mill did well, especially in output of large-diameter tubes and special tubing for oil refinery stills. Smelting operations were also improved, with significant savings in coal, coke, electricity, and other raw materials. Coke consumption in blast furnaces reportedly reached advanced levels. Overall progress was made in iron recoveries and quality of concentrates, with the installation of new magnetic separation equipment at various mines. A new open pit iron mine at nearby Chita Mountain,[8] which has a large ore dressing plant and magnetic separators, and the old standby Kungchangling mine were operating at high output levels.

The Penhsi (Penchi) complex of several dozen mines and plants became fairly integrated in recent years, with the addition of rolling mills and new steel furnaces to complement the iron, coal, and refractory mines, and the coke ovens and blast furnaces. Local iron ore and coking coal deposits are extensive and high grade. There are two blast furnace plants: No. 1 has two 333-cubic-meter furnaces; and No. 2, two 917-cubic-meter furnaces. Thus, Penhsi is capable of producing perhaps 1.5 million metric tons of pig iron per year. Apparently the steelmaking capacity is considerably smaller, which leads one to believe that pig iron is shipped to other steel plants in Manchuria. Output of steel ingots in 1970 may have been about 1 million metric tons. Penhsi's 1970 output target calls for a 10-percent increase over 1969, and quotas were reportedly fulfilled during the first 9 months.[9]

Prior to 1970, the Wuhan steelworks in Hupeh Province had three blast furnaces (1,386, 1,436, and 1,513 cubic meters); six open hearths (four 500-ton and two 250-ton); three byproduct coke plants; and various rolling mills, including a blooming mill and a heavy mill for making rails, girders, and I-beams. A new open hearth furnace, probably of 500-ton size, went into production near the turn of the year. On May 16, 1970, ground-breaking ceremonies were held to start construction work on a No. 4 blast furnace.[10] Annual crude steel production capacity for Wuhan was raised to approximately 2.5 million metric tons. Actual steel output in 1970 is conservatively estimated at 2 million tons. Apparently additional rolling and other processing facilities were under construction or being planned.

A large underground iron mine, Chengchao, was brought into production in late 1969 to provide ore for the steelworks.[11] A large sintering plant, capable of eliminating some sulfur, started operations in May 1970.[12] Exploration in Hupeh Province uncovered additional resources of coal suitable for blending. Wuhan steelworks had a peaceful, normal year of operation, and the basic construction underway indicates development into a sizable integrated steel center.

The Peking or Capital steelworks, a merger of Shihchingshan and other plants

[7] New China News Agency (International Service in English; Peiping). Dec. 27, 1970, p. 1.
[8] China Reconstructs (Peiping). April 1970, pp. 2–7.
[9] Shenyang Liaoning Provincial Mandarin (in Chinese; Shenyang). Nov. 19, 1970, p. 1.
[10] Wuhan Hupeh Provincial Service (in Mandarin; Wuhan). May 17, 1970, p. 1.
[11] New China News Agency (International Service in English; Wuhan). Nov. 8, 1969, p. 1.
[12] New China News Agency (in Chinese; Peiping). May 5, 1970, p. 1.

in the municipality of Peking, spearheaded an emulation drive, and output levels in 1969 and 1970 were said to be considerably higher than in earlier years. With the completion of a new blooming mill in September 1969, the Peking steelworks became much more integrated, although some ingots and semimanufactures were still sent to Tientsin and Tangshan. Facilities at Shichingshan included three blast furnaces (413, 512, and 963 cubic meters), three coke units, sintering plants, top-blown oxygen converters, and rolling mills. Annual steel capacity may be about a million tons, somewhat less than pig iron capacity. The Chinese hope to greatly expand facilities. Lungyen had been the main supplier of iron ore. However, a new iron mine came on stream in 1970 that may be important in stimulating future steel output.

Shanghai, with at least eight small steel plants, did well in 1970, and combined ingot output is conservatively estimated at 1.5 million metric tons. Apparently some plants processed iron materials supplied by the Maanshan steelworks in nearby Anhwei. Shanghai No. 1 was the most important steelworks, with two 255-cubic-meter blast furnaces, two 70-ton open hearths, about five small Bessemer and Thomas converters, possibly three 30- to 35-ton homemade oxygen top-blown converters, a slabbing mill, a medium plate mill, and a forging mill. The Shanghai No. 3 steelworks stressed diversification of products, installing additional converters, electric furnaces, and a Regino plate mill. The Shanghai No. 5 plant trial produced a large smelting furnace suitable for making high-grade alloy steels.

With the completion of a second rolling mill shop, the Maanshan steelworks in Anhwei Province became almost fully integrated. Previously, Maanshan had about 10 very small blast furnaces (roughly 34 cubic meters in size), five larger, but still small, blast furnaces of 210 to 250 cubic meters, two open hearth shops with furnaces in the 100- to 150-ton range, coke plants, a sintering plant, a number of top blown oxygen converters, some electric furnaces, and a heavy rolling mill. Efforts were made to achieve raw material self-sufficiency by greatly expanding iron ore extraction at the Kungshan, Taochung, Nanshan, and other mines. Nanshan capacity was said to have been raised 30 percent.[13] Taochung is already equipped with a large ore dressing plant, and additional iron beneficiation facilities were added. A large limestone quarry was opened up in Huanshan in mid-1970.

Many technical improvements have been made in recent years, especially in open hearth and converter steel practice, whereby output has been raised very substantially. Production of rolled steel products has also been greatly increased. In fact, Maanshan is being built up as an industrial complex, with the completion of various manufacturing plants as well. During 1970, Maanshan may have produced up to 1 million tons of pig iron and steel, with some surplus crude metals going to the steel plants in Shanghai.

Development of Taiyuan in Shansi Province into an integrated steelworks moved ahead during the year. Existing facilities included two 55-ton Austrian Linz-Donowitz (LD) furnaces (or BOF's) five blast furnaces (1,053 and 291 cubic meters plus three smaller ones), two coke oven plants, an electric furnace shop, and two rolling mill plants. In 1970 the following projects were brought into production: A sintering plant on March 22, a locally made top-blown oxygen converter, and another blast furnace at the Linfen steel plant.[14] All told, the Taiyuan steelworks probably produced more than a million metric tons of steel ingots in 1970.

Construction of Paotou into an integrated steelworks continued. Existing facilities included a 1,513-cubic-meter blast furnace, two byproduct coke plants, a coal preparation plant, a sintering plant, two 500-ton open hearths, and supporting iron, coal, and refractory mines. Three significant developments took place in 1970. About mid-year a top-blown oxygen converter was blown in. Iron ore beneficiation was improved in terms of making higher grade concentrates, first through flotation, and lately, by high-intensity magnetic separation with specially designed equipment.[15] A large, modern coal mine, Wuhushan, was reportedly completed, in support of Paotou steelworks.[16]

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[13] New China News Agency (in Chinese; Peiping). Sept. 19, 1970, p. 1.
[14] Taiyuan Shansi Provincial Service (in Chinese; Taiyuan). Oct. 12, 1970, p. 1.
[15] New China News Agency (International Service in English; Peiping). Dec. 20, 1970, p. 1.
[16] New China News Agency (International Service in English; Peiping). June 8, 1970, p. 1.

Present annual steel ingot capacity for this center may be only 800,000 metric tons. Construction of a second large blast furnace had barely begun in 1960, when the Soviets left. Providing that raw materials are available, it would not be surprising if Paotou's capacity would be doubled eventually.

The Chungking steelworks in Szechuan Province with three blast furnaces (620, 134, and 55 cubic meters) and two open hearth workshops may have a total capacity of half a million tons of steel ingot per year. A somewhat outmoded plant, Chungking, apparently did well during the year, and one of the open hearth furnaces reportedly was turning out steel at a record rate of 4.5 hours per heat.

Many small and medium-sized iron and steel plants were in the news. The Canton steelworks in Kwangtung Province already has three blast furnaces, the largest of which is 255 cubic meters, and a fourth one is about to be completed; a top-blown oxygen converter has been installed to complement existing steelmaking and rolling facilities. Shaokuan, a second medium-size steelworks in Kwangtung, reportedly completed a blast furnace of relatively large size in August and thereby increased its pig iron capacity by 200 percent.[17] The Tientsin steelworks, which uses scrap and iron materials from the Peking steelworks, may have produced 150,000 tons of steel ingots in 1970. The Hantan steelworks in Shihchiachuang, Hopeh Province, has been developed into a medium-size complex.

The Kunming steelworks added a medium-size blast furnace and a modern coke plant of several hundred thousand tons to the rolling facilities already installed. Several small but integrated steel plants have been built in Hunan Province, including an oxygen converter shop at the Lienyuan steelworks. Output at the Dairen steelworks in Manchuria, which has a long history and a moderate production level, registered a significant increase in 1970. There is a small complex in Hungshih, Kirin Province, with blast furnaces and rolling mills. The Hofei steelworks in Anhwei Province reportedly completed a Bessemer converter shop of 100,000-ton annual capacity. Wuhu, another steelworks in Anhwei, completed its No. 2 blast furnace of 100 cubic meters in June 1970. There are small steel plants in Pinghsiang and Fengcheng, Kiangsi Province. The Anyang steelworks in Honan reportedly doubled daily pig iron production to 800 tons. The old Hanyang steelworks in Hupeh and the Sian steelworks in Shensi both completed their first oxygen converters. A similar top-blown oxygen converter was also installed in Hainan, well known for high-grade iron ore.

Lead and Zinc.—The contract signed with the British to build an Imperial Smelting Process (ISP) plant at Shaokuan in northern Kwangtung was not yet implemented by 1970. Originally, the plant was to produce in excess of 35,000 tons of zinc and 18,000 tons of lead annually.

The old standby Shuikoushan lead-zinc mine in Hunan Province had been modernized. The Chingchengtzu lead-zinc mine near Fushun and the Hsiuyen lead mine, both in Liaoning Province, apparently fulfilled their 1970 production targets.[18] A small electrolytic zinc refinery has been built in Shanghai.

China's annual output of roughly 100,000 metric tons each of lead and zinc has not been adequate to meet demand. Zinc is needed in galvanizing and making alloys, and lead is needed principally for batteries and cables to support the transport and electrical industries. The Chinese purchased considerable lead on the world market in recent years, including 43,189 metric tons in 1969 and 26,200 tons in 1970 from the United Kingdom alone. During 1968, Canada furnished about 15,800 tons of zinc (5,100 tons in the first half of 1970), and Japan nearly 5,000 tons. North Korea probably also has been supplying sizable tonnages of lead and zinc to China.

Manganese.—Mainland China's manganese ore production continued at the million-ton level in response to a greater demand from expanded steel smelting operations. Hsiangtan in Hunan, Mukwei and Leiping in Kwangsi, Chin Hsien and Fangcheng in Kwangtung, Tsunyi in Kweichow, Chienchi near Nanking, and Wafangtzu in Manchuria were again the main producers. About 22,000 tons of Chinese manganese ore went to Japan during the first 9 months of 1970.

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[17] Canton City Service (in Chinese; Kwangchow). Sept. 25, 1970, p. 1.
[18] Shenyang Liaoning Provincial Service (Shenyang). Oct. 31, 1970, p. 1.

Tin.—Chinese tin output was at one time much higher than recent levels, as attested by the large exports to the Soviet Union. Official Soviet trade returns, however, have shown only nominal transactions during the last few years. Free world imports of tin from mainland China have also declined from 5,000 to 7,000 tons annually during 1962–65 to 3,000 tons or less during 1967–70. Annual tin consumption in China has been estimated at 5,000 to 7,000 tons. Facilities for making tinplate remained inadequate, and large purchases have to be made from Japan and elsewhere. For 1970 combined tin output from China's two traditional tin centers, Kuchiu in Yunnan and Fuhochung in Kwangsi, has been estimated at 20,000 tons. A new placer area is Chiumou in Kwangsi. Undoubtedly, considerable tin has been stockpiled in the last few years. Trade circles speculate that Chinese tin exports may soon again attain high levels and that large-scale trading of tin with the Soviet Union may eventually be resumed.

Titanium.—China produces no titanium metal, but probably makes titanium dioxide at a chemical plant in Nanking. A year ago, local equipment for manufacturing titania was apparently being developed. The Chinese were anxious to manufacture the pigment, titanium dioxide, rather than export titanium ore and import the finished product. Japan has been the main source of titania for China, supplying 3,077 metric tons in 1968, only 525 tons in 1969, and 317 tons in the first 11 months of 1970. The sharp decline strengthens the belief that China indeed is producing the pigment.

Tungsten.—Despite advancing prices, Chinese exports of tungsten declined in recent years with the pattern of outlet changing from predominantly Communist countries to free world countries. The Soviet Union imported nearly 19,000 metric tons of Chinese tungsten concentrates [19] in 1960, but only nominal amounts since 1967. In contrast, free world imports rose to a maximum of about 8,300 tons by 1966, followed, however, by a decline to roughly 6,500 tons in 1967 and 4,000 to 5,000 tons in 1968 and 1969. Among free world countries, Austria, West Germany, Sweden, France, the United Kingdom, and Japan have been the leading importers. Total tungsten receipts from China, as reported by importing countries, were as follows, in metric tons of contained tungsten: 1965—6,364; 1966—6,134; 1967—3,832; 1968—2,575; and 1969—2,063 (incomplete, with no data for Austria and the U.S.S.R.).[20]

For the past 5 years tungsten production by mainland China, mainly wolframite from Kiansi Province, has been estimated at about 15,000 metric tons of concentrates or roughly 8,000 tons of tungsten content annually, which is about 25 to 30 percent of world output. Chinese tungsten reserves have long been acknowledged as being the foremost among all countries. There is a recent claim that large additional hidden (presumably meaning no outcrops) reserves have been discovered by modern geophysical methods; this rejuvenated the tungsten mines.[21] The mill of the No. 1 tungsten mine in Kiangsi Province was reportedly renovated, and production at Pankushan mine, also in Kiangsi, apparently surpassed targets. Considerably less than half of the estimated output can be accounted for by countries reporting imports, which suggests more stockpiling and a slight rise in consumption. Despite prices exceeding $70 per short ton unit for most of the year, large sales of high-grade Chinese tungsten concentrates have not materialized. In fact, some low-grade scheelite was offered for sale.

Uranium.—Uranium-235 used in hydrogen bomb tests is processed at a gaseous diffusion plant near Lanchow in Kansu Province, partly from uranium ore coming from Kiangsi and Kwangtung Provinces. During 1970, a 3-megaton range nuclear explosion was recorded on October 14, which was China's 11th test and made with airborne delivery. There was speculation in 1970 that the Chinese were considering moving some nuclear facilities away from Lop Nor, because of the tense relations with the Soviet Union.

NONMETALS

Asbestos.—Mainland China continued to rank about fifth among world producers of asbestos during 1970, providing possibly 4

[19] Mostly wolframite, averaging 68 percent WO_3. A ton of 68 percent WO_3 concentrate contains 0.5392 ton of W (tungsten), whereas a ton of 60 percent WO_3 concentrate contains 0.4578 ton of W.

[20] Tungsten Statistics. United Nations, UNCTAD Committee on Tungsten (Geneva). October 1970, pp. 1–68.

[21] Ta-kung-pao (Peiping). Dec. 11, 1969, p. 3.

percent of the world total. Production of asbestos, mainly long-fiber, chrysotile type, was somewhat higher than in 1969 and well above the 150,000-ton level. The bulk of the output came from Shihmien in Szechuan Province, where a dozen projects were built in recent years. There was news that a secondary producer, the Chinchou asbestos mine in Liaoning Province, fulfilled the 1970 production plan 37 days ahead of schedule and registered a 69-percent increase in output over the 1969 level.[22] Usually a small exporter, China has sought to buy asbestos from Canada in recent years. Chinese and Canadian asbestos experts have visited each other's countries in the past.

Barite.—Barite production apparently reached a new high in 1970 of possibly 150,000 tons, because of the accelerated domestic oil drilling program. China's output may be 2 to 3 percent of the world total, and prospects are good for increased production. Rising demand, however, has cut export availability. Japan, historically the largest purchaser of Chinese barite, took only 20,500 metric tons during January to November 1970, compared with nearly three times this tonnage as a yearly average during 1966–67. Poland had been importing close to 10,000 tons annually during 1967–68, about double the 1969 tonnage.

Boron Minerals.—A surplus of borax continued, although no specific information was available on the extensive boron-bearing lake deposits in the Iksaydam area of Tsaidam, Tsinghai Province. During 1969 Japan imported from China about 3,889 metric tons of sodium borate and 1,808 tons of boric acid.

Cement.—Mainland China's cement production stayed at the 10-million-ton level achieved in 1969. The economic disruptions of the Cultural Revolution were finally shaken off, and construction activities picked up momentum. Compared with 1967 and 1968, many more cement plants were mentioned in the press. Numerous small local cement plants have been built recently in Provinces like Honan, Heilungkiang, Hunan, Anhwei (Anhui), Chekiang, Fukien, and others. Various new cement products plants have also been constructed, particularly those to make pipes and shapes. There is a program to build cement boats.

As of yearend 1970 the country's cement industry primarily consisted of 50 to 60 large and medium-size plants of 100,000- to 1-million-ton annual capacity and many hundreds of small plants. The World Cement Directory[23] published in 1965 lists then-known Chinese plants. More than a dozen important cement plants have since been constructed.

Some of the larger cement plants built in various Provinces during the 1960's were as follows (when available, the estimated annual capacity in thousands of metric tons is in parentheses): Hantan (1,000 or more), south of Shihchiachuang in Hopeh; Yao Hsien (1,000) in Shensi; Huahsin or Huanghih (1,000) in Hupeh;[24] Kwangchow (700) in Kwangtung; Yungteng (600) in Kansu; Chungking (550) in Szechuan; Tatung (500) in Shansi; Mutanchiang (400) in Kirin; Tungfanghung (400) or Nanking in Kiangsu; Kunming (330) in Yunnan; Kweiyang (300) in Kweichow; Liuchow (recently expanded to 300) in Kwangsi; Kaiyuan (270) in Yunnan; Tungchiang in Kirin; Nanchang in Kiangsi; and Nanping (100) in Fukien. The maximum size of individual rotary kilns was reported at 300,000 tons. Two large cement plants with long histories—Fushun (originally 550) and Ch'ihsin (originally 400)—have been expanded in recent years, along with Anshan. Chaohu (300) in Hofei, Anhwei Province and another dozen or so older plants are rated a 200,000- to 700,000-ton annual capacity.

Diamond.—Changte in the Yuangchiang Basin of western Hunan is the only diamond mine known to have been worked in China. Reportedly, diamond deposits have also been found in Kweichow and Shantung Provinces. Synthetic diamonds were apparently being produced in Tsingtao, Shantung. There was a shortage, however, judging from United Kingdom exports of diamonds to China worth more than $20 million in 1969.

Fertilizer and Chemical Materials.—During 1970, mainland China produced possibly 10 million metric tons of processed fer-

[22] Shenyang Liaoning Provincial Service (in Chinese; Shenyang). Dec. 8, 1970, p. 1.
[23] World Cement Directory (CEMBUREAU; Paris). European Cement Association. 1965, pp. 64–67.
[24] Wuhan Hupeh Provincial Service (Wuhan). Dec. 1, 1970, p. 1. Source states Huangshih attained 1970 output quota 56 days ahead of schedule.

tilizers, all nitrogenous except for perhaps 2 to 3 million tons of chemical and ground phosphates. Most output was ammonium sulfate and urea, although superphosphates, ammonium bicarbonates, and mixed fertilizers were also produced. The Chinese Communists claim more than a 30-percent output increase in chemical fertilizers and phosphate rock over the tonnages for 1969.[25] While these claims might well be exaggerated, production clearly rose sharply, judging from the many reports on individual plants and the emphasis on building small but reasonably efficient plants. In fact, small plants account for about two-fifths of the national capacity. For the medium and large plants, a concerted effort was made to utilize industrial waste and byproducts. Many chemical and fertilizer facilities were established at metallurgical, coal, and petroleum complexes.

Even with increasing capacity, mainland China needs far more fertilizer than it can produce. With imports of 5 to 6 million metric tons of chemical fertilizers annually during the last few years, in addition to phosphate rock, the country has become rather important in world fertilizer trade. Contracts covering 1970–71 show that China's worldwide purchases would exceed 1.7 million metric tons of contained nitrogen in the span of 1 year.[26]

The very large Nanking plant, which turns out millions of tons of chemical fertilizers annually, reported an output increase exceeding 20 percent. There were many developments in the technical area for Nanking, including building of a synthetic ammonia tower, adoption of more automated practices, and introduction of new techniques for making urea in pellet form, and drying. For the Kirin chemical complex, the news is that an ammonia absorption tower has been rebuilt to recover waste coal gas with the result that the synthetic ammonia capacity was raised by 8,000 tons per year; also carbon black has been successfully recovered. The Taiyuan plant likewise streamlined operations through recovery of waste gases and raised annual capacity by 20,000 tons of fertilizers. An equipment plant in Taiyuan manufactured two sets of towers, each capable of producing 3,000 tons of chemical fertilizer annually. There was also some information on some other relatively large plants, such as Chuchow in Hunan, Kunming in Yunnan, Yangchow in Kiangsu, Liling in Hunan, Hofei in Anhui, and Tsinan in Shantung. Various petroleum refineries also have large fertilizer plants, as for example Lanchow in Kansu.

On August 15, 1970, Japan negotiated a contract to deliver about 1.165 million metric tons N (contained nitrogen) in all fertilizers, including 793,000 tons N in urea (conversion factor is 0.454), 204,000 tons N in ammonium sulfate (conversion factor is 0.212), and 165,000 tons N in ammonium chloride (conversion factor is 0.262), for delivery before July 1971. The contract prices for Japanese shipments, c.i.f. China ports, were respectively \$56 for urea, \$31 for ammonium sulfate, and about \$30 for ammonium chloride. The overall Japanese contract, therefor, would amount to roughly \$135 million, including transport. NITREX, a European consortium, has contracts for 1970–71 to deliver chemical fertilizers containing about 460,000 tons of N, and ANIC, another consortium, has contracts to deliver 113,000 tons of N. Finland, Bulgaria, and Romania have contracted to deliver additional smaller tonnages of fertilizers to China for this period. Actual Japanese trade returns show the following, in thousands of metric tons: 1969—ammonium sulfate, 628; urea, 841; and ammonium chloride, 448; and 11 months of 1970—ammonium sulfate, 676; urea, 945; and ammonium chloride, 396. The Canadians have been trying to sell potash, but with no success as yet. East Germany, however, may have negotiated or even shipped 30,000 to 35,000 metric tons of potash to China in 1970.

Pyrite production probably increased to about 2 million metric tons during the year on account of requirements for making sulfuric acid and fertilizers. Most output presumably came from Hsiangshan in Anhwei (Anhui) and Yingte in Kwangtung. At Hsiangshan, the iron residue from making sulfuric acid has recently been cleaned and utilized as raw material for steel. Additional pyrite was produced in Szechuan and Shansi Provinces, but output is not included in usual estimates since this pyrite is converted to about 250,000 tons of elemental sulfur annually.

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[25] Ta-kung-pao (Peiping). Dec. 27, 1970, p. 1.
[26] Nitrogen (London). The British Sulphur Corp., Ltd. September–October 1970, pp. 9, 11.

A "large, mechanized sulfur refining furnace" was designed and built by the Kansu Metallurgical Co.[27]

Phosphate rock production in 1970 surpassed 1.2 million metric tons, coming mainly from Chinghsiang in Hupeh, Liuyang, Shihmen, and Huachiao in Hunan, Kaiying in Kweichow, and Nantung in Kiangsu. Although China's phosphate rock is usually only fair grade, an extensive high-grade deposit apparently was discovered in Kungyang, Yunnan Province. Large quantities of phosphate rock have been imported from Morocco in recent years, usually more than a half million tons annually. China also imports apatite from Laokay, North Vietnam, as much as 100,000 tons in 1970.

Fluorspar.—China's fluorspar production was perhaps 7 percent of the world total, showing a slight increase over the general level in recent years. Output from Chekiang and Hopeh Provinces remained steady, but Kwangsi Province has become a significant new source. The bulk of the fluorspar has been traditionally exported, with accountable tonnages reaching about 200,000 tons annually. Japan, the principal importer, took 121,944 metric tons in 1969 and 112,761 tons during the first 11 months of 1970. Other significant importers include the Soviet Union, West Germany, and Poland. The Kamaishi Co. of Tokyo was the sole Japanese contractor for Chinese fluorspar. Domestic consumption of fluorspar must have risen within China, in view of the growth of the steel and aluminum industries.

Quartz Crystal.—Production of quartz crystals for the electronics industry has been reported for China during the year.[28] The Kansu Metallurgical Co. and a plant in Hsiangtan, Hunan, both successfully grew good-quality single-crystal quartz and trial-produced poly-crystal quartz.

Salt.—Mainland China retained its position as the second largest world producer of salt, after the United States. Apparently, 1970 output slightly surpassed the average level in 1968–69, establishing a new record of possibly 16 million metric tons. Operating conditions were good for the four main coastal sea salt-producing provinces —Kiangsu, Shantung, Hopeh, and Liaoning. For Shantung, the Tungfung salt field under the Tsingyao Salt Administration was mechanized and enlarged to 20 square kilometers.[29] With regard to the salt factory in Tangku, Hopeh's main salt field, good results were said to have been achieved through technical innovations. Through adopting new techniques to prolong the working season and achieve early production, Liaoning established an output record and fulfilled its target by mid-October.[30] Yingko on Hainan Island, a new sea salt field and the biggest producer in South China, continued to expand sharply, with output in the first half of 1970 reported to be about two-fifths more than in the corresponding period of 1969.

The extensive lake salt deposits of Tsinghai were worked at a record pace, providing increasing quantities of both salt and byproducts like potassium chloride, boric acid, sodium borate, bromine, iodine, and barium chloride. Many additional small salt plants fueled by natural gas were built to work the brines of Tzuliuching, Szechuan. In Tayao County of Yunnan Province, many rock salt mines have been established, along with small coal pits. An enormous salt deposit was discovered in Chingkangshan, Kiangsi Province, where a 20,000-ton salt refinery was quickly built by the workers of the Kiangsi No. 92 salt mine.[31] An important salt mine was opened in Li County, on the shore of Tungting Lake in Hunan Province.[32]

Great emphasis has been placed on streamlining operations, with the Tientsin Tangku Salt Refining Institute given a leading role. A national conference on the mechanization of salt production was convened in Shantung Province during 1970.

Although most salt goes into food, industrial demand has risen within China. For example, the Tientsin soda plant increased capacity by about 3,600 tons, and the Tsingtao chemical plant started to produce more and better quality soda. Traditionally, surplus salt has been exported, principally to Japan which took 1,022,000 metric tons in 1969 and 813,776 tons during the first 11 months of 1970.

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[27] Jen-min Jih-pao (People's Daily; Peiping). Apr. 9, 1969, p. 2.
[28] Jen-min Jih-pao (People's Daily; Peiping). Oct. 9, 1970, p. 3.
[29] New China News Agency (International Service in English; Peiping). June 11, 1970, p. 1.
[30] Jen-min Jih-pao (People's Daily; Peiping). Oct. 27, 1970, p. 4.
[31] New China News Agency (International Service in English; Peiping). Dec. 15, 1970, p. 1.
[32] Ta-kung-pao (Peiping). Dec. 2, 1969, p. 1.

Steatite and Talc.—Chinese steatite and talc from Taling in Liaoning Province are world famous. Between one-third and one-half of the 1970 output was exported, with Japan as the main purchaser. During January to November 1970, Japan imported 26,233 metric tons of steatite and 23,220 tons of talc from China. The U.S.S.R., the United Kingdom, and Poland have also imported lesser but significant quantities of Chinese steatite and talc.

MINERAL FUELS

Coal.—The coal industry had a very successful year and, judging from the many claims regarding attainment of targets for individual mines and combines, a still higher production year can be anticipated for 1971, unless political developments hold back progress. Dislocations of the Cultural Revolution have been substantially overcome, although the PLA was still the stabilizing force within the various Revolutionary Committees or Alliances formed to bring industrial operations back to normal. National Coal Conferences convened in recent years helped. The national emulation campaign also played a role in stimulating production. Simultaneously, the transport bottleneck eased and local coal shortages clearly lessened, although drives were still in progress to economize on coal with a view to improve efficiency of utilization. Significant developments included development of small mines, construction of coal preparation plants, and emphasis on assuring adequate supplies of better quality coking coal for the steel industry.

By the Chinese Communist's own account,[33] the coal mining industry was making steady, sustained progress, with output of many established mines stabilized at record levels. During January to August 1970, national coal production was reported to be 24 percent higher and costs 7 percent lower than in the corresponding period of 1969, and as much new capacity was brought into production as in all of 1969. The quota for coal mine development work was completed by August. Many deposits were reportedly discovered south of the Yangtze River, which supposedly does not have much coal. It was claimed that small and medium-size mines may be just as economical and rational to develop. For example, many small coal mines were developed in Kwangtung, Fukien, and Chekiang Provinces, and production from such mines reached several million tons in 1970 for each province. Many large mines reportedly surpassed designed output levels, including Kailan, Fuhsin, Huainan, Chinghsing, Yangchuan, Penhsi, Tzupo, Liaoyuan, Fangtzu, and Hsuchow. Discounting exaggerations, the country's production of mine-run coal is conservatively estimated at 360 million metric tons for 1970.

About a third of China's nearly 80 principal coal combines were mentioned in the press, including most of the larger ones. Those reportedly fulfilling their 1970 output goals were as follows (when available, the number of days ahead of schedule is in parentheses): Fushun (94), Fuhsin (99), Kailan (55), Tatung (31), Huainan (93), Chihsi, Hokang, Pingtingshan (43), Yangchuan (63). Tzupo, Peking (50), Fengfeng (43), Chiaotso (33), Shuangyashan, Tsaochuang (120), Huaipei (68), Penhsi (115), Chinghsing, Hopi, Peipiao (100), Liaoyuan (98), Akanchen (95), Hsuchow (114), Nanpiao (80), Yima (85), and Hami (57). Target achievements have also been reported by provinces, as follows (when available, the number of days ahead of schedule is in parentheses): Liaoning (80), Heilungkiang (35), Kirin (160), Honan (38), Hopeh (54), Shantung (58), Anhui (65), Hunan, Kiangsu (65), Kiangsi (52), Chekiang (40), Kweichow (55), Inner Mongolia (90), Ninghsia (54), Kansu (40) and Sinkiang (57). Coal output in Kwangtung and Hupeh Provinces was reportedly more than double the 1969 tonnage.

The Kailan combine in Hopeh Province, with a new hydraulic mine and a 3-million-ton preparation plant at Luchiatun, apparently produced at a level higher than in 1969. Luchiatun's development quota was said to have been attained by mid-August. Kailan has long been known for its coking coal. Fushun and Fuhsin, China's two largest coal combines or mines, both located in Liaoning Province, competed with each other with a view to stimulate production and seemed to have achieved considerable success. Efforts were made to save electricity in Fushun's Hungwei open pit, which has 450 kilometers of electrified railways. Underground development work at the

[33] Jen-min Jih-pao (People's Daily; Peiping). Sept. 16, 1970, p. 1.

equally large Hungchi mine was said to be many months ahead of schedule. Fushun is actually a very large and expanding industrial complex, with oil, cement, shale, aluminum, nonferrous, and chemical operations as well. Fuhsin reported a record daily production of 93,000 metric tons of mine-run coal on May 26, 1970.[34] The Hsinchiu and Haichow open pits ran smoothly. The Pingan underground mine with thin seams was singled out as achieving the 1970 quota many months ahead of schedule. Fuhsin had a program to assist small mines nearby, which together produced in excess of a million tons of coal during the year.

Chihsi and its collieries like Chengtzuho and Tunghai did well, although the combine's overall 1970 performance was not reported. The same is true for the Hokang combine and collieries under it like Hungwei, Hungchi, Yaochin, and Chunli. Six newly built mining shafts started production in 1970; simultaneously, Hokang was also sustaining several tens of small coal mines. These two combines were primarily responsible for pushing Heilungkiang Province's output over the quota. The Tatung combine in Shansi Province, with many new collieries developed during the 1960's, including Yungtingchuang, Luan, and Hungchih, surpassed quotas for 31 consecutive months and reportedly established the highest output ever.[35] Tatung was also building supporting facilities, for such items as cement, equipment, and refractories. To the south in Anhui (Anhwei) Province, the Huainan combine not only operated its big colliery, coincidentally also named Tatung, but also an old mine called Liyi and four small open pits of 30,000 to 800,000 tons per year. In addition Huainan set up many small factories during the year to service the coal mines.

These seven combines or administrations each produced more than 13 million tons of mine-run coal in 1970, with Fushun and Fuhsin probably both topping 20 million tons. Another relatively new combine, Pingtingshan in Honan, continued to expand and may have surpassed the 10-million-ton level; another colliery was added in 1970 to the 10 already in existence. Estimated 1970 output ranges for some of the leading combines, in millions of metric tons of mine-run coal, are as follows:

Combine	Province	Output range
Fushun	Liaoning	20 to 22
Fuhsin	do	20 to 22
Kailan	Hopeh	17 to 19
Tatung	Shansi	14 to 16
Huainan	Anhwei	13 to 15
Hokang	Heilungkiang	13 to 15
Chihsi	do	13 to 15
Pingtingshan	Honan	9 to 10
Fengfeng	Hopeh	6 to 8
Peking	Peking	6 to 8
Tzupo	Shantung	5 to 7
Yangchuan	Shansi	5 to 7
Chiaotso	Honan	3 to 5
Shuangyashan	Heilungkiang	3 to 5
Huaipei	Anhwei	3 to 5
Penhsi	Liaoning	3 to 4
Peipiao	do	3 to 4
Tsaochuang	Shantung	3 to 4
Hopi	Honan	3 to 4
Chinghsing	Hopeh	2 to 3
Pinghsiang	Kiangsi	2 to 3
Hsian	Liaoning	2 to 3
Tungchuan	Shensi	2 to 3

Many lesser combines and mines, mostly producing 2 to 8 million tons of coal annually, were mentioned in the press. The Peking combine, China's big anthracite producer, with mines called Tatai, Chengtzu, Mentoukou, and Muchengchien, plus others, reportedly did satisfactorily in 1970, particularly Muchengchien. The Yangchuan combine in Shansi surpassed output targets consecutively for 16 months and reportedly was producing at levels much above the design capacity.[36] The old Penhsi (Penchi) combine in Liaoning, known for coking coal, was 3 months or more ahead of schedule in both production and development. The Peipiao combine, also in Liaoning, was said to have produced far more than in 1969 and much above the design capacity. The Liaoyuan combine in Kirin Province completed a new mine shaft capable of handling 450,000 tons annually.

The Fengfeng combine in Hopeh Province was still being expanded, with a record of 30 consecutive months of meeting production and development quotas. New reserves were found at the Lihsin colliery. The old Chinghsing colliery was being streamlined, with additional washing facilities installed to improve the quality of the coking coal and a 3,000-meter aerial tramway built from mine to railway station.[37] The Hopi combine, with the Fanti and Hsima mines plus two open pits, was men-

[34] Jen-min Jih-pao (People's Daily; Peiping). Aug. 22, 1970, p. 4.
[35] Taiyuan Shansi Provincial Service (in Chinese; Taiyuan). Dec. 16, 1970, p. 1.
[36] Jen-min Jih-pao (People's Daily; Peiping). Nov. 24, 1970, p. 2.
[37] Jen-min Jih-pao (People's Daily; Peiping). Nov. 17, 1970, p. 1.

tioned as having done well. The Tsaochuang combine in adjacent Shantung Province completed a 1.2-million-ton washing plant.[38] The Tungpu mine of the Tungchuan combine in Shensi Province reportedly trebled capacity to 600,000 tons. The Akanchen colliery in Kansu Province further increased production. The Pinghsiang coking coal mine in Kiangsi Province was being revamped, with the Chuyuan colliery fulfilling schedule ahead of time, the old Anyuan colliery being rejuvenated, and the Huangchung field developed for production. The main open pit of the Hami combine in Uighur, Sinkiang Province, reportedly employs two 185-ton electric shovels, each capable of excavating 4,500 cubic meters per day.[39] A large underground mine reportedly started operations in Hupeh Province. The first coal mine in Tibet, a small one by the name of Machala, started operations in 1970. In Shensi Province, several tens of mine shafts were reportedly built.

Petroleum.—Crude oil production (including approximately 4 million metric tons of oil from shale) in mainland China made another significant leap in 1970, reaching possibly 24 million metric tons. (For rough conversion of metric tons per year into barrels per day, divide by 50.) There was no severe political or labor trouble in any of the operations, and production was reportedly up in virtually all cases. One source claimed "China's output of crude oil from January to August was 34 percent higher than the corresponding months of 1969" and that "the productive capacity of new fields tapped in the first half of 1970 was greater than the figure for all of the previous year."[40] Similar advances were made in refining, with capacity approximately sufficient for treating the crude produced. Generally, refineries were not located near oilfields but rather in the consuming areas. Taching overshadowed other oilfields; even the local refinery was large by Chinese standards, although far from adequate to process the crude extracted.[41] Taching may be approaching its limit, so that substantial further increases in China's petroleum output may have to come from new fields like Shengli, Tsaidam, and offshore areas.

No significant oil-economizing drives have been reported in recent years. Some coal-fired locomotives switched to fuel oil, and a Shanghai shipyard was building 15,000-ton tankers to transport petroleum along the coast. All these factors strengthen the belief that production was at high levels and oil was not in short supply.

A few years ago, there was an estimate placing mainland China oil reserves at 15 billion barrels or 2-plus billion metric tons.[42] In addition to Taching, the areas included were Karamai, Yumen, Central Szechuan, and Tsaidam. The above information should be treated only as an order of magnitude. The same source also noted that natural gas production may be about a billion cubic meters (35.3 billion cubic feet) per year and that the potential could support a much higher output. The main natural gasfields mentioned were in the vicinity of Shanghai, Szechuan, and the Tsaidam Basin.

The Chinese have developed a deep well drilling machine in recent years, weighing 300 tons and run by 3,000-horsepower diesel units. Although drilling depth was not known, this rig gives some idea of Chinese capabilities. The Chinese can build some of the less complicated types of refineries and have good knowledge of catalytic cracking. The four largest refineries, Taching, Lanchow, Fushun, and Shanghai, all have petrochemical plants, most of which also produce fertilizers.

Output at the Taching field has been steadily going up in recent years, with one claim stating that "production in the 4 years since the Cultural Revolution began in 1966 was double that of the previous 4-year period."[43] Much drilling, development, and construction took place in 1969, indicating that a much higher level of production was in the offing. This was subsequently confirmed, and Taching's crude oil output in 1970 is conservatively estimated at 10 million metric tons. The local refinery at Lungfeng between Anta and Saertu was originally capable of producing somewhat over 2 million tons an-

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[38] Jen-min Jih-pao (People's Daily; Peiping). Oct. 6, 1970, p. 3.
[39] Ta-kung-pao (Peiping). Nov. 21, 1970, p. 1.
[40] Jen-min Jih-pao (People's Daily; Peiping). Sept. 25, 1970, p. 1.
[41] China Reconstructs (Peiping). December 1970, pp. 16–17.
[42] International Petroleum Encyclopedia. 1970, p. 200.
[43] New China News Agency (in Chinese; Peiping). Sept, 23, 1970, p. 1.

nally. The refinery throughput capacity was subsequently expanded to possibly 4 million tons, judging from expansion activity involving the refinery and storage facilities. Nonetheless, most of the crude had to be shipped elsewhere for refining to places like Shanghai, Fushun, Dairen, Lanchow, and even as far as Maoming in the south.

The Karamai oil complex in Sinkiang, including the local oilfields at Karamai and Tushantzu, resumed normal operations in 1969–70 after a Revolutionary Alliance was formed. The exploration and drilling program was well ahead of schedule in 1970. Crude oil and refinery production presumably topped last year's levels by 15 to 20 percent. Karamai's crude oil output may have reached nearly 3 million metric tons, a new record. The Tushantzu refinery apparently has an annual capacity of just over a million tons, not too different in size from the Karamai refinery. Both refineries were worked at capacity, with surplus crude shipped elsewhere for refining. One source [44] estimated Karamai crude reserves at about 1.9 billion barrels.

Output of the very old Yumen oilfields probably topped 3 million metric tons, 15 to 20 percent higher than in 1969. The 1970 plan for drilling was completed well ahead of schedule.[45] Much has been written about rejuvenating Shihyukou, the mainstay of Yumen. Yumen experienced a shortage of drilling equipment, because many had been dispatched elsewhere to prospect new areas. The local refinery has also been built up, but it is still one of the smaller ones in China so that perhaps two-thirds of Yumen's crude oil must be shipped elsewhere for refining, mainly to the Lanchow refinery.

Lanchow had a peaceful and productive year, under the guidance of the Revolutionary Committee and the PLA. The year's targets were more than fulfilled, which meant that the 3-million-ton annual capacity was fully utilized in processing crude from the Yumen and Karamai fields, among others. Considerable technical progress and diversification of products was also reported. This industrial complex also has petrochemical, fertilizer, and machinery plants. It was reported that the machinery plant made large urea synthesizing vessels, new-type pumps, and deep drilling rigs.

Little was said about Shanghai, one of the country's large refineries with thermal cracking and platforming units. Crude came mainly by sea from Taching in Heilungkiang Province, Manchuria, on specially built tankers. One of these tankers, the second of the 15,000 tonners, has been named Taching No. 28. This industrial complex has been an important center for manufacturing oil refining and drilling equipment. During recent years, some important new techniques were introduced in Shanghai, including a modified process of catalytic cracking, new catalysts, and a special method for making petroleum coke. The No. 7 Dairen refinery, originally rated at about 500,000 tons per year, was greatly expanded; in fact, one source [46] reported that enough equipment had been installed to double capacity. The No. 6 refinery at Chinchou, which is not large, seemed to have been working on local crude, synthetic fuels, and even edible oils.

The Shengli (Victory) field in Shantung, possibly located near the mouth of the Yellow River, was not mentioned in the press. Previously there was speculation that it may be potentially very important and that some of the crude produced might be going to the Shanghai refinery. Another oilfield of possible future importance was reportedly discovered at Shashih in Hupeh, west of Tayeh.

For the first time in many years, oil production in Tsinghai Province, presumably within the Tsaidam Basin, was mentioned in the press. One source [47] indicates that production has been rising by the month, that two units had completed the 1970 output target by September, and that a new refinery was completed in 75 days to supplement one already in existence.

The Chinese Communists probably have started to look into the matter of offshore exploration and drilling for oil. Reportedly, offshore equipment was purchased from West Europe and Romania. Meanwhile, two separate investigating groups have made surveys in international waters contiguous to mainland China and found two promising areas, one in the Yellow Sea between mainland China and Korea and

[44] World Oil. V. 169, No. 3, Aug. 15, 1969, p. 213.

[45] New China News Agency (International Service in English; Peiping). Oct. 17, 1970, p. 1.

[46] Shenyang Liaoning Provincial Service (in Chinese; Peiping). Dec. 8, 1970, p. 1.

[47] Ta-kung-pao (Peiping). Sept. 24, 1970, p. 1.

the other farther south in the Senkaku Islands, only 100 miles north of Taiwan. The two groups were respectively under American and Japanese auspices. Taiwan and Japan had previously made claims on Senkaku Islands. On December 3, 1970, the Chinese Communists also put in a bid for Senkaku Islands as an extention of the Continental Shelf from mainland China.[48]

Shale Oil.—The Fushun shale oil operations were back in full production, with the retorts feeding into two refineries. Crude output from these shale oil refineries probably reached 2 million metric tons in 1970. There is a third refinery in Fushun, of at least million-metric-ton annual capacity, which processes natural crude from the Taching field. Fushun waste shale has long been used for making cement. Other waste materials like water, slag, and gases were being utilized to make chemical, fertilizer, and other products. Oil shale mixed with local coal, which occurs in beds just below the shale, was also being used directly as fuel to generate power.

Maoming (or Mowming) in Kwangtung Province has often been mentioned in the press so that there seems to be no question that retorting facilities are operating and that considerable crude oil and refined petroleum are being produced. Crude oil output from shale in 1970 may have been as high as 2 million metric tons. Maoming's third retort plant was completed around September 1969 and a fourth, presumably in the first half of 1970.[49] Some byproduct metal of great value was also being recovered from the oil shale. Maoming's overall oil refining capacity is large enough to handle both the local crude from shale and imported crude from distant Taching.

[48] Washington Post (Washington, D.C.). Dec. 5, 1970, p. 1.

[49] New China News Agency (in Chinese; Peiping). Oct. 4, 1969.

The Mineral Industry of Colombia

By Gordon W. Koelling [1]

A 31-percent increase in crude oil output from the Putumayo area oilfields overshadowed other mineral industry developments in Colombia during 1970. The rapid rise in production from these fields not only compensated for the declining output at most of the country's other oilfields but also increased total annual crude oil production to an alltime high for the second consecutive year.

The performance of other sectors of Colombia's mineral industry was mixed. Coal continued to be the country's most valuable nonpetroleum mineral product, probably followed by emerald. Colombia, the world's principal source of emerald, ranked among the top 10 gold producers, and was one of the few producers of platinum.

On the basis of geologic surveys conducted during the past 10 years, the Instituto de Investigaciones Geologico-Mineras de Colombia has issued an assessment of some of the country's mineral resources as follows: Phosphates, 200 million tons; gypsum, 40 million tons; iron ore, 100 million tons; bauxite, 700 million tons; short fiber asbestos, 0.3 million tons; coal, 30 million tons; nickle 2 to 4 percent, 32 million tons, and grading 1 percent, 30 million tons; lead ore, 0.9 million tons; and talc, 26 million tons. Deposits of silver were estimated to contain 1.4 million troy ounces.

In mid-1970, the Government-owned oil company, Empresa Colombiana de Petróleos (ECOPETROL), issued general guidelines for the presentation of joint venture offers by private companies for exploration and/or exploitation of reserves areas in the llanos of eastern Colombia. These reserves were granted to ECOPETROL in accordance with the authority granted by Law 20 of 1969. Principal requirements outlined were that (1) the contractor assume all exploration risks, (2) ECOPETROL be allowed to take an equity position of up to 50 percent at the exploitation stage, (3) ECOPETROL's share of production after deduction of royalty payments be at least 50 percent, and (4) exploitation operations be controlled equally by the contractor and ECOPETROL.

PRODUCTION

Output of mineral fuels, especially crude oil and refined products, rose significantly during 1970, but the performance of the metals and nonmetals sectors of the Colombian minerals industry was mixed. Production of some items including iron and steel, lead, cement, salt, limestone, marble, and sulfur increased; however, the output of diatomite and barite declined drastically and the production of such important items as gold, silver, platinum, mercury, and zinc was down.

[1] Geographer, Division of Fossil Fuels.

Table 1.—Colombia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS			
Chromite, gross weight	----	160	170
Copper mine output, metal content e	----	7	200
Gold troy ounces	239,555	218,872	201,500
Iron and steel:			
Iron ore and concentrate thousand tons	578	352	453
Pig iron do	198	201	e 240
Crude steel do	256	263	e 300
Lead mine output, metal content e	740	409	585
Manganese ore, gross weight	500	550	464
Mercury 76-pound flasks	362	344	215
Platinum group troy ounces	22,280	27,805	26,358
Silver [2] do	100,344	77,136	75,581
Zinc mine output, metal content	650	423	389
NONMETALS			
Barite	7,000	12,242	6,821
Cement, hydraulic thousand tons	2,367	2,408	2,757
Clays:			
Kaolin (including china clay) do	84	88	93
Other do	500	555	616
Diatomite	13,179	15,976	280
Feldspar thousand tons	21	22	23
Gem stones, emerald thousand carats	1,020	NA	NA
Gypsum thousand tons	121	151	189
Lime do	915	e 1,000	e 1,000
Mica, all grades	26	17	26
Phosphate rock thousand tons	----	12	e 15
Quartz, quartzite, glass sand do	150	158	165
Salt:			
Rock do	317	344	532
Marine do	188	334	230
Total do	505	678	762
Stone n.e.s.:			
Dolomite do	12	13	(3)
Limestone do	4,287	4,258	5,007
Marble cubic meters	3,927	100	2,850
Sulfur:			
From ore	28,750	e 26,900	e 29,900
Refinery byproduct	3,500	e 3,800	e 3,600
Total	32,250	e 30,700	e 33,500
Talc, soapstone, pyrophyllite	1,349	1,525	1,723
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades thousand tons	3,100	3,317	e 3,320
Coke, all types do	435	465	498
Fuel briquets, all grades do	16	NA	NA
Gas, natural:			
Gross production million cubic feet	95,357	103,882	104,894
Marketed do	38,247	44,767	46,736
Natural gas liquids thousand 42-gallon barrels	3,302	4,006	4,510
Petroleum:			
Crude oil do	63,435	76,776	79,594
Refinery products: [4]			
Aviation gasoline do	684	619	558
Motor gasoline do	13,842	14,338	16,002
Naphthas do	2,344	2,117	1,731
Kerosine do	2,958	3,147	3,552
Jet fuel do	835	1,085	1,292
Distillate fuel oil do	7,480	6,843	6,769
Residual fuel oil do	16,501	15,633	16,352
Liquefied petroleum gas do	1,183	1,216	1,651
Lubricants do	423	467	499
Asphalt and bitumen, refinery do	1,668	1,676	1,576
Petroleum coke do	896	825	870
Other do	1,415	1,847	2,378
Total do	50,229	49,813	53,230

e Estimate. p Preliminary. NA Not available.

1 In addition to the commodities listed, carbon black, chromite, fertilizer materials, and magnesite are also produced, but the level of output is unknown.

2 Reported by Banco de la Republica as precious metal refinery output.

3 Less than ½ unit.

4 Includes refinery fuel and unfinished oils destined for interrefinery transfer and further processing.

TRADE

Shipments of crude oil, Colombia's principal mineral export item, increased sharply. Exports of platinum, ammonia, coal, and residual fuel oil also rose significantly. A majority of imported mineral items registered increases; the rise in iron and steel was the most significant.

Table 2.—Colombia: Exports of mineral commodities
(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	Principal destinations, 1969
METALS			
Aluminum including alloys, all forms	126	399	Mainly to Ecuador.
Copper:			
Ore and concentrate	153	139	Mainly to Japan.
Metal including alloys	40	750	West Germany 328; Sweden 150; Belgium-Luxembourg 80.
Iron and steel including alloys, all forms	664	826	Mainly to Ecuador.
Lead:			
Ore and concentrate	1,130	550	All to United States.
Metal including alloys	--------	1	All to Ecuador.
Mercury ... 76-pound flasks	149	21	Mainly to Argentina.
Platinum-group:			
Ore and concentrate	20	--------	
Platinum partly worked ... troy ounces	25,913	27,457	All to United States.
Zinc:			
Ore and concentrate	575	--------	
Metal including alloys	38	363	Japan 233; Ecuador 122.
Other:			
Ore and concentrate	39	146	Sweden 96; Japan 50.
Ash and residue containing nonferrous metal	56	--------	
NONMETALS			
Asbestos	2	--------	
Cement ... thousand tons	r 328	278	Puerto Rico 90; Brazil 79; Netherlands Antilles 32.
Clays and products (including refractory brick):			
Crude, kaolin and other	r 15	10	All to Venezuela.
Products, refractory	r 103	152	Mainly to United States.
Fertilizer materials:			
Crude	5,410	NA	
Ammonia	r 21,470	25,473	Costa Rica 12,370; Netherlands 7,420; Venezuela 3,478.
Precious and semiprecious stones [2] ... kilograms	852	659	United States 444; Japan 109.
Sulfur	165	33	All to Ecuador.
Talc, steatite	8	10	Do.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	2,073	5,114	Peru 1,484; Chile 1,374; Guatemala 546; Brazil 530.
Coal and coke, all grades	2,802	3,689	Mainly to Venezuela.
Petroleum:			
Crude [3] ... thousand 42-gallon barrels	18,448	29,853	Mainly to United States.
Refinery products:			
Gasoline and naphtha ... do	1,242	475	Mainly to Netherlands Antilles.
Distillate fuel oil ... do	2,038	1,399	United States 831; Virgin Islands 364.
Residual fuel oil ... do	7,344	9,893	Mainly to United States.
Other ... do	56	(4)	Mainly to Venezuela.
Mineral tar and other coal, petroleum or gas derived crude chemicals	r 43,348	33,951	All to Venezuela.

r Revised. NA Not available.
[1] In addition to the reported commodities, Colombia is known to export gold and silver, but data are not available concerning shipments of these items.
[2] Includes emerald.
[3] Includes small quantities of natural gas liquids mixed with crude oil.
[4] Less than ½ unit.

Table 3.—Colombia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	5,930	4,600
Oxide (alumina) and hydroxide	750	954
Metal including alloys:		
Ingots, castings, scrap	9,018	8,005
Semimanufactures	1,158	2,973
Antimony including alloys	r 16	---------
Copper including alloys, all forms	r 4,282	4,420
Iron and steel:		
Ore and concentrate	348	---------
Metal:		
Pig iron and scrap	r 2,525	12,097
Ferroalloys	5,641	3,472
Steel, primary	r 46,368	71,471
Semimanufactures	122,564	244,623
Lead:		
Oxides	1,081	936
Metal including alloys, all forms	2,270	2,339
Magnesium including alloys, unwrought	17	129
Mercury .... 76-pound flasks	46	332
Nickel:		
Metal including alloys, unwrought	39	8
Semimanufactures	27	209
Platinum-group including alloys .... troy ounces	72,411	60,980
Silver including alloys, all forms .... do	22,666	1,640
Tin including alloys, all forms .... long tons	250	336
Zinc including alloys, all forms	4,381	5,607
Other n.e.s	NA	19
NONMETALS		
Abrasives, natural, n.e.s.:		
Crude	396	171
Grinding stones and wheels	49	53
Asbestos, crude	r 14,093	12,187
Barite and witherite	---------	2
Boron materials, refined borax	152	266
Cement	307	351
Clays and products:		
Crude n.e.s.:		
Bentonite	r 2,613	2,889
Kaolin	3,194	2,484
Other	74	38
Products, refractory	3,286	1,372
Cryolite	NA	5
Diatomite and other infusorial earths	1,203	1,312
Fertilizer materials crude and manufactured:		
Nitrogenous	7,295	8,634
Phosphatic	58,377	67,608
Potassic	60,960	61,925
Other including mixed	34,046	16,609
Graphite, natural	46	50
Gypsum and plasters	12,374	22,071
Magnesite	118	71
Mica, all forms	r 232	36
Pigments, mineral	433	817
Salt	8	10
Sodium and potassium compounds, n.e.s	27,128	19,103
Stone, sand and gravel	5,577	4,651
Sulfur	79	2,602
Talc, soapstone, pyrophyllite	532	1,391
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	189	153
Carbon black	349	428
Liquefied petroleum gases	---------	75
Petroleum refinery products:		
Gasoline .... thousand 42-gallon barrels	41	463
Kerosene and jet fuel .... do	2	22
Distillate fuel oil .... do	15	15
Lubricants .... do	12	122
Mineral jelly and wax .... do	181	161
Other .... do	115	107
Mineral tar and other coal, petroleum, or gas derived crude chemicals	NA	849

r Revised. NA Not available.

Source: Official customs returns of Colombia.

COMMODITY REVIEW

METALS

Aluminum.—Kaiser Aluminum & Chemical Corp. continued its investigation of extensive bauxite deposits in the Department of Cauca. However, the ore in these deposits is low grade and may not be economically exploitable within the near future. Applications for mining claims covering these deposits were filed by Kaiser with the Ministerio de Minas y Petróleos, but as of yearend 1970 no mining contract talks with the Ministerio had been programmed.

Gold.—Gold output during 1970 decreased for the sixth consecutive year due primarily to the lower grade of gravel worked at placer mining operations and a decline in underground operations. Almost 69 percent of the year's gold production was accounted for by a consortium of five companies. Four of these were wholly owned subsidiaries of the International Mining Corp. (United States), which also owned a controlling interest in the fifth, Pato Consolidated Gold Dredging, Ltd.

During 1970, production of gold by wholly owned subsidiaries of International Mining totaled 76,921 troy ounces, of which 50,296 troy ounces were from the country's only underground gold mining operation at Frontino. The 21-percent decline in this mine's gold output, in comparison with that of the previous year, resulted from the failure of an expansion program initiated in 1964 to develop sufficient new high-grade reserves to support previous production levels at current prices. Placer mining operations of International's wholly owned subsidiaries involved the use of six dredges. A total of 17.6 million cubic yards of materials were dredged from which 26,625 troy ounces of gold were recovered, a 19-percent decline for the year.

Pato Consolidated, operated four dredges which dredged 19.1 billion cubic yards during the year. Approximately 62,000 troy ounces of gold were recovered from this material. This 14-percent decline in production during 1970 resulted in part from the fact that a fifth dredge, which capsized in November 1969, could not be salvaged economically and returned to service. Some equipment, usable on the other dredges, was recovered.

Iron and Steel.—Acerías Paz del Rio, S.A. continued to be the country's only producer of iron ore and pig iron and the dominant producer of crude steel in 1970. Although this company's output of iron ore increased 29 percent during the year, it continued to draw sizable quantities of fines from its large stockpile. These fines provided part of the feed for the company's relatively new ore-sinterization and oxygen-blasting facilities.

Iron ore deposits of Acerías Paz del Rio are presently worked by adit. The current mining method is a room-and-pillar system worked on a rise which generally varies from 30 to 50°. When that part of the deposit is reached where the dip of the ore bed becomes less steep, it is intended to introduce transloaders and to arrange the rooms diagonally to the dip. The transloaders will transfer the ore through a semiportable crusher to a belt conveyor.

A new 10,000-ton-per-year electric furnace probably was placed in operation at the Corporación de Acero steel mill before the end of 1970. Siderúrgica de Medellín's expansion program involving the doubling of its electric furnace capacity to 40,000 tons per year and the addition of a line for bar and structural steel production was nearing completion at yearend.

Nickel.—In July 1970 the Colombian Government signed a mining concession contract and a Instituto de Fomento Industrial (IFI) joint-venture agreement with Hanna Mining Co. and Chevron Oil Co. for the development of a lateritic nickel deposit at Cerro Matoso in the Department of Córdoba. Each of the three entities involved in the joint-venture company, Compañia de Niquel Colombiano, S.A., will contribute one-third of the over $100 million [2] investment required for the project, but the Government-owned IFI will have a 50-percent voting interest. The mining concession will extend 25 years after the initiation of ferronickel ingot production. Upon its expiration all mining and plant facilities and equipment will revert to the Colombian Government. Compañia de Niquel will be required to pay a royalty of 8 percent based on minehead mineral value.

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2 Where necessary, values have been converted from Colombia Pesos (CP) to U.S. dollars at the rate of CPs 17.60 = US $1.00.

The Cerro Matoso project will be the largest mining venture in Colombia's history. Plans call for the development of an open pit mine and an adjacent smelter with an annual capacity of 17,000 tons of ferronickel ingot (nickel content only). Production is scheduled to begin before the end of 1973.

NONMETALS

Asbestos.—During 1970 development of an asbestos deposit in the northern part of the Department of Antioquia was in progress. The deposit contained approximately 10 million tons of 4-percent-fiber-content ore. Construction was also proceeding on an adjacent milling plant designed to process a projected ore output of 36,000 to 63,000 tons per year, and asbestos fiber production was scheduled to begin in 1972. Nicolet Industries, Inc., of Ambler, Pa., holds a 70-percent interest in this asbestos mining and milling venture.

Fertilizer Materials.—Construction was in progress during 1970 on a 60,000-ton-per-year superphosphate plant at Ventaquemada in the Department of Boyacá. This plant was being constructed under contract by Pan American Consulting, Ltd., for Compañia Columbiana de Minas (COLMINAS), a dependency of IFI. This project is the first step under an IFI program for the development of Colombia's phosphate rock deposits.

COLMINAS continued its geologic studies of phosphate rock deposits in the Sardinata and Azufrada areas in the Department of Santander and in the Sogamosa area of the Department of Boyacá. The latter area, where large tonnages of phosphate rock have been outlined by detailed geologic mapping and sampling, is considered to offer the best economic potential. Sogamosa's principal phosphate rock strata range in thickness from approximately 5 to 10 feet and consist of abundant sand-size phosphate grains in a matrix of very fine-grained quartz, some clay, and perhaps, apatite.

Gem Stones.—Emerald deposits, described as potentially rich, were reportedly discovered at Guateque in the Department of Boyacá during 1970. This discovery was made by Empresa Colombiana de Emeraldas, an autonomous Government entity established in 1968 to operate the Muzo and Coscuez mines and to carry out exploration in national reserve areas.

Salt.—Construction was reportedly in progress during 1970 on an expansion of the daily output of IFI's Mamonal alkali plant to 750 tons of sodium carbonate, 260 tons of caustic soda, 250 tons of refined salt, and 108 tons of sodium. This expansion was being financed through loans from Swiss, Italian, and Mexican companies. IFI also continued to expand its sea water evaporation facilities at Manaure.

MINERAL FUELS

Coal and Coke.—An initial 10,000-ton shipment of anthracite coal from a recently developed deposit in the Department of Santander was exported to Spain in April 1970 by Carbonos de Carare. This company, owned by Spanish/Colombian private interests, hopes to export about 100,000 tons of anthracite per year.

A test drilling program involving the coal deposits at El Cerrejon in the Department of Guajira was completed by IFI during 1970. Results of this test program indicate reserves of 50 to 100 million tons of steam-grade, noncoking coal. Seams slope downward from the surface at a 20° angle, and strip mining methods would reportedly be economical for 10 to 15 years. However, part of the reserves would be recoverable only by means of underground mining.

Acreías Paz del Rio, the country's principal producer and consumer of metallurgical coke, continued to be the only company operating a major coal washery.

Petroleum and Natural Gas.—Output of crude oil rose 4 percent to a new high during 1970. This increase resulted from the expansion of production at the Putumayo area fields that occurred despite breaks in the Orito-Tumaco pipeline and demonstrations that interrupted operations at the Tumaco export terminal. Aggregate production from the country's other fields, most of which are old and are characterized by high depletion rates, continued to decline.

Natural gas production, which increased only 1 percent during 1970, was primarily from oilfields where, in a number of cases, gas/oil ratios have been rising steadily in conjunction with reservoir depletion. Output of natural gas liquids increased 13 percent during the year.

Table 4.—Colombia: Salient statistics of the petroleum and natural gas industry

	1968	1969	1970
Crude oil:			
Production thousand 42-gallon barrels	63,435	76,776	79,594
Delivered to refineries do	45,244	46,565	49,030
Exported do	18,448	29,853	31,246
Natural gas:			
Production million cubic feet	95,357	103,882	104,894
Consumption [1] do	38,247	44,767	46,736
Injected [2] do	41,325	37,421	38,150
Flared do	15,785	21,694	20,008
Natural gas liquids:			
Production thousand 42-gallon barrels	3,302	[r] 4,006	4,510
Consumption [3] do	2,041	[e] 2,200	[e] 2,500
Delivered to refineries do	886	[r] 1,519	1,706
Exported, mixed with crude oil do	215	[e] 220	[e] 230
Refinery products:			
Refinery output [4] do	50,229	49,813	53,230
Consumption [5] do	30,728	32,005	35,396
Unfinished oils rerun following inter-refinery transfer do	2,821	1,449	1,844
Exported do	10,680	11,767	10,558

[e] Estimated. [r] Revised.
[1] Includes shrinkage at natural gas processing plants and oil company use for fuel.
[2] Includes small quantities used for gas-lift operations.
[3] Excludes the propane and butane output of refineries.
[4] Includes refinery gains and quantities used for fuel.
[5] Excludes propane and butane produced at refineries and most oil company use.

Source: Centro de Información de la Industria Petrolera.

Proved reserves of crude oil reportedly totaled 1,675 million barrels at yearend 1970. As of the same date, proved reserves of natural gas were reported at 2,800 billion cubic feet.

At the beginning of 1970, 73 petroleum concessions granted by the Colombian Government were in effect. Of these, 41 covering 1.7 million hectares were exploration concessions and 32 encompassing 2.1 million hectares were exploitation concessions. Two private concessions also remained in effect; the 512,000-hectare De Mares area held by ECOPETROL and a 127,000-hectare tract held by Texas Petroleum Co. (TEXPET).

In May 1970 the Government issued seven decrees reserving areas totaling almost 8.2 million hectares for exploration and exploitation by the Government-owned oil company ECOPETROL, in accordance with the authority granted by Law 20 of 1969. Included in these areas, are the three zones previously designated for exploration by ECOPETROL under the terms of earlier legislation. Those portions of the reserved areas located in the llanos of eastern Colombia and on the Continental Shelf adjacent to the Departments of Magdalena and Guajira are considered to offer the best prospects for major oil and/or natural gas discoveries. The reserved areas are not subject to the country's basic petroleum code, Law 10 of 1961, and ECOPETROL has therefore been granted considerable latitude for negotiating joint-venture exploration and development contracts.

General guidelines for the presentation of joint-venture offers by private companies for exploration and/or exploitation in ECOPETROL's reverse area in the llanos were issued during July 1970. According to these guidelines, contractors are to assume all exploration risks and to make a minimum investment of $500,000 in the first year of exploration and $750,000 in each of the following 2 years. ECOPETROL would take an equity position, up to 50 percent, at the exploitation stage. A contract exploitation period of 25 years is contemplated. The contractor's royalty payment to ECOPETROL should not be less than 16 percent and ECOPETROL's share of production after deduction of royalty payment should not be less than 50 percent regardless of ECOPETROL's equity percentage in the joint venture. Exploitation operations would be under the direction of a Committee of Operation, in which the contractor and ECOPETROL would have an equal vote.

Subsequent to the issuance of these guidelines, a number of companies submitted proposals for joint exploration/exploitation ventures in the llanos reserve area and by yearend ECOPETROL had announced the winning bids. Continental Oil

Co. in partnership with Shell Oil Co. (U.S.-based member of the Royal Dutch/Shell Group) was declared the winner of three of the blocks available. Two blocks were won by International Petroleum Colombia, Ltd., (ITROCOL) and one block each was won by BP Colombian, Inc., and the Superior Oil Co. of Colombia in partnership with Sun Oil Co. and Signal Companies, Inc. No bids were received on an eighth block.

Earlier in 1970 ECOPETROL awarded a contract for a joint exploration/exploitation venture covering an area in the Middle Magdalena Valley to Socios Petroleros de Colombia. This company is owned by Herrera International de Colombia, Ltd., Alpine/Andean Oil Corp., and Monoil Co.

Exploratory drilling declined sharply in 1970, but development activity, mostly in the Putumayo area, increased. Data on drilling activity and results were as follows:

	1969	1970
Wells drilled:		
Exploratory:		
Oil number	9	3
Dry do	22	15
Subtotal do	31	18
Development:		
Oil do	20	39
Gas do	-------	1
Injection do	5	-------
Dry do	6	2
Subtotal do	31	42
Total do	62	60
Footage drilled feet	430,180	404,898

A new 30,000-barrel-per-day crude oil distillation unit was completed at ECOPETROL's Barrancabermeja refinery by the end of 1970. The addition of this unit raised the refinery's rated crude throughput capacity to 105,000 barrels per day. Installation of a paraffin unit was nearing completion at the Barrancabermeja plant at yearend.

Following several demonstrations in the Department of Nariño, including the occupation and shutdown of the Tumaco crude oil export terminal in connection with the choice of a refinery site in the western part of the country, the Government issued a decree during October 1970 calling for the construction of a 75,000-barrel-per-day plant at Tumaco. It was also specified that crude oil from the Putumayo oilfields would not be refined elsewhere in Colombia and that a smaller refinery to be constructed later in the Department of Valle would obtain its feedstock elsewhere. The Tumaco refinery is to be owned and operated by ECOPETROL.

In 1970 ECOPETROL announced its decision to become involved in the distribution of refined products. It indicated a desire to form an association with an existing distributor and to set up a chain of gasoline service stations as ECOPETROL outlets. To this end, ECOPETROL made an offer of association to each of the country's three products distributors: Esso Colombiana S.A., TEXPET, and Codi-Mobil.

The trans-Andean crude-oil pipeline from the Orito field in the Putumayo area to the port of Tumaco, owned by Gulf Oil Co. and TEXPET and operated by the latter, was shut down for a total of almost 8 weeks during 1970. Landslides in Cañon Sucio during February and August caused breaks in the pipeline that required more than 1 and 2 weeks, respectively, to repair. The longest shutdown in pipeline operations occurred when the Tumaco export terminal was shutdown for a month by protestors. Both the terminal and the pipeline resumed operations during the latter part of October following the Government decision to construct a new refinery at Tumaco.

The Puerto Salgar-Cartago refined products pipeline, owned by ECOPETROL, reportedly became fully operative over its entire length around the beginning of 1970. This 210-kilometer line laid with a combination of 6-and 8-inch pipe has a capacity of 20,000 barrels per day. Elevations along this line vary from 650 feet at Puerto Salgar to 12,329 feet at the Páramo de Letras crossing of the Andes; it is reported to be the world's second highest pipeline in operation. The Puerto Salgar-Cartago pipeline links ECOPETROL's Galán-Puerto Salgar products line with the Buenaventura-Cartago line of Oleoducto del Pacifica, S.A., and makes possible the transport of refined products via pipeline from the Barrancabermeja refinery all the way to the country's west coast. Previously, the western part of Colombia had to be supplied with products shipped by tanker from Mamonal via the Panama Canal to the port of Buenaventura.

Several petrochemical facilities were under construction in 1970. Among these was ECOPETROL's aromatic hydrocarbons plant, located adjacent to the Barrancabermeja refinery. This plant will have an annual production capacity of 23,000 tons of benzene, 20,000 tons of toluene, and 36,000 tons of xylenes from naphtha. The processes to be used have been licensed by the UOP Process Division of the Universal Oil Products Co. of Des Plaines, Ill. Among the processes involved are platforming and sulfolane extraction for the production of high-purity, nitration-grade aromatics, hydeal hydrodealkylation for the catalytic conversion of toluene and/or xylenes to benzene, and hydrar hydrogeneration for the catalytic saturation of benzene with hydrogen to produce equivalent purity cyclohexane.

ECOPETROL was also in the process of erecting a plant adjacent to the Barrancabermeja refinery for the output of ethylene and propylene, raw materials for the manufacture of polyethylene and polypropylene. This plant's capacity for production of ethylene and propylene will be approximately 19,000 to 10,000 tons per year, respectively. The ethylene will be used by the 15,000-ton-per-year, low-density polyethylene plant of Poliolefinas Colombianas, S.A., a company owned jointly by ECOPETROL and The Dow Chemical Co.

Construction neared completion during 1970 on a caprolactam plant at Barranquilla, which was being erected as a result of a petrochemical integration agreement between Colombia and Venezuela. ECOPETORL and Instituto Venezolano de Petroquímica (I.V.P.), a Venezuelan Government-owned company, will each have a 45-percent share in the venture, and a Netherlands company will have the remaining 10 percent. Principal feedstocks for this plant will be cyclohexane from ECOPETROL's Barrancabermeja aromatic hydrocarbons complex and ammonia from an I.V.P. plant in Venezuela. Planned capacity for the Barranquilla plant is 16,000 tons per year of caprolactam and a byproduct output of 4.3 tons of ammonium sulfate per ton of caprolactam produced. Plans call for installing the necessary equipment for the conversion of the ammonium sulfate into marketable fertilizer.

Early in 1970 it was announced that a polyvinyl plant at Cartagena, owned by Petroquímica Colombiana and Diamond Shamrock Oil and Gas Co., would be expanded to produce approximately 14,000 tons of vinyl chloride monomer per year. This expansion project also involves the installation of facilities to produce about 23,000 tons of ethylene dichloride per year.

Table 5.—Colombia: Ownership, crude oil production, and refining capacity of companies holding petroleum concessions as of July 1970

Company [1]	Principal ownership or affiliation	Nationality of ownership	Crude oil production during 1970 (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1970 (thousand 42-gallon barrels daily)
Antex Oil and Gas Co., Inc.	Petroquímica del Atlántico and U.S. citizens.	Colombian/United States.	1	----------
Chevron Petroleum Co. of Colombia.	Standard Oil Co. of California.	United States	10,560	----------
Colombia-Cities Service Petroleum Corp. (COLCITCO).	Cities Service Co	do	3,903	----------
Colombia Gulf Oil Co	Gulf Oil Corp	do	----------	----------
Colombian Petroleum Co. (COLPET).	Mobil Oil Corp. and Texaco, Inc.	do	7,351	4
Empresa Colombiana de Petróles (ECOPETROL).	Colombian Government	Colombia	9,624	105
International Petroleum Colombia, Ltd. (INTERCOL).	Standard Oil Co. (New Jersey).	United States	----------	55
John W. Mecom	John W. Mecom	do	----------	----------
Marathon Petroleum Colombia, Ltd.	Marathon Oil Co	do	----------	----------
Phillips Petroleum Co	Phillips Petroleum Co	do	----------	----------
Provincia Petroleum Co	International Petroleum Colombia, Ltd. and British Petroleum Co., Ltd.	United States/British.	8,027	----------
Shell-Condor, S.A	Royal Dutch/Shell Group	British/Dutch	7,176	----------
Sinclair Colombian Oil Co	Atlantic Richfield Co	United States	----------	----------
Tennessee Colombia, S.A. (TENNECOL).	Colombian citizens and Southdown, Inc.	Colombian/United States.	747	----------
Texas Petroleum Co. (TEXPET).	Texaco, Inc	United States	8,831	3
Texas Petroleum Co. and Colombia Gulf Oil Co.	Texaco, Inc. and Gulf Oil Corp.	do	23,374	1
The Superior Oil Co. of Colombia.	Superior Oil Co	do	----------	----------
Total			79,594	168

[1] Companies appearing in this column are limited to those listed as concessionaires in official records and publications. Such official lists exclude firms which have obtained a participating interest from concession holders of records.

The Mineral Industry of the Democratic Republic of the Congo (Kinshasa)

By Harold J. Schroeder [1]

In 1970 the Congo (Kinshasa) was the fifth ranked country in production of copper, and the income derived from that production furnished the foundation for the Congolese economy. The Congo remained the largest producer of cobalt and industrial diamond in the world. Other mineral output of importance included zinc, gold, germanium, manganese, tin, and columbium-tantalum. To these must be added the initiation of oil production in 1970 from an offshore well, which promises an entirely new dimension in Congolese economics.

Katanga Province is by far the most important mineral producing region in the Congo. All of the copper mines, with associated cobalt, zinc, and germanium production are located in Katanga. La Générale Congolaise des Minerais (GECOMINES), a Government-owned company, was the sole producer in 1970. However, a joint Japanese-Congolese concern, Société de Developpement Industriel et Minier du Congo (SODIMICO), was formed in 1969 and has been developing a copper property for scheduled 1972 output. In addition, a consortium of American, British, French, and Japanese companies, and a Canadian company are actively investigating copper mining opportunities in Katanga Province.

Mining in Kivu Province is comprised mostly of small-scale operations producing tin, gold, tungsten, columbium-tantalum, beryl, and manganese. The major companies in the area are Syndicat Minier de l'Etain (SYMETAIN), Kivumines, Compagnie Belge d'Entreprises Minières (Cobelmin), and Compagnie Minière des Grands Lacs (MGL), moderate-sized affiliates of the Brufina and Empain financial groups in Belgium. Sociéte Minière-Union Carbide-Somikubi (SOMUCAR), 51-percent-owned by Union Carbide, has a columbium-tantalum deposit under development.

PRODUCTION AND TRADE

The available data on mineral production and trade are shown in the following tables:

[1] Physical scientist, Division of Nonferrous Metals.

Table 1.—Congo (Kinshasa): Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Beryllium, beryl concentrate, gross weight	--	144	130
Cadmium smelter production	320	r 316	260
Cobalt:			
Mine output, metal content	10,562	10,596	13,958
Refinery production	10,549	r 10,596	13,374
Columbium-tantalum concentrate	113	83	146
Copper:			
Mine output, metal content	327,000	356,906	385,679
Blister and leach cathodes	326,500	363,758	385,543
Refined	167,000	182,291	189,600
Germanium, content of concentrates kilograms	NA	r 11,325	NA
Gold troy ounces	169,975	175,804	177,128
Manganese ore and concentrate, gross weight	321,811	311,429	346,950
Rare earth metals, monazite concentrate, gross weight	NA	178	143
Silver thousand troy ounces	2,139	1,896	1,709
Tin:			
Mine output, metal content long tons	r 6,165	r 6,542	6,345
Smelter, primary do	1,892	r 1,851	1,374
Tungsten mine output, metal content	r 86	r 143	--
Zinc:			
Mine output, metal content	126,529	94,558	105,082
Metal, primary	62,573	63,732	63,750
NONMETALS			
Cement, hydraulic thousand tons	294	322	e 384
Diamond:			
Gem thousand carats	551	491	1,750
Industrial do	11,353	13,625	12,336
Total do	11,904	14,116	14,086
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous thousand tons	71	66	102
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	691	884	1,022
Kerosine and jet fuel do	r 421	573	572
Distillate fuel oil do	1,006	1,180	1,332
Residual fuel oil do	1,595	1,898	1,754
Lubricants do	126	--	--
Other do	10	9	13
Refinery fuel and losses do	248	354	266
Total do	4,097	4,898	4,959

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

Table 2.—Congo (Kinshasa): Apparent exports of mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum scrap	--	50	All to West Germany.
Copper:			
Matte	--	460	All to Italy.
Metal:			
Scrap	185	399	France 137; West Germany 121; Belgium-Luxembourg 101.
Unwrought:			
Unrefined	6,232	2,444	France 2,424; Italy 20.
Refined	80,778	79,004	Italy 36,546.
Unspecified (unrefined and/or refined)	226,622	245,725	All to Belgium-Luxembourg.
Semimanufactures	204	--	
Iron and steel scrap	1,522	5,146	Italy 4,041; Spain 1,105.
Manganese ore, gross weight	100,345	274,977	United States 98,860; Belgium-Luxembourg 81,469; Norway 57,225.
Tin:			
Ore and concentrate, gross weight long tons	7,602	7,285	Belgium-Luxembourg 4,552; Netherlands 1,616; Spain 1,117.
Metal unwrought do	1,827	1,777	All to Belgium-Luxembourg.
Tungsten ore and concentrate, gross weight	164	117	West Germany 66; United Kingdom 27; Belgium-Luxembourg 24.
Uranium and thorium ores value, thousands	--	$142	All to France.
Zinc:			
Ore and concentrate	72,577	72,679	Belgium-Luxembourg 62,707; France 9,972.
Metal unwrought	42,251	57,440	West Germany 19,311; Belgium-Luxembourg 18,088; United States 9,635.
Other:			
Ores and concentrates n.e.s. value, thousands	$1,895	$1,286	Belgium-Luxembourg $683; United States $603.
Metallurgical residues containing recoverable metals	384	722	West Germany 623.
Metals, nonferrous n.e.s., unwrought and semimanufactures	[2] 12,777	[2] 14,953	Belgium-Luxembourg 11,058; Japan 3,438.
NONMETALS			
Asbestos, crude	272	--	
Diamond:			
Gem value, thousands	$31,182	$43,966	United Kingdom $43,881.
Industrial do	$1,465	$1,462	Italy $1,098; United States $333.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Partly refined oil thousand 42-gallon barrels	76	--	
Refinery products:			
Distillate fuel oil do	--	150	All to Belgium-Luxembourg.
Residual fuel oil do	650	713	Belgium-Luxembourg 687; Portugal 26.

[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, the United States, and Yugoslavia.
[2] Partial figures; quantity listed for 1968 valued at $47,634,000; quantity listed for 1969 valued at $60,101,000; an additional unspecified quantity was reported in sources, which gave a value of $4,680,000 for the unreported 1968 quantity and $9,948,000 for the unreported 1969 quantity; by far the larger part of these total values for unspecified quantities was credited to the United States in both 1968 and 1969.

Source: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 650–653; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 462–464.

Table 3.—Congo (Kinshasa): Apparent imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal and alloys, all forms	667	524
Copper metal and alloys, all forms	80	247
Iron and steel:		
Pig iron and ferroalloys	149	200
Steel semimanufactures	65,551	92,422
Lead:		
Oxide	69	--
Metal and alloys, all forms	140	126
Silver crude and partly worked ...value, thousands	$201	$61
Tin metal and alloys, all forms ...long tons	--	15
Titanium oxide	275	334
Zinc metal and alloys, all forms	--	73
Other metals and alloys n.e.s., all forms	104	--
NONMETALS		
Asbestos	1,701	794
Cement, hydraulic	840	2,068
Clay products:		
Nonrefractory	1,038	2,317
Refractory	1,428	1,641
Diatomaceous earth	432	330
Fertilizer materials:		
Crude, natural, phosphatic	1,275	--
Manufactured:		
Nitrogenous	4,379	8,090
Potassic	1,973	3,565
Mixed and unspecified	3,452	4,020
Gypsum and plasters	7,000	7,500
Lime	1,768	1,587
Pigments, mineral, iron oxides	208	141
Salt	--	432
Slag and other nonmetal bearing metallurgical residues	163	150
MINERAL FUELS AND RELATED MATERIALS		
Coal and coal briquets	70,337	9,337
Coke, all types	20,037	--
Petroleum refinery products:		
Gasoline ...thousand 42-gallon barrels	16	--
Kerosine and jet fuel ...do	3	5
Distillate fuel oil ...do	30	57
Lubricants ...do	34	25
Liquefied petroleum gas ...do	4	--
Other ...do	34	64

[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, the United States, and Yugoslavia.

Source: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 654–672; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 465–478.

COMMODITY REVIEW

METALS

Cobalt.—Production of cobalt—14,000 tons, 32 percent greater than in 1969—came from GECOMINES copper operations in Katanga. The company operated eight mines with most of the copper-cobalt ore produced in the western area of the province near Kolwezi. Three open pit mines, Kamoto, Musonoi, and Ruwe, and one underground mine, Kamoto, under development, accounted for the total output. Total ore feed from the mines to concentrators and washing plants was about 10 million tons. GECOMINES operated two hydrometallurgical plants, Luilu and Shituru, where approximately 75 percent of the copper and all of the cobalt was electrowon. Increased capacity installed at Shituru accounted for the increased output. The ore is roasted and leached to extract copper and cobalt. The cobalt is precipitated from solution following precipitation of iron and copper. The cobalt precipitate is redissolved, and the cobalt is electrodeposited. A third Dorr Fluo-Solids roaster was being installed at the Luilu plant and was expected to be on stream by January 1972. The new roaster will nearly double the throughput of copper-cobalt concentrate from the present 370 tons per day to 720 tons per day. The principal feeds to the Luilu plant were sulfide and oxide concentrates from the Kamoto and Kolwezi concentrators. The sulfide concentrate contained 43 percent copper and 2.5 percent cobalt, and the oxide concentrate contained 24 percent copper and 2 percent cobalt.

Columbium-Tantalum.—SOMUCAR completed construction of its plant for treatment of pyrochlore ore at Bingo, in Kivu Province. Production was planned for 1970, but technical difficulties delayed startup operations. The plant is expected to be in production in 1971.

Copper.—GECOMINES accounted for the total metal output of 385,700 tons, an increase of 8 percent over 1969. Additions to the Kambove concentrator and the Ruwe washing plant completed in October contributed to the greater output and were part of a 5-year expansion program designed to increase GECOMINES annual copper-producing capacity to 460,000 tons in 1974.

SODIMICO, a joint Congolese-Japanese concern, announced discovery of copper ore in the Kinsenda area of Katanga Province. The company plans to develop two mines, Musoshi and Tshinsenda. SODIMICO estimates ore reserves at Musoshi of 100 million tons, averaging 2 to 3 percent copper, and an estimated 35 million tons, containing 5 percent copper, at Tshinsenda. Plans at Musoshi, where work was in progress, call for a concentrator to produce a 36-percent copper concentrate. The concentrate will be railed to Beira, Mozambique, for shipment to Japan. Production is scheduled for 1972 at an annual rate of 53,000 tons of copper. The Tshinsenda underground mine is scheduled for production in 1976.

Société Internationale des Mines du Congo and Société Congolaise du Tenke-Fungurume (SIMICO/SOCOTEF) was formed in September by a consortium of five companies and the Congolese Government. The companies comprising this consortium are Amoco Minerals Co. (a subsidiary of Standard Oil Co. of Indiana), Charter Consolidated, Ltd., of London, Mitsui & Co. Ltd., Bureau de Recherches Géologiques et Minières (BRGM) of Paris, and Leon Tempelsman & Son, Inc., of New York. Prospecting and development rights have been granted in two areas of Katanga Province, one of which contains the known copper deposits of the Tenke-Fungurume locality; the other area is an unprospected region of 25,000 square kilometers.

Falconbridge Nickel Mines, Ltd., has established an office in Kinshasa and is making a study of copper deposits around the Lufukwe River in Southern Pweto Territory, Katanga Province.

Manganese.—Société Minière de Kisenge (SMK), a Congolese company wholly owned by Société Generale de Belgique, is the only source of manganese in the country. Production was 346,950 tons of ore, containing 45 percent manganese, an increase of 11 percent over that of 1969. Output comes from two open pit mines at Kisenge, near the Angola border. The ore is crushed and blended to produce a uniform quality ore and shipped by rail to Lobito, Angola, for final shipment to the United States and Europe for use in the steel industry. SMK has begun developing a third open pit mine and is considering construction of a new treatment plant for the production of a 90-percent concentrate. The higher-grade concentrate would be suitable for the chemical industry.

Tin.—Cassiterite is produced in Katanga and Kivu Provinces. Congo-Etain, a Congolese company 50-percent-owned by the Congolese Government and Compagnie Géologique et Minière des Ingénieurs et Industriels Belges GEOMINES, operated four open pit mines near Manono, in northeastern Katanga. The ore is treated by crushing, washing, and concentration. The resulting concentrate is smelted at the Manono smelter, which produces ingots containing 99 percent tin. SYMETAIN, the largest producer in the country, operates mines in the Kalima and Punia areas, in the Maniema district, Kivu Province. Of the 13 operating properties, eight are small hand-worked sluice operations. Other tin producers were Enterprises Minières Congolaises (EMC), which reopened the Bukena mine, Katanga, in 1970; Cobelmin and MGL; Kivumines; and Philipp Brothers Sobaki (Phibraki). Production of tin concentrate and metal totaled 6,345 and 1,374 long tons, respectively, in 1970.

Zinc.—Zinc production, from GECOMINES copper-zinc Kipushi mine, rose 8 percent to 184,000 tons of concentrate containing 103,000 tons of zinc. The zinc concentrate is sold to SOGECHIM, a union Minière du Haut Katanga affiliate; sulfuric acid is produced, and the roasted concentrate is sent to Société Métallurgique du Katanga (Métalkat), another Belgian-owned company, for producing refined zinc. The concentrate accounts for all cadmium and germanium output, and small quantities of copper, gold, and silver.

NONMETALS

Diamond.—Production of industrial diamond by Société Minière de Bakwanga (MIBA) decreased from 13.6 million carats to 12.3 million carats in 1970. Production could be expanded, since annual capacity of the MIBA operations is 18 million carats. Output of gem stones from the alluvial deposits in the Kasai field totaled 1.7 million carats, compared with 491,000 carats in 1969.

MINERAL FUELS

Petroleum.—In late 1970, Gulf Oil Corp., in association with Société Littoral Congolais (SOLICO) began producing at a rate of 1,800 barrels per day from a well sunk 10 miles offshore in a concession obtained from the Congolese Government. The Congo's oil refinery near the mouth of the Congo River operated at capacity throughout the year.

The Mineral Industry of Cyprus

By E. Shekarchi [1]

The only mineral commodity of the Republic of Cyprus significant in the world market continued to be pyrite, produced largely as a coproduct with copper. While production of gypsum, bentonite, chromite, salt, asbestos, and cement increased 51 percent, 43 percent, 39 percent, 19 percent, 18 percent, and 9 percent, respectively, output of the main exchange earner, pyrite, decreased 6 percent during 1970. Revenue from mineral products represented about 31 percent of the total value of exports from the island in 1970, compared with 33 percent in 1969. Cyprus Mines Co. of the Cyprus Mines Corp. (CMC), a U.S.-owned company headquartered in Los Angeles, Calif., was the most important mineral producer on the island in 1970.

It was announced in June 1970 [2] that the Common Market's Executive Commission had recommended to the European Economic Community (EEC) Council of Ministers that an associate membership for Cyprus be considered concurrently with membership for Great Britain. Great Britain is one of the main customers for mineral products from Cyprus.

Intensive prospecting for minerals continued to be conducted by both the private sector and Government organizations during 1969, the most recent year for which data were available. The Geological Survey Department, in cooperation with experts of the United Nations Special Fund, continued prospecting for copper in the west-central part of the island. The private sector, particularly CMC, drilled 17 holes totaling 18,930 feet in an area northeast of their present operation. Hellenic Mining Co. Ltd. drilled 77 holes representing a total of 49,868 feet.

The average number of persons employed on a daily basis in the mining industry during 1970 was estimated to be 5,000.

In 1969 the gross national product (GNP) of Cyprus based on 1968 dollars was $482 million, as per capita GNP reached a new high of $764. [3]

PRODUCTION AND TRADE

The available data on mineral production and trade are given in the following tables:

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[1] Physical scientist, Division of Ferrous Metals.
[2] Barclays Overseas Review. June 1970, p. 25.
[3] Where necessary, values have been converted from Crypus pounds (C£) to U.S. dollars at the rate of C£1=US$2.40.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Chromite ore and concentrate	r 25,105	23,921	33,335
Copper mine output, metal content [2]	r 17,037	17,233	18,161
NONMETALS			
Asbestos	19,317	21,706	25,706
Clays, crude:			
Bentonite [3]	9,215	9,181	13,101
Other (unspecified) e [4]	191,000	157,130	NA
Cement	r 237,543	242,601	264,000
Gypsum:			
Crude	17,750	22,817	34,352
Calcined e [4]	28,000	10,318	9,002
Lime, hydrated e [4]	94,000	100,000	108,000
Mineral pigments:			
Terra verte [3]	7	11	11
Umber	r 6,119	17,154	6,953
Yellow ocher	650	-------	451
Pyrites:			
Gross weight	r 1,049,968	926,865	870,548
Sulfur content	503,673	437,151	424,718
Salt, marine	4,816	5,871	7,000
Stone, sand and gravel:			
Dimension stone, marble e [4]	27,000	39,500	NA
Crushed and broken building stone e [4]	170,200	356,220	NA
Sand and aggregate e [4] thousand tons	1,600	1,682	NA

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

[1] In addition to the commodities listed, Cyprus produces other crude nonmetallic construction materials, 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 from Annual Report of Senior Mines Officer, Republic of Cyprus, for 1968 and 1969.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum scrap	246	8,486	West Germany 8,367.
Chromite	r 24,161	26,892	Austria 15,886; France 6,886.
Copper:			
Concentrate	r 62,916	63,788	West Germany 45,915; Spain 11,441.
Cement	r 11,581	9,563	All to West Germany.
Cuprous pyrite	150,397	86,019	West Germany 80,218; Netherlands 5,436.
Metal scrap	494	32,897	West Germany 28,344; Italy 4,301.
Iron and steel:			
Scrap	4,370	6,699	Greece 3,386; Italy 3,305.
Semimanufactures:			
Universals, plates, and sheets	67	-------	
Tubes, pipes, and fittings	148	472	Libya 354; Malta 114.
Lead scrap	482	436	West Germany 185; Belgium 128.
Zinc scrap	85	45	Spain 36; United Kingdom 6.
Other:			
Ash and residues bearing nonferrous metals n.e.s	58	-------	
Waste and scrap of base metals	17	29	Greece 28.
NONMETALS			
Asbestos, crude	r 17,897	19,144	United Kingdom 5,635; Denmark 5,007; Austria 1,640.
Cement	800	-------	
Clays and products:			
Refractory minerals n.e.s	9,179	9,747	Israel 9,182.
Products, nonrefractory value	$36,965	-------	
Gypsum	r 10,752	9,025	All to Lebanon.
Lime	1,893	1,971	Do.
Pigments, mineral (ocher, red umber, burnt umber)	7,254	9,430	United States 6,211; United Kingdom 2,378.
Pyrites unroasted	r 815,246	847,469	Italy 307,614; Netherlands 258,647.
Gravel and crushed stone	1,213	1,380	Israel 936; Libya 444.

r Revised.

[1] Includes reexports.

Source: Cyprus Department of Statistics and Research, Ministry of Finance. Statistics of Imports and Exports, 1969. Nicosia, 1970, 414 pp.

Table 3.—Cyprus: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	r 796	795
Copper:		
Copper sulfate (including alums) and persulfates	498	956
Metal including alloys, all forms	r 137	136
Gold including platinum-plated, unwrought and semimanufactures ------ troy ounces	15,738	15,408
Iron and steel:		
Scrap	1,047	1
Pig iron (including cast iron) and ferroalloys	403	601
Primary forms	1,287	32
Semimanufactures	r 65,500	85,664
Lead:		
Oxides	24	108
Metal including alloys, unwrought and semimanufactures	r 195	174
Nickel including alloys, unwrought and semimanufactures	12	5
Platinum-group and silver:		
Silver and platinum ores ------ troy ounces	45	758
Metal including alloys:		
Platinum-group ------ do	12	23
Silver ------ do	55,547	96,412
Tin including alloys:		
Scrap ------ long tons	3,527	3,465
Unwrought and semimanufactures ------ do	r 713	381
Titanium oxides	63	69
Zinc:		
Oxide and peroxide	12	37
Metal including alloys, unwrought and semimanufactures	477	475
Other base metals ore and concentrate n.e.s	82	2
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	239	318
Grinding and polishing wheels and stone ------ value	$61,817	$73,224
Barite and witherite	90	483
Cement	r 5,523	42,374
Chalk	230	NA
Clays and products (including all refractory brick):		
Crude n.e.s	1,429	4,412
Products:		
Refractory (including nonclay bricks) ------ value	$111,168	$47,786
Nonrefractory ------ do	$295,039	$428,376
Diamonds, gem not set or strung ------ do	$4,082	$16,774
Diatomite and other infusorial earths	75	336
Fertilizer materials:		
Crude	106	22
Manufactured:		
Nitrogenous	r 48,035	42,017
Phosphatic	r 27,589	18,446
Potassic	592	910
Other including mixed	48,476	25,884
Ammonia	65	15
Graphite, natural	1	--------
Gypsum and plasters	646	869
Pigments, mineral:		
Natural, crude	207	282
Iron oxides, processed	12	19
Precious and semiprecious stones except diamond:		
Natural ------ value	$9,338	$5,818
Manufactured ------ do	$6,540	$15,288
Salt and brines	375	485
Sodium and potassium compounds n.e.s	278	481
Stone, sand and gravel:		
Dimension stone	503	702
Gravel and crushed rock	5	35
Sand, excluding metal bearing	34	46
Sulfur:		
Elemental, other than colloidal and other	2,562	608
Sulfur dioxide	58	55
Sulfuric acid, alum	186	226
Talc, steatite, natural	61	115
Other n.e.s., building materials of asphalt, asbestos and fiber, cement	4,598	12,283
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	r 3,926	1,716
Coal including briquets, all grades	r 199	181
Coke and semicoke	922	623
Gas, hydrocarbon, manufactured	17,213	18,185
Peat including briquets and litter	22	85

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS—Continued		
Petroleum:		
Crude ... 42-gallon barrels	--------	10
Partly refined ... do	1	1,219
Refinery products:		
Gasoline (including natural) ... thousand 42-gallon barrels	r 691	826
Kerosine and jet fuel ... do	498	292
Distillate fuel oil ... do	997	983
Residual fuel oil ... do	1,566	1,570
Lubricants ... do	40	44
Mineral jelly and wax ... do	1	2
Asphalt and bitumen ... do	85	114
Other nonlubricants ... do	(1)	24

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

Source: Cyprus Department of Statistics and Research, Ministry of Finance. Statistics of Imports and Exports, 1969. Nicosia, 1970, 414 pp.

COMMODITY REVIEW

METALS

Chromite.—Exports of chromite in 1969 increased by 11 percent compared with 1968 exports. Australia remained the principal consumer, followed by France. Hellenic Mining Co. Ltd. was the only producer and exporter of chromite on the island, and production increased 39 percent in 1970, to a record 33,335 metric tons. Prospecting work for chromite minerals during the year by an independent U.S. company did not produce favorable results.

Copper.—Cyprus Mines Corp. was the largest producer and exporter of sulfide minerals. The company operated the Movrovouni underground mine, and the Skouriotissa, Apliki, and Lefka open pit mines. It was reported that the Movrovouni mine is almost depleted and that CMC is considering closing it to concentrate all its production efforts on opencast mining at the other sites. As a part of its development program in 1969, the company drilled 17 holes, totaling 18,930 feet, in areas covered by their prospecting permits.

The Hellenic Mining Co., Ltd., continued to mine sulfide ore from the Kalavasos underground mine and the Mathiati and Meni open pit mines. Under the company's expansion program, development work has begun on an underground copper mine at Kokkinoyia, and it has drilled 77 exploratory holes totaling 49,868 feet. Also, following an extensive geophysical survey, the company started stripping at Kampia mine and expects to begin production in 1972.

Cyprus Sulfur and Copper Co. produced pyrites from an open pit mine at Limni. The firm has started exploratory drilling on its new concession, and reportedly 11 holes were drilled totaling 2,716 feet in 1970.

A newly formed company, Kambia Mines Ltd., assumed a number of prospecting permits from Cytechno Co. and undertook an extensive stripping operation in 1970. Some high-grade iron-pyrite and cuprous pyrite have been found, but, no detailed information on reserves or development plans was available by yearend.

Pyrite.—Pyrite production decreased 6 percent in 1970, owing to the drop of copper prices in the international market during the latter part of the year and the depletion of higher grade ore at the Movrovouni mine.

NONMETALS

Asbestos.—Cyprus Asbestos Mines Ltd. intensified prospecting activities during the year, and feasibility studies were made independently by two teams of experts, Soviet and Canadian. The results of both studies indicated that enough long and short fiber asbestos reserves exist in the Troodos mountain region, to make a mining operation competitive in the international market.

The United Kingdom remained the principal country buying Cyprus' asbestos products during 1969, followed by Denmark and Austria. Hungary obtains a large portion of Cyprus' asbestos on a barter basis.

Production of asbestos reached a new high in 1970, with an 18-percent increase over that of 1969.

Gypsum.—During the year United Gypsum Ltd. continued quarrying operations in the Psematismenos area, producing approximately 24,000 tons of crushed gypsum. Most of the 4,000 tons of gypsum rock produced by Limassol Chemical Products was crushed and calcined for indigenous use, primarily in the chemical and plastic industries.

Production of gypsum increased 51 percent compared with the 1969 output. The closing of the Suez Canal since 1967, which affected Cyprus' export of gypsum, was completely overcome during 1970 by obtaining new markets in the Middle East.

Lime.—Kythrea Lime Co. and Akamas Lime Co. continued during 1970 as the two most important lime and crushed limestone producers in the country. Overall production of hydrated lime decreased 21 percent in 1970, compared with 1969 output.

MINERAL FUELS

Petroleum.—The Cyprus Council of Ministers granted, in the early part of 1970, both onshore and offshore, oil exploration rights in the area of Limassol at Akrotiri Bay to Cypriot Co. of Terrabayss. The details of the contract and duration of exploration were not available by yearend. The Government also announced that oil exploration rights were given to the local representative of the American Oil Exploration Co. (OXOCO) to prospect in the Famagusta area of eastern Cyprus and at Kyrenia in the northern part of the island.[4] Apart from the duration, 5 years of prospecting rights, no details of the contract were available by the end of 1970.

Cyprus Petroleum Ltd. contracted with a British firm for the construction of an oil refinery at Lavanaca during 1970. The refinery will have a 13,000-barrel-per-day throughput and is expected to be completed by early 1972, at a cost of $17 million. Shell Oil Co. has 25.5 percent of the shares and also will have the management of the refinery. The other partners are British Petroleum Co. Ltd., Mobil Oil Corp., and the Cpyrus Government. The apportionment of shares of the latter partners was not available by the end of 1970.

[4] Petroleum Times. V. 74, No. 1892, March 1970, p. 48.

The Mineral Industry of Czechoslovakia

By Bernadette Michalski [1]

The Czechoslovak economy burdened by the political and economic crises of 1968 showed only a few signs of recovery in 1970. The Government's price freeze policy checked inflationary trends, and imbalances in foreign trade diminished. Computed on current prices, 1970 industrial production reportedly rose 7.5 percent over the previous year. Fuel and power shortages continued to plague the economy, with 1970 production of electric energy reportedly only 4.5 percent over that of 1969 and falling far short of the estimated 7 percent annual production growth rate required to satisfy expanding electric energy consumption. By yearend, a nuclear power development agreement was signed with the Soviet Union; however, early effects of the program will not be registered on the nation's power grids until the late 1970's.

Significant developments in the mineral industry during the year included the following: the first full-year operation of the Italian-built Rudnany mercury smelter; limited capacity expansion at major iron and steel plants; construction of additional production units for mineral fertilizer materials and fertilizers; a record solid fuel output, largely attributable to increased labor productivity in mechanized colliery and pit operations; and the Czechoslovak-U.S.S.R. agreement for construction through Czechoslovakia of an international gas pipeline. This 28-billion-cubic-meter-capacity pipeline will serve Czechoslovakia, East Germany, West Germany, Austria, Italy, and possibly France.

PRODUCTION

Official published data on Czechoslovakia's 1970 mineral output were available for only a few commodities at the time of this writing. Available information on the industry's general performance indicates that production of most commodities probably reached new highs in 1970, with increases believed to be achieved in the production of antimony and copper (metal content of ore mined), mercury, fertilizers, magnesite, and solid fuels.

TRADE

Since no details of Czechoslovakia's 1970 mineral trade were available at the time of this writing, Czechoslovak sources claimed that overall trade with other European Communist nations increased by 7 percent, compared with a 3-percent increase in trade with non-Communist nations.

The following mineral commodity trade tables for 1968 and 1969 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 of 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.

[1] Foreign mineral specialist, Division of Fossil Fuels.

Table 1.—Czechoslovakia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS			
Aluminum ingot including secondary e ____ thousand tons__	65	65	65
Antimony:			
Mine output, metal content e	600	600	700
Metal	1,200	1,300	e 1,300
Copper:			
Mine output, metal content	r 4,670	4,920	e 5,000
Metal including secondary	r 14,084	16,441	e 17,000
Iron and steel:			
Iron ore, gross weight ____ thousand tons__	1,573	1,569	1,607
Pig iron (including blast furnace ferroalloys) ____ do____	r 6,918	7,009	7,621
Ferroalloys, electric furnace ____ do____	100	97	
Crude steel ____ do____	10,555	10,802	11,480
Steel semimanufactures ____ do____	r 8,554	8,565	e 9,300
Lead:			
Mine output, metal content	r 6,930	6,630	e 7,000
Metal including secondary	r 17,885	20,145	e 18,000
Manganese ore, gross weight	86,000	84,000	e 85,000
Mercury ____ 76-pound flasks__	116	435	e 2,000
Nickel metal, primary e	800	800	800
Silver e ____ thousand troy ounces__	1,100	1,100	1,100
Tin:			
Mine output, metal content ____ long tons__	162	155	e 163
Metal including secondary ____ do____	48	69	e 70
Zinc mine output, metal content	r 9,850	10,460	e 10,500
NONMETALS			
Barite e	6,500	7,000	7,500
Cement, hydraulic ____ thousand tons__	6,493	6,733	7,401
Clays, kaolin ____ do____	341	343	e 350
Fertilizer materials manufactured:			
Nitrogenous, nitrogen content ____ do____	r 261	299	e 350
Phosphatic:			
Thomas slag, P_2O_5 content	10,302	4,196	e 9,000
Other, P_2O_5 content	253,516	284,650	e 303,300
Fluorspar e	50,000	60,000	80,000
Gypsum and anhydrite:			
Crude ____ thousand tons__	407	440	e 460
Calcined ____ do____	24	e 25	e 25
Lime (quicklime and hydrated) [2] ____ do____	r 2,270	e 2,300	e 2,300
Magnesite:			
Crude ____ do____	2,150	e 2,200	e 3,000
Clinker e ____ do____	800	900	1,100
Perlite e	10,000	10,000	10,000
Pyrite:			
Gross weight ____ thousand tons__	380	357	e 360
Sulfur content e ____ do____	161	150	151
Salt ____ do____	r 207	209	213
Stone, limestone and other calcareous ____ do____	16,841	e 17,000	NA
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	674,720	e 700,000	e 700,000
Coal:			
Bituminous ____ thousand tons__	25,927	27,068	28,053
Brown ____ do____	70,835	75,262	78,007
Lignite ____ do____	4,050	4,075	3,776
Total ____ do____	100,812	106,405	109,836
Coke:			
From bituminous coal:			
Metallurgical ____ do____	7,518	7,905	e 8,000
Gashouse ____ do____	89	29	e 30
Unspecified [3] ____ do____	1,926	2,108	e 2,100
Total ____ do____	9,533	10,042	e 10,130
From brown coal ____ do____	1,808	1,548	e 1,550
Fuel briquets from brown coal ____ do____	1,100	1,308	e 1,310
Gas:			
Manufactured, all types ____ million cubic feet__	226,754	240,174	e 240,000
Natural, marketed ____ do____	34,000	33,000	e 33,000
Petroleum:			
Crude:			
As reported ____ thousand tons__	205	210	e 210
Converted e ____ thousand 42-gallon barrels__	13,903	14,242	14,242
Refinery products: [4]			
Kerosine ____ do____	1,628	1,728	NA
Diesel oil ____ do____	19,560	20,239	NA
Lubricants ____ do____	812	791	NA

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

[1] In addition to the commodities listed, Czechoslovakia also produces arsenic, gold, feldspar, graphite, uranium, a number of additional crude construction material commodities such as stone, sand and gravel, and other petroleum products such as gasoline and residual fuel oil, but available 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.

Compiled on the basis of reverse trade data, Czechoslovakia's mineral commodity exports to non-Communist nations (including Yugoslavia) were valued in excess of US$227 million in 1969, about 41 percent above the previous year's level; the country's 1969 mineral commodity imports from these countries were valued at almost US$98 million, compared with approximately US$96 million in 1968.

Mineral exports to the U.S.S.R. were reported at US$205 million [2] in 1969 and imports, at US$537 million.

[2] 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 Czechoslovakia, resulting in the above figures being more representative of a general range rather than actual world market price value for the mineral commodities.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Oxide and hydroxide	--	4,506	All to Austria.
Metal and alloys:			
Scrap	489	1,134	Austria 766; West Germany 165; Italy 152.
Unwrought and semimanufactures	8,826	12,319	Italy 3,206; West Germany 3,157; France 2,153.
Chromium oxide and hydroxide	--	230	All to West Germany.
Copper:			
Ore and concentrate	3,062	5,865	West Germany 4,218; Spain 1,647.
Metal and alloys:			
Scrap	497	954	Austria 530; West Germany 424.
Unwrought and semimanufactures	r 2,035	2,032	All to West Germany.
Iron and steel:			
Ore and concentrate	r 615	12,111	All to Austria.
Roasted pyrite	r 5,535	6,491	Do.
Scrap thousand tons	16	41	Austria 36; West Germany 5.
Pig iron do	66	69	All to Yugoslavia.
Ferroalloys do	28	32	West Germany 10; United Kingdom 7; Austria 7.
Steel ingots and other primary forms do	114	289	West Germany 99; Italy 50; United Kingdom 46.
Semimanufactures [2] do	2,124	2,398	West Germany 261; U.S.S.R. 227; Poland 152.
Lead:			
Ore and concentrate	1,292	2,051	All to Belgium-Luxembourg.
Metal and alloys:			
Scrap	--	150	All to Denmark.
Unwrought and semimanufactures	2,996	1,356	West Germany 1,242.
Magnesium metal and alloys:			
Scrap	384	618	All to Austria.
Unwrought and semimanufactures	177	151	All to West Germany.
Nickel:			
Matte and speiss	--	10	NA.
Metal and alloys:			
Scrap	231	992	West Germany 940.
Unwrought	265	1,602	West Germany 518; France 407; Japan 200.
Platinum-group metals unworked and partly worked value, thousands	$283	$740	All to West Germany.
Tin:			
Ore and concentrate long tons	r 49	--	
Metal and alloys unwrought and semimanufactures do	r 16	15	All to Turkey.
Titanium oxides	328	1,484	Sweden 726; France 265; Italy 220.
Tungsten:			
Ore and concentrate	413	386	United Kingdom 206; West Germany 180.
Metal, all forms	20	20	All to West Germany.
Zinc:			
Ore and concentrate [3]	19,360	23,415	Poland 11,281; Yugoslavia 9,409; Belgium-Luxembourg 2,206.
Metal scrap only	--	280	All to Austria.
Metals, nonferrous n.e.s.:			
Ore and concentrate	--	7,938	Do.
Waste and sweepings of silver and platinum-group metals value, thousands	$723	$644	United Kingdom $415; Switzerland $128; West Germany $101.
Ash and other nonferrous base metal bearing residues	r 8,826	9,733	West Germany 5,834; Austria 1,525; Belgium-Luxembourg 1,391.
Metal unwrought and semimanufactures	1,679	942	West Germany 621; Sweden 90; United Kingdom 87.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS			
Barite	360	--	
Cement, hydraulic ... thousand tons	151	209	Yugoslavia 181; West Germany 28.
Clays and products:			
Crude: [4]			
Bleaching clay [5] ... do	2	3	All to Poland.
Kaolin [2] ... do	59	57	Poland 44; East Germany 13.
Type not specified [6] ... do	324	340	West Germany 160; Yugoslavia 45; Italy 36.
Products:			
Nonrefractory ... do	21	25	Austria 5; West Germany 5; Yugoslavia 5.
Refractory ... do	r 22	24	Sweden 11; West Germany 5.
Feldspar, fluorspar and cryolite	[7] 3,055	--	
Diamond, gem and industrial ... value, thousands	$87	$298	Belgium-Luxembourg $271; United Kingdom $27.
Fertilizer materials:			
Crude phosphatic [8]	20,000	4,000	All to Hungary.
Manufactured:			
Nitrogenous [3]	62,407	20,878	West Germany 11,046; Yugoslavia 9,832.
Phosphatic [3]	23,000	--	
Ammonia [3]	13,838	2,627	Austria 2,019; Poland 608.
Gem stones, precious and semiprecious, except diamond ... value, thousands	$104	$130	Canada $64.
Graphite ... do	--	$40	NA.
Magnesite [2] ... thousand tons	263	352	West Germany 148; Poland 64; Hungary 45.
Mica worked	28	37	Italy 22; Yugoslavia 15.
Stone, sand and gravel:			
Dimension stone crude and worked	42,115	36,112	West Germany 32,989; Netherlands 3,123.
Gravel and crushed rock	54,110	142,649	All to West Germany.
Sand	10,489	9,928	All to Austria.
Talc [5]	2,873	4,024	Poland 3,854; Yugoslavia 170.
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous [2] ... thousand tons	2,420	2,654	East Germany 887; Hungary 570; Austria 361; Romania 195.
Lignite [2] ... do	1,159	1,248	East Germany 1,209; Austria 29.
Coke and semicoke [2] ... do	2,281	2,586	East Germany 706; Romania 545; Hungary 311.
Gas, natural and manufactured (including LPG) ... do	118	86	Austria 75; West Germany 7.
Petroleum:			
Partly refined oil ... thousand 42-gallon barrels	1,187	3,147	All to Austria.
Refinery products:			
Gasoline ... do	1,138	806	Austria 722; West Germany 84.
Distillate fuel oil ... do	3,758	2,672	Switzerland 1,730; West Germany 888; Finland 53.
Residual fuel oil ... do	1,404	2,116	All to Austria.
Lubricants ... do	40	27	United Kingdom 23.
Other ... do	447	613	Netherlands 197; West Germany 193; Austria 186.
Crude chemicals from coal, gas or oil distillation [3]	61,524	61,031	West Germany 40,230; Italy 12,155; France 3,235.

r Revised. 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 noted, information is from the 1968 and 1969 editions of Supplement to the World Trade Annual. V. 1 (East Europe), prepared by the Statistical Office of the United Nations and published by Walker and Company, New York.

[2] Statisticka Rocenka Ceskoslovenske Socialistické Republiky, 1970 (Statistical Annual of the Czechoslovak Socialist Republic, 1970). Prague 1970, 603 pp.

[3] Supplement to the World Trade Annual (See footnote 1) and official Polish trade returns (See footnote 5).

[4] Official Czechoslovak sources report the export of kaolin alone as follows: 1968–170,000 tons; 1969—249,000 tons. These figures are not included in the body of the table because they duplicate in part data presented under the caption "Type not specified" which are from the Supplement to the World Trade Annual, but the latter figures do not include shipments to Poland and East Germany which have been listed separately under kaolin.

[5] Glówny Urzad Statystyczny (Central Statistical Council). Rocznik Statystyczny Handlu Zagranicznego 1968 (Foreign Trade Annual for 1968). Warsaw 1970, 458 pp.

[6] Includes kaolin (See also footnote 3).

[7] Includes 100 tons of cryolite to Poland (figure from source listed in footnote 4); balance of figure is feldspar and fluorspar reported in Supplement to the World Trade Annual.

[8] Hungarian Central Statistical Office, Statistical Yearbook 1969. Budapest, 1970, 395 pp.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate [2 3] thousand tons	431	429	Hungary 290; Yugoslavia 104; Greece 35.
Oxide and hydroxide [2 3] do	10,181	9,000	All from Hungary.
Metal and alloys:			
Scrap [2]	805	800	All from Austria.
Unwrought [2 3 4]	r 47,194	60,231	U.S.S.R. 57,900.
Semimanufactures [2 4]	r 17,793	21,662	U.S.S.R. 15,500; West Germany 3,856; Yugoslavia 1,880.
Cadmium metal, all forms [4 5]	174	--	
Chromium, chromite ore and concentrate thousand tons	122	134	U.S.S.R. 70; Turkey 60; Yugoslavia 4.
Copper:			
Ore and concentrate [2]	947	--	
Metal and alloys:			
Unwrought [2 4]	38,169	42,017	U.S.S.R. 37,800; Belgium-Luxembourg 1,800; West Germany 988.
Semimanufactures [2 4]	r 10,291	8,900	West Germany 6,202; Yugoslavia 1,529; U.S.S.R. 900.
Iron and steel:			
Iron ore and concentrate thousand tons	11,147	10,716	U.S.S.R. 9,100; India 810; Sweden 372.
Scrap [2 5] do	37	1	All from West Germany.
Pig iron, ferroalloys, and similar materials do	484	706	U.S.S.R. 701.
Steel semimanufactures [2 3 4 5] do	r 759	673	U.S.S.R. 399; West Germany 126; Poland 67; Hungary 35.
Lead:			
Oxides [2]	3,464	3,759	Austria 1,878; Yugoslavia 790; Netherlands 549; France 542.
Metal and alloys, all forms [2 4]	27,009	25,538	U.S.S.R. 25,000.
Magnesium metal and alloys, all forms [4]	1,375	1,600	All from U.S.S.R.
Manganese ore and concentrate thousand tons	r 414	387	U.S.S.R. 302; India 65; Morocco 12.
Mercury [2] 76-pound flasks	4,641	3,510	All from Spain.
Molybdenum metal and alloys, all forms [2]	1	2	All from Austria.
Nickel metal and alloys, all forms [2]	59	16	All from West Germany.
Platinum-group metals and alloys unwrought and semimanufactures [2] value, thousands	$26	$209	United Kingdom $104; Yugoslavia $99.
Silver and alloys unwrought and semimanufactures [2] do	$6,125	$1,545	United Kingdom $392; Switzerland $386; West Germany $371.
Tin:			
Oxides [2] long tons	32	--	
Metal and alloys, all forms [2] do	120	1,226	United Kingdom 507; Denmark 404; Yugoslavia 118.
Titanium oxide [2]	901	993	Italy 619; West Germany 374.
Tungsten:			
Ore and concentrate [2]	75	--	
Metal and alloys, all forms	NA	1	All from Austria.
Zinc:			
Dust (blue powder) [2]	2,684	855	All from Belgium-Luxembourg.
Metal and alloys, all forms [2 4 5]	r 39,279	40,067	U.S.S.R. 23,000; Poland 11,765; Yugoslavia 2,175.
Other:			
Ore and concentrate [2]	r 26,295	11,313	Finland 9,905.
Metal and alloys n.e.s.[2]	62	91	Belgium-Luxembourg 66; United Kingdom 25.
NONMETALS			
Abrasives, natural:			
Pumice, emery and natural corundum [2]	672	--	
Grinding stones [2]	193	172	West Germany 66; Italy 61; Austria 41.
Asbestos	36,906	29,229	U.S.S.R. 16,607; Austria 3,886; Canada 2,255.
Barite [2]	1,870	1,059	All from West Germany.
Borates:			
Crude, natural [2]	6,900	11,100	All from Turkey.
Boric oxides and acid [2]	340	--	
Cement [2 3 4 5] thousand tons	r 503	391	U.S.S.R. 370; Hungary 19.
Clays and products:			
Crude [3]	10,338	13,275	Yugoslavia 12,215.
Products:			
Nonrefractory [2]	726	247	All from Italy.
Refractory [2]	r 4,131	2,542	France 1,103; West Germany 674; Italy 373.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Diamond:			
Gem [2] value, thousands	$70	$49	All from United Kingdom.
Industrial [2] do	$1,479	$1,741	All from Belgium-Luxembourg.
Feldspar and fluorspar [2]	1,020	6,310	West Germany 3,755; Yugoslavia 2,555.
Fertilizer materials:			
Crude, phosphatic thousand tons	476	498	All from U.S.S.R.
Manufactured:			
Nitrogenous, N content do	85	86	U.S.S.R. 61; Austria 23.
Phosphatic, P_2O_5 content do	291	328	U.S.S.R. 190; Lebanon 14; United Arab Republic 8.
Potassic, K_2O_5 equivalent do	482	459	East Germany 405; U.S.S.R. 52.
Gem stones, precious and semiprecious except diamond value, thousands	$51	$29	NA.
Graphite, natural [2 4]	481	638	U.S.S.R. 349; West Germany 289.
Gypsum [5]	3,136	3,441	All from Poland.
Lime [5]	39,575	104,519	Do.
Magnesite [3]	7,000	3,515	Turkey 3,000; Austria 515.
Mica worked [2]	14	11	All from Switzerland.
Pigments, mineral, iron oxides [2]	2,841	2,076	All from West Germany.
Pyrite, sulfur content of thousand tons	31	33	U.S.S.R. 20; Yugoslavia 5.
Salt:			
Rock	11,882	40,399	All from Poland.
Brine	16,419	16,803	Do.
Stone, sand and gravel:			
Dolomite [5]	3,095	--	
Quartz and quartzite [2]	2,191	1,500	All from West Germany.
Crushed stone and gravel [2]	2,801	2,568	Austria 1,660; Denmark 908.
Dimension stone worked [2]	196	535	All from Italy.
Sand [2]	--	1,965	All from West Germany.
Sulfur:			
Elemental, all forms thousand tons	287	267	Poland 208; U.S.S.R. 59.
Sulfuric acid [2 4 5] do	68	47	U.S.S.R. 43; Poland 3; Yugoslavia 1.
Other unspecified crude nonmetals [2]	3,075	492	West Germany 335.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen [3]	53,995	51,667	All from Hungary.
Carbon black [2 4]	9,614	13,675	U.S.S.R. 5,100; Yugoslavia 3,027; Italy 2,324.
Coal, anthracite and bituminous thousand tons	r 4,623	4,624	U.S.S.R. 2,663; Poland 1,961.
Coke and semicoke [4] do	59	81	All from U.S.S.R.
Gas, natural million cubic feet	20,744	31,380	Do.
Petroleum:			
Crude thousand 42-gallon barrels	57,404	68,906	Do.
Refinery products:			
Gasoline [2] do	--	97	Yugoslavia 61; United States 36.
Kerosine and jet fuel [2] do	37	59	West Germany 46; Yugoslavia 13.
Lubricants [2] do	295	337	Austria 325.
Other [2] do	5	10	Austria 6; West Germany 4.
Undifferentiated [4 6] do	3,990	4,571	All from U.S.S.R.
Crude chemicals from coal, gas or oil distillation [2]	474	163	All from West Germany.

r Revised. NA Not available.

[1] Because Czechoslovakia publishes only limited data on imports of mineral commodities, this table has been compiled from a variety of sources. Entries appearing without a source footnote are from: Statisticka Rocenka Ceskoslovenske Socialistické Republiky, 1970 (Statistical Annual of the Czeckoslovak Socialist Republic, 1970). Prague, 1970, 603 pp. Sources of all other data are noted.

[2] Statistical Office of the United Nations. 1968 and 1969 editions of Supplement to the World Trade Annual. V. 1 (East Europe), Walker and Company, New York.

[3] Official trade returns of Hungary.

[4] Official trade returns of the U.S.S.R.

[5] Official trade returns of Poland.

COMMODITY REVIEW

METALS

Antimony.—Production of antimony metal was reported to be about 1,300 tons in 1969. About half of this output apparently was derived from imported Turkish concentrate; exports to Czechoslovakia from Turkey totaled 1,640 tons in 1968 and 985 tons in 1969. Domestic sources may include a newly operational open pit mine at Struzec and possible byproduct recovery in lead smelting and in copper-iron-mercury concentrate processing at Rudnany. About half of the Czechoslovak output is exported; West Germany, one of the larger, if not the largest market, reported receipt of 322 tons of Czechoslovak antimony metal in 1968, 156 tons in 1969, and 187 tons in 1970.

Iron and Steel.—Czechoslovakia's major steelworks continued operation under expansion and modernization programs. Three tandem furnaces were installed at the Vitkovice Iron and Steel Plant, and a third open hearth furnace was installed at the Klement Gotwald Steelworks near Ostrava. Steel production by furnace type is listed in table 4.

Table 4.—Salient statistics on iron and steel production

	1967	1968	1969
PIG IRON			
Number of blast furnaces	20	19	NA
Production of pig iron and ferroalloys:			
Pig iron for steelmaking thousand metric tons	6,255	r 6,423	6,537
Pig iron for foundry do	521	r 446	451
Blast furnace ferroalloys do	46	49	21
Electric furnace ferroalloys do	97	100	97
Total do	6,919	r 7,018	7,106
Materials consumed per ton of pig iron:			
Iron ore and manganese ore kilograms	428	361	385
Sinter do	1,444	1,571	1,538
Scrap do	44	40	36
Coke do	651	637	638
Limestone do	178	172	164
INGOT STEEL			
Production of crude steel:			
Open hearth thousand metric tons	7,441	7,493	7,536
Bessemer do	247	246	225
Electric furnace do	1,254	1,272	1,270
Oxygen converter do	1,060	1,544	1,771
Total do	10,002	10,555	10,802
Materials consumed per ton of crude steel:			
Pig iron kilograms	623	632	701
Scrap do	472	462	392

r Revised. NA Not available.

Mercury.—Mercury byproduct recovery operations were expanded in 1970, with the operation of the Rudnany plant designed and manufactured by Del Monego S.p.A., of Milan, Italy. The plant capacity is 40 tons per day of concentrate containing 21 percent copper, 28 percent iron, 28 percent sulfur, 5 percent antimony, 3 percent silicon dioxide (SiO_2), 2 percent mercury, 1 percent arsenic, and a moisture content of 5 to 6 percent. The plant contains two BSP-Del Monego eight hearth furnaces and one mercury-refining retort for production of 99.99-percent-pure mercury. As of mid-1970, not all concentrate was being processed in Czechoslovakia;. an unreported quantity was shipped to Japan for separation and smelting.

NONMETALS

Fertilizer Materials.—Expansion programs during the fourth 5-year plan (1966–70) have brought Czechoslovakia beyond the point of self-sufficiency in ammonia, with output reaching the level of about 350,000 tons of contained nitrogen in 1970. The largest facility, the Duslo plant at Sala Nad Vahom, has an annual ammonia production capacity of 240,000 tons of contained nitrogen and utilizes feedstocks of lignite, refinery gases and natural gas. The ammonia facility at the Zaluzi chemical plant has an annual capacity of 200,000 tons of contained nitrogen. Most of the output is shipped to the Lovosice fertilizer plant for processing. The Straszka plant in East Slovakia operated a 110,000-ton-capacity (nitrogen content) ammonia unit. Only a fraction of the output is used in fertilizer manufacture, as the main derivative is technical ammonium nitrate.

Phosphate fertilizer producton is centered at Lovosice, Bratislava, and Prerov. All plants manufactured single superphosphate, which constituted about 76 percent of total phosphorous pentoxide (P_2O_5) output in 1970; however, during the fifth 5-year plan (1971–75), the Lovosice units will be replaced with triple superphosphate units.

Table 5.—Czechoslovakia: Planned fertilizer output

(Thousand metric tons)

Fertilizer type	1970	1975	1980
Nitrogen content of—			
Ammonium sulfate	56.0	68.0	75.7
Calcium nitrate, ammonium nitrate, and calcium ammonium nitrate	192.5	191.3	293.0
Urea	31.5	56.0	79.0
Complex	56.0	214.1	325.6
Others	14.0	81.7	104.4
Total	350.0	611.1	877.7
Phosphorus pentoxide content of—			
Triple superphosphate	--	136.3	109.2
Single superphosphate	237.8	38.3	23.0
Thomas slag	9.0	12.0	12.0
Complex	65.5	239.7	309.5
Total	312.3	426.3	453.7
Potassium oxide equivalent of—			
Complex	69.6	260.8	337.1

Czechoslovakia's potash requirements are met by imports principally from East Germany. Imported potash materials are processed to make complex fertilizers in Czechoslovakia. Output of these complex fertilizers in 1970 approached 70,000 tons in terms of potassium oxide (K_2O) equivalent. By 1980, however, plans call for complex fertilizer production to expand to 337,000 tons K_2O equivalent. Three basic types of complex fertilizers are slated for production, with nitrogen-phosphorus pentoxide-potassium oxide equivalent ratios of 0.6:1:1, 1:1:1, and 1:1:1.5.

Magnesite.—Magnesite mining and plant operations are under control of the state enterprize Slovenska Magnesitove Zavody (Slovak Magnesite Complex), which employs about 2,000 people. Mining operations are scattered throughout the country; principal deposits are near Bankov, Mikova, Jedlovec, and Podrecany. Plants are located at Kosice-Tahanovce, Lubenik and Mikova. The Mikova plant treats 600,000 tons of ore per year, and in 1970, included two Lepel rotary kilns, each with a 300,000-ton capacity. Czechoslovakia produces more than 20 varieties of magnesite and magnesite chrome bricks totaling 200,000 tons in 1970. About 30 percent of the refractory brick output is exported.

MINERAL FUELS

Czechoslovakia's primary energy consumption in 1970 was estimated at 82 million tons measured in standard coal equivalent (SCE). Solid fuels supplied about 75 percent of the consumption requirements: liquid fuels, about 19 percent; natural gas, 3.5 percent; and manufactured gas and hydroelectric power provided the small remainder. As indigenous crude petroleum production is insignificant and natural gas output is below 35 million cubic feet per year, as much as 25 percent of the nation's energy requirements are derived from imported fuels. In 1970 crude oil imports were over 70 million barrels and natural gas imports were estimated at 52 billion cubic feet.

Although demands on Czechoslovak electric power supplies are growing at a rate of 7 percent per year, the nation, in spite of its rich uranium resources, has experienced long delays in entering the nuclear power field. As early as 1956 an agreement was entered into with the Soviet Union for the construction in Slovakia of a type A-1 heavy-water reactor fueled by unenriched uranium available in Czechoslovakia. Construction of this first nuclear powerplant began in 1958; however, delays were repeatedly encountered forcing the rescheduling of the completion date at least eight times. The last completion date has been set at 1972. During 1970, however, it was apparent that the decision to construct future heavy-water reactors was abandoned in favor of light-water reactors operating on Czechoslovak uranium, which was enriched to U-235 in the U.S.S.R. A second agreement was signed with the U.S.S.R. covering construction of four light-water nuclear reactors of 420 megawatts each. Two reactors will be installed at Jasnovske Bohunice and the others at Dalesice. By 1980, plans call for a total of eight nuclear powerplants to be in operation, and the Czechoslovaks estimate that by 1990 nuclear power stations will supply 40 percent (12 million kilowatts) of the nation's power requirements.

Coal.—The bulk of Czechoslovak bituminous coal output is derived from the Ostrava Karvina basin, which yielded a record output of 24 million tons in 1970. A record output was also obtained from the Most brown coal basin where production reached 53 million tons, or 68 percent of the total Czechoslovak brown coal output. Czechoslovakia's record output of solid fuels follows a 4-year period of reduced output resulting from the implementation of the 1965 industrial reform requiring the shutdown of marginal mines and increasing mechanization in the remaining collieries and pits.

Natural Gas.—Well over half of Czechoslovakia's 1970 natural gas requirements were imported from the Soviet Union, delivered via the Bratsvo pipeline, which carried an estimated 52 billion cubic feet of gas in 1970.

By yearend, an agreement was signed for the transport of natural gas through Czechoslovakia to East and West Germany, Austria, Italy, and possibly France. The line will be 1,200 millimeters in diameter in the eastern sections through the U.S.S.R. and 900 millimeters in the central and western sections. Carrying capacity will be 990 billion cubic feet per year, making this line the largest in Europe. Most of the pipe wil be supplied by East Germany and Czechoslovakia. The pipeline is scheduled to supply natural gas to Austria and Italy by January 1973, East Germany by April 1973, and West Germany by October 1973. The pipeline will run 1,000 kilometers through Czechoslovakia. Seven compressor stations are to be constructed in Czechoslovakia. In return for materials, construction assistance, and transit rights, the Soviet Union will offer Czechoslovakia 56 billion cubic feet of natural gas per year. Added pipeline facilities will enable Czechoslovakia to transport U.S.S.R. gas at the rate of 280 billion cubic feet per year by 1980.

Petroleum.—Domestic crude production remained insignificant. The bulk of liquid fuel requirements were satisfied by imports totaling over 70 million barrels of crude in 1970. Over 96 percent of the total was obtained from the U.S.S.R. via the Druzba pipeline. During 1970, more than 43 million barrels of crude was delivered to the Bratislava refinery, where expansion was underway to bring annual capacity to 60 million barrels by 1975. A pipeline joining the Pardubice refinery with the Druzba mainline was completed during 1970, voiding the annual runs of 210 trains (each carrying 60 tank cars) to deliver Soviet crude from the Druzba line.

In northern Bohemia, the Zaluzi chemical works placed a residual fuel oil cracking facility into operation. The additional gasoline output that will result from this installation reportedly will replace gasoline produced from solid fuels, an expedient adopted during World War II and continused through the present. The conversion reportedly should effect a reduction in gasoline prices and release about 3 million tons of lignite (formerly used for gasoline production) for use in thermal power generation.

The Mineral Industry of Finland

By F. L. Klinger[1]

In 1970 noteworthy developments in the Finnish mineral industry included increased mine output of nickel; a marked rise in output and exports of ferrochromium, steel, and zinc; and beginning production of cadmium, mercury, and platinum. New mines were being developed for iron ore, copper, and nickel. A new steelworks and two rolling mills were nearing completion, and increased productive capacity was evident in sulfuric acid, titanium pigments, and petroleum refining. A relatively high level of construction activity was maintained for the second straight year.

Government controls on increases in wages and prices were continued, although average rises of 8 percent and 3 percent, respectively, were reported for 1970. For the first time, a guaranteed minimum wage (about $US0.71 per hour) was established for all workers above the age of 18. The outlook for continued industrial growth was favorable for 1971, although the rate of growth was expected to be lower than in 1969 or 1970.

PRODUCTION

Production indices for major sectors of the mineral industry in 1970, and revised indices for 1968 and 1969, follow:

Sector	(1959 = 100)		
	1968	1969	1970
Mining and quarrying	149	163	167
Basic metal industries	246	289	314
Nonmetallic mineral processing	240	274	295
Chemicals	253	278	320
All industry	182	205	223

Source: Central Bureau of Statistics (Helsinki). Bulletin of Statistics (Tilastokatsauksia), No. 4, 1971.

[1] Physical scientist, Division of Ferrous Metals.

Table 1.—Finland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1968	1969	1970 p
METALS			
Cadmium, refined	---------	---------	89
Chromium, chromite concentrates:			
Gross weight	36,196	71,326	120,509
Chromic oxide content	14,949	30,100	50,614
Cobalt:			
Mine output, metal content e	r 1,100	r 1,200	1,300
Metal, refined	505	778	1,008
Copper:			
Mine output, metal content	r 30,054	33,135	31,146
Metal:			
Primary:			
Blister	31,996	32,283	34,728
Electrolytic	35,895	33,877	34,047
Secondary (unrefined)	12,498	12,330	14,844
Gold troy ounces	21,380	18,872	20,319

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS—Continued			
Iron and steel:			
Iron ore:			
Magnetite concentrate ____ thousand tons	e 510	588	585
Pelletized iron oxide (from pyrite) ____ do	341	296	275
Roasted pyrite (purple ore) ____ do	101	123	148
Pig iron ____ do	1,039	1,162	1,164
Ferrochromium ____ do	8	26	33
Steel:			
Crude ____ do	r 729	968	1,169
Semimanufactures ____ do	554	713	798
Lead mine output, metal content	4,524	4,553	5,005
Nickel:			
Mine output, metal content	3,326	3,625	5,111
Sulfate, metal content	177	191	150
Metal, electrolytic	3,327	3,722	4,009
Platinum	---------	---------	e 645
Rare earth, lanthanide concentrate:			
Gross weight	12,152	10,117	6,750
Oxide content	402	355	163
Selenium ____ kilograms	7,296	6,197	6,946
Silver ____ troy ounces	r 677,447	624,945	739,755
Titanium concentrate (ilmenite), gross weight	139,500	138,200	151,000
Vanadium pentoxide:			
Gross weight	2,139	2,403	2,348
Vanadium content	1,198	1,346	1,315
Zinc:			
Mine output, metal content	65,400	70,800	62,609
Metal	---------	1,084	55,820
NONMETALS			
Asbestos	r 13,139	14,050	13,625
Cement, hydraulic ____ thousand tons	1,476	1,759	1,839
Diatomite	r 1,975	1,817	666
Feldspar	r 52,844	53,398	62,126
Fertilizer materials manufactured:			
Nitrogenous ____ thousand tons	NA	188	215
Phosphatic ____ do	320	215	215
Other ____ do	NA	934	830
Lime ____ do	210	213	230
Mica	---------	20	---------
Pyrite:			
Gross weight ____ thousand tons	774	e 981	971
Sulfur content ____ do	371	e 447	444
Stone:			
Limestone:			
For cement ____ thousand tons	r 3,145	2,394	2,430
Other industrial ____ do		210	220
Dimension ____ do	1,790	3,680	4,200
Quartz ____ do	r 43	81	87
Sulfur byproduct (recovered):			
Elemental	125,249	111,841	114,822
Gaseous (in SO_2)	205,088	192,846	212,612
Talc and soapstone	NA	28,740	62,723
Wollastonite	r 3,505	5,200	6,051
MINERAL FUELS AND RELATED MATERIALS			
Coke, all types ____ thousand tons	125	127	127
Fuel briquets ____ do	26	30	e 30
Gas manufactured ____ million cubic feet	2,108	2,363	2,095
Peat:			
For fuel use ____ thousand tons	r e 110	120	97
For agricultural and other use ____ do	138	138	158
Petroleum refinery products:			
Gasoline ____ thousand 42-gallon barrels	9,112	8,747	9,087
Jet fuel ____ do	496	560	704
Kerosine ____ do	85	85	70
Distillate fuel oil ____ do	12,533	14,801	e 19,474
Residual fuel oil ____ do	15,058	19,081	e 21,249
Liquefied petroleum gas ____ do	615	568	673
Other ____ do	2,409	3,737	4,811
Refinery fuel and losses ____ do	3,720	4,324	e 4,753
Total ____ do	44,028	51,903	60,821

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

[1] In addition to the commodities listed, mercury production began in 1970, but information is inadequate to make a reliable estimate of output levels.

TRADE

The value of Finland's trade in mineral commodities increased substantially in 1970. Compared with 1969, the value of imports increased about 35 percent, while the value of exports increased only about 20 percent. Consequently, the deficit in mineral commodity trade rose to approximately $500 million in 1970, about 42 percent more than in the previous year. The principal increases in imports occurred in steel, crude oil, and solid fuels; the rise in export value was due mainly to increased exports of steel, zinc, and titanium pigments.

Mineral commodity trade in 1968 and 1969 is detailed in the following tables:

Table 2.—Finland: Exports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys:		
Scrap	986	1,048
Unwrought	1,287	607
Semimanufactures	2,738	3,703
Antimony, unwrought and semimanufactures	----------	18
Chromium:		
Chromite	----------	5
Metal including alloys, all forms	23	NA
Cobalt, unwrought and semimanufactures	352	806
Copper including alloys:		
Scrap	157	61
Unwrought including matte	[r] 10,830	6,470
Semimanufactures	13,029	16,135
Gold unworked or partly worked ..... troy ounces	13	113
Iron and steel:		
Ore and concentrate, except roasted pyrite	170,623	225,811
Roasted pyrite	14,352	5,058
Metal:		
Scrap	10,470	6,272
Pig iron, ferroalloys, spiegeleisen, and similar materials	[r] 685,532	586,915
Steel, primary forms	[r] 337	46,232
Semimanufactures	[r] 159,353	201,857
Lead:		
Ore and concentrate	9,399	5,607
Metal including alloys:		
Unwrought	83	33
Semimanufactures	2	22
Nickel including alloys:		
Scrap	----------	2
Unwrought	[r] 2,928	3,546
Semimanufactures	[r] 1	55
Mercury ..... 76-pound flasks	3	3
Platinum-group including alloys ..... troy ounces	4,067	730
Selenium, elemental	6	NA
Silver including alloys ..... troy ounces	21,715	3,627
Tin including alloys:		
Scrap ..... long tons	25	22
Unwrought ..... do	8	4
Titanium:		
Ore and concentrate	45,889	13,022
Oxides	[r] 4,284	3,539
Vanadium oxides	2,572	2,779
Zinc:		
Ore and concentrate	125,947	133,591
Oxide	4	11
Metal scrap	[r] 106	60
Other:		
Ore and concentrate of base metals, n.e.s	----------	10
Ash and residue containing nonferrous metals	[r] 8,545	28,965
Waste and sweepings of precious metals ..... kilograms	13,018	1,377
NONMETALS		
Asbestos	10,322	11,949
Cement	82	32,959
Clay products:		
Refractory (including brick)	138	1,253
Nonrefractory	6,503	4,149
Diamond:		
Industrial ..... carats	1,500	4,500
Other ..... do	1,000	500
Diatomite and other infusorial earths	28	58
Feldspar	45,255	46,057

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Fertilizer materials manufactured:		
Nitrogenous	13,326	15,953
Phosphatic, other than Thomas slag	----------	31,717
Other including mixed	35,731	130
Graphite, natural	----------	12
Lime	----------	1,080
Mica, crude including splittings and waste	44	56
Precious and semiprecious stones, except diamond:		
Natural carats	35,500	251,300
Manufactured do	66,500	1,000
Pyrite (gross weight)	45,637	91,215
Sodium and potassium compounds, n.e.s.:		
Caustic soda	3,154	4,053
Caustic potash	2	(1)
Stone, sand and gravel:		
Dimension stone	12,287	13,267
Other stone:		
Limestone	10,675	17,331
Quartz and quartzite	43	159
Crushed, broken, and gravel, n.e.s	10,967	430
Sand excluding metal bearing	4,163	668
Sulfur:		
Elemental forms	24,780	38,378
Sulfuric acid	32,593	4,212
Talc and steatite	13	182
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal bearing:		
From manufacture of iron and steel	3,007	2,843
Slag and ash, n.e.s	21	546
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	874	1,038
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	----------	20
Coal, all grades including briquets	r 1,198	1,836
Coke and semicoke	14,027	48,345
Peat and peat briquets	680	2,304
Petroleum refinery products:		
Gasoline (including naphtha) thousand 42-gallon barrels	826	2,370
Distillate fuel oil do	15	715
Residual fuel oil do	232	293
Lubricants do	3	8
Liquefied petroleum gas do	66	64
Bitumen do	1	26
Other do	5	1
Mineral tar and other coal, petroleum, or gas derived crude chemicals	1	1,500

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

Table 3.—Finland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Ore and concentrate	NA	1,224
Oxide and hydroxide	12,289	16,508
Metal including alloys:		
Unwrought	12,262	15,218
Semimanufactures	r 14,361	48,927
Antimony, including alloys, all forms	39	----------
Arsenic:		
Trioxide, pentoxide, and acids	226	56
Metal including alloys, all forms	3	----------
Cadmium including alloys, all forms	6	----------
Chromium:		
Chromite	1,243	3,732
Oxide and hydroxide	282	390
Cobalt:		
Oxide and hydroxide	3	36
Metal including alloys, all forms	4	----------
Copper:		
Ore and concentrate	2,181	483
Copper sulfate	647	477
Metal including alloys:		
Unwrought	8,165	7,688
Semimanufactures	3,662	3,198
Gold worked or partly worked troy ounces	133,959	78,641

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS—Continued		
Iron and steel:		
Ore and concentrate, except roasted pyrite	628,272	1,206,209
Roasted pyrite	3,505	782
Metal:		
Scrap	67,904	92,997
Pig iron including cast iron	726	1,560
Sponge iron, powder and shot	3,303	2,944
Ferroalloys	r 14,831	20,749
Steel, primary forms	20,521	35,582
Semimanufactures:		
Bars, rods, angles, shapes, sections	160,963	205,337
Universals, plates and sheets	304,327	312,920
Hoop and strip	27,958	41,097
Rails and accessories	298	981
Wire	12,475	16,360
Tubes, pipes, and fittings	77,733	93,227
Castings and forgings, rough	230	490
Lead:		
Oxides	464	639
Metal including alloys:		
Unwrought	8,521	10,574
Semimanufactures	1,596	2,018
Magnesium, including alloys, all forms	r 10	46
Manganese, ore and concentrate	44,777	56,619
Mercury 76-pound flasks	r 496	1,813
Molybdenum including alloys, all forms	4	2
Nickel:		
Ore and concentrate	----------	4,818
Metal including alloys:		
Scrap	186	24
Unwrought	130	104
Semimanufactures	r 179	179
Platinum-group thousand troy ounces	12	20
Silver including alloys do	r 1,849	2,346
Silicon	212	301
Tin:		
Oxides long tons	25	218
Metal including alloys:		
Unwrought do	r 244	345
Semimanufactures do	29	52
Titanium:		
Ore and concentrate	201	60
Oxides	22	48
Tungsten including alloys, all forms	5	9
Zinc:		
Oxides	362	370
Metal including alloys:		
Blue powder	239	----------
Unwrought	r 5,483	9,620
Semimanufactures	r 493	700
Other:		
Ore and concentrate	51	5,234
Metals including alloys, all forms:		
Metaloid, n.e.s	7	79
Pyrophoric alloys	2	1
Base metals, n.e.s	r 58	149
NONMETALS		
Abrasives, natural, n.e.s value, thousands	r $188	$187
Asbestos	4,540	4,727
Barite and witherite	489	492
Borates, crude, natural	2,911	5,202
Cement	7,332	5,155
Chalk	r 10,084	10,179
Clays and products (including all refractory brick):		
Crude	235,057	275,351
Products:		
Refractory (including brick)	37,136	44,524
Nonrefractory value, thousands	$718	$898
Cryolite and chiolite, natural	50	142
Diamond:		
Gem not set or strung value, thousands	$256	$314
Industrial do	$108	$202
Diatomite	390	926
Fertilizer materials:		
Crude, phosphate	455,666	507,684
Manufactured:		
Nitrogenous	67,564	106,706
Phosphatic: Thomas (basic) slag	11,513	11,430
Potassic	201,918	182,322
Other, including mixed	2,493	79,416
Ammonia	r 52,958	70,031

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Fluorspar	6,281	6,590
Graphite, natural	332	329
Gypsum and plasters	r 122,334	128,644
Lime	r 20	35
Magnesite	2,971	2,382
Mica, all forms	657	726
Pigments, mineral:		
Natural, crude	714	82
Iron oxides, processed	1,300	1,564
Precious and semiprecious stones, except diamond:		
Natural value, thousands	$176	$247
Manufactured do	$127	$108
Salt (excluding brine)	434,670	427,298
Sodium and potassium compounds, n.e.s.:		
Caustic soda	r 18,688	24,092
Caustic potash	237	254
Stone, sand and gravel:		
Dimension stone	2,827	3,913
Dolomite, chiefly refractory grade	4,849	3,581
Gravel and crushed rock	2,104	1,533
Limestone, except dimension	234,305	255,941
Quartz and quartzite	1,273	3,526
Sand, excluding metal bearing	r 88,956	88,700
Sulfur:		
Elemental	r 34,244	39,115
Sulfuric acid	28	33
Talc and steatite	4,381	6,049
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal bearing:		
From manufacture of iron and steel	9,170	668
Slag and ash, n.e.s	200	----------
Oxides and hydroxides of magnesium, strontium, and barium	5,772	5,972
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	360	620
Carbon black	3,732	4,789
Coal, all grades, including briquets thousand tons	2,094	2,464
Coke and semicoke do	662	762
Gas, hydrocarbon, liquefied do	9	11
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	42,747	51,980
Refinery products:		
Gasoline do	406	172
Kerosine and jet fuel do	181	116
Distillate fuel oil do	14,495	14,007
Residual fuel oil do	6,227	6,009
Lubricants do	441	551
Others [1] do	401	1,615
Mineral tar and other crude chemicals derived from coal, petroleum or gas thousand tons	14	15

r Revised. NA Not available.

[1] Includes other finished products and unfinished oils requiring further processing, including topped crude.

COMMODITY REVIEW

METALS

Chromium.—Output of chromite ore and concentrate at the Kemi mine in 1970 increased about 69 percent compared with the previous year. A total of 300,046 metric tons of crude ore were processed, yielding 120,509 tons of concentrate with an average chromium content of approximately 28.7 percent and 26,088 tons of lump ore containing about 16 percent chromium. Processing capacity of the concentrator was about 400,000 tons of crude ore per year.

The ferrochromium plant at Tornio produced 58,426 tons of sintered pelletized concentrate and 33,021 tons of ferrochrome averaging 53.5 percent chromium. The output of ferrochrome was nearly 18 percent higher than the annual capacity previously reported.

Exports in 1970 included 4,386 tons of chromite and 29,467 tons of ferrochrome valued at $3.46 million.

Cobalt.—Production of cobalt metal in 1970 was equivalent to about 85 percent of annual production capacity at the Kokkola works. Exports of cobalt declined to 703 tons, about 15 percent less than in 1969, but the value of exports increased 20 percent, to $3.86 million.

Pyrite concentrates from the Outokumpu mine continued to be the principal source of cobalt; other byproduct sources in 1970 included the Otanmäki mine, which recovered 7,700 tons of cobaltiferous pyrite, and the Luikonlahti mine which produced 4,051 tons of unspecified cobalt-bearing concentrates. The new Vuonos mine, scheduled to begin production in late 1971, is expected to produce about 70,000 tons of cobaltiferous pyrite per year, but this level of output probably will not be realized until 1973.

Copper and Nickel.—The Outokumpu and Kotalahti mines remained the major producers of mine copper and nickel, respectively, in 1970. The Telkkälä nickel-copper mine, which began production in 1969, accounted for an estimated 28 percent of total Finnish output of mine nickel in 1970 but was closed in November because the ore body was mined out. Two nickel-copper mines were opened in 1970 at Hitura and Puumala. Mining of a small nickel deposit at Kylmäkoski was scheduled to begin in the spring of 1971, and production at the new Vuonos mine was to start by yearend.

Production of copper and nickel concentrates in 1970, by mine, was as follows, in thousand metric tons (all mines except Luikonlahti are operated by the Outokumpu Co.):

Mine	Copper		Nickel	
	Quantity	Metal content	Quantity	Metal content
Outokumpu	80,392	16,322	-------	-------
Kotalahti	2,681	e 810	50,570	3,128
Telkkälä	704	169	39,262	1,455
Pyhäsalmi	23,936	5,334	-------	-------
Luikonlahti	23,773	5,848	-------	-------
Vihanti [1]	11,916	2,155	-------	-------
Hitura	(2)	161	10,839	415
Puumala	36	10	2,394	113
Virtasalmi	1,131	273	-------	-------
Metsämonttu (Aijala)	364	64	-------	-------
Total	144,933	e 31,146	103,065	5,111

e Estimate.
[1] Includes 2,646 tons produced from Tervola mine.
[2] Included in nickel concentrates.

Source: Outokumpu Oy., Annual Report (Vuosikertomus) for 1970; American Embassy (Helsinki), Airgram A-181, June 5, 1971.

The smelters at Harjavalta consumed 133,412 tons of copper concentrates, including 23,445 tons purchased from the Luikonlahti mine and 93,107 tons of nickel concentrates, including 6,277 tons imported from Norway. Output of metal included 43,276 tons of copper anodes for refining at Pori, as well as all production of electrolytic nickel. Byproducts included cobalt hydroxide and 69,900 tons of gaseous sulfur. The Outokumpu Co. decided to increase production capacities of the nickel smelter and refinery, but no details were available.

The works at Pori continued to account for practically all Finnish production of electrolytic copper, copper and alloy semimanufactures, precious metals, and selenium.

Exports of copper and alloys, in unwrought and semimanufactured forms, declined to 18,355 tons in 1970, but imports rose to 19,529 tons. Exports of unwrought nickel rose slightly, to 3,694 tons valued at $17.2 million.

Gold, Silver, and Platinum.—Data on mine output of gold and silver were scarce. Most of the values were probably contained in copper concentrates produced at the Outokumpu and Pyhäsalmi mines; Outokumpu accounted for most of the gold and Pyhäsalmi, for most of the silver. The Vihanti mine was also believed to be an important source of silver. The Metsämonttu mine contributed about 10 to 15 percent of Finland's output of both metals.

Average metal content of ores mined at the various localities, from analyses published in previous years or calculated from production data reported in 1969 and 1970, follows in grams per metric ton:

Mine and year	Metal content of crude ore	
	Gold	Silver
Outokumpu:		
1938	0.8	12.0
1953	1.0	12.0
1964	.67	8.1
Pyhäsalmi: 1969 [1]	.2	14.0
Vihanti: 1963 [2]	.5	30.0
Metsämonttu:		
1953	.3–.4	5.7–7.0
1970	1.26	28.2

[1] Calculated from metal content of 28,302 tons of copper concentrates produced from 807,116 tons of crude ore.
[2] Zinc-copper-lead ore only. Metal recovery in concentrate believed to be relatively low compared with Outokumpu and Pyhäsalmi.

Platinum ingot was produced for the first time in 1970 at the Pori copper refinery. Previously, the metal was recovered abroad. Production was expected to be about 20 kilograms per year. The Outokumpu mine was believed to be the principal source of platinum.

Iron and Steel.—*Iron Ore.*—In 1970 production of iron concentrate at the Raajärvi and Otanmäki mines of Rautaruukki Oy. was 303,400 tons and 281,600 tons, respectively. All output at Raajärvi and most of that at Otanmäki was shipped to the company's steelworks at Raahe. Production of iron concentrate at the Kokkola works of Outokumpu Oy., including pelletized iron oxide from the pyrite smelter and "purple ore" from the cobalt plant, accounted for most of the remaining production. About 2,000 tons of magnetite concentrate was recovered from zinc-copper-lead ore processed at the Vihanti mine.

Rautaruukki Oy. was developing two new iron mines in 1970. Mining from the Leveäselkä deposit, close to the Raajärvi mine, was scheduled to begin in late 1971. The shaft was sunk to a depth of about 590 feet, and four new levels were opened in 1970. The ore will be processed at Raajärvi. In northwest Finland, the Rautuvaara mine near Kolari was being prepared for production by 1975. The mine will produce about 400,000 tons of iron concentrates per year from 700,000 tons of crude ore.

Imports of iron ore in 1970 totaled 748,000 tons, 38 percent less than in 1969, but exports rose slightly to 229,000 tons. Data on iron ore consumption in 1970 was available only for the Raahe works, which used 1,121,528 tons. Approximately 48 percent of this quantity was derived from the company's own mines, 37 percent from other Finnish sources, and 15 percent from imports.

Pig Iron.—Output of pig iron in 1970 by the major producers was virtually unchanged from the 1969 levels. Rautaruukki Oy. produced 743,000 tons at Raahe, and the Ovako Co. produced 283,000 tons at Koverhar and 138,000 tons at Turku. Coke consumption at Raahe averaged 477 kilograms per ton of hot metal produced.

Exports of pig iron continued to decline, as production of crude steel was increased at Raahe. Exports in 1970 were 244,000 tons less than in 1969.

Steel.—The increase in Finland's output of crude steel in 1970 was entirely due to rising output at Raahe. The state-owned works produced 724,000 tons, 38 percent more than in 1969; output of continuously cast slabs was up 42 percent, to 678,000 tons, and production of industrial and shipbuilding plate increased 9 percent, to 360,000 tons. Consumption of pig iron for steelmaking at Raahe totaled 684,000 tons in 1970.

The oxygen steelworks being constructed at Koverhar by the Ovako Co. was scheduled for completion in mid-1971. The two 50-ton Linz-Donawitz converters will increase the company's steelmaking capacity to 630,000 tons per year.

Rautaruukki Oy. expected to bring two rolling mills into production by early 1972. A hot-rolling mill at Raahe will produce about 100,000 tons per year of sheet (in thicknesses up to 5 millimeters) and 230,000 tons of strip. The strip will be delivered to a cold-rolling mill at Hämeenlinna. The latter plant will produce about 200,000 tons of cold-rolled products per year, including galvanized items.

During the 1970's, Rautaruukki Oy. plans to double its productive capacity to 1.5 million tons of crude steel per year, all to be rolled into flat products. Production of stainless steel plate was also being planned, in cooperation with Outokumpu Oy.

Net imports of steel semimanufactures rose slightly in 1970, to 488,000 tons. Imports rose by 203,000 tons, mainly from a 120,000-ton increase in sections, bars and rods; exports increased by 173,000 tons due to an increase of 160,000 tons of ingots and other crude forms.

Finland's consumption of steel in 1970 was estimated by Rautaruukki Oy. at 1.8 million tons of crude steel equivalent, about 14 percent more than in 1969. Consumption in 1971 was estimated at 2.0 million tons.

Lead, Zinc, and Associated Metals.—Increased output and exports of lead concentrates in 1970 was apparently due to higher grade ore mined at Korsnäs and Metsämonttu, which made up for reduced output from Vihanti. The output of lanthanide concentrates, a byproduct of lead mining at Korsnäs, was 33 percent less than in 1969, although crude ore production was down only 4 percent.

Production of lead and zinc concentrates in 1969 and 1970, by mine, follows, in thousand metric tons:

Mine	Lead		Zinc	
	1969	1970	1969	1970
Vihanti	3,612	3,369	70,004	65,745
Pyhäsalmi	------	------	58,106	48,026
Korsnäs	3,737	4,638	------	------
Metsämonttu	535	1,125	------	491
Outokumpu	------	------	4,326	5,406
Total	7,884	9,132	132,436	119,668

Finland became virtually self-sufficient in zinc, cadmium, and mercury in 1970, as the new zinc plant at Kokkola was operated for the first full year. The plant was completed in late 1969. Cadmium and mercury were produced for the first time; most of the cadmium (63 tons) was exported, and the output of mercury, which is expected to be about 600 flasks per year, will be used for domestic consumption. The domestic production of zinc caused marked shifts in the country's zinc trade; as compared with 1969, exports of concentrate virtually ceased; exports of slab zinc rose to 39,000 tons; and imports of unwrought metal decreased by two-thirds.

Titanium.—Both production and exports of ilmenite concentrate increased in 1970. Exports of ilmenite were 24,667 tons, and exports of titanium dioxide and pigments increased to nearly 40,000 tons valued at $16.2 million.

NONMETALS

Cement and Other Construction Materials.—Building construction in 1970 was at a record high. The number of building completions was about 20 percent more than in 1969, and completions of stone buildings was up 15 percent. The relatively high level of construction activity generated an increase of about 8 percent in production of nonmetallic mineral manufactures compared with 1969. Increased output of cement was accompanied by a 75-percent reduction in net exports of cement in 1970 compared with the previous year.

Clays (Kaolin) and Talc.—Despite increased Finnish production of talc, imports of kaolin in 1970 rose to 308,000 tons, a 30-percent increase compared with imports in 1969. Most of the kaolin was imported from the United Kingdom. Production of talc was begun in 1969 at Lahnaslampi (central Finland), for use as a substitute for imported kaolin in the manufacture of paper. Output of talc in 1970 was about 90 percent of production capacity at Lahnaslampi as reported in 1969, but additional capacity was being installed in 1970.

Feldspar, Quartz, and Mica.—Output of feldspar and quartz continued to rise in 1970, but production of mica was reported to be temporarily suspended. Exports of feldspar increased to approximately 60,000 tons, about half of which was destined for the United Kingdom. Trade in quartz remained small, because most of the output appeared to be used within Finland.

Pyrite and Sulfur.—Production of pyrite concentrate, by mine, in 1969 and 1970 follows, in metric tons:

Mine	1969	1970
Pyhäsalmi	465,882	475,622
Outokumpu:		
Mine	168,648	145,257
Old tailings	81,522	57,790
Luikonlahti	e 175,000	201,236
Vihanti	82,579	83,098
Otanmäki	7,500	7,700
Total	e 981,131	970,703

e Estimate.

Increased recovery of sulfur in elemental and gaseous forms in 1970 was due to increased processing of sulfides at Kokkola, including the cobalt and zinc plants. Output of sulfur dioxide at Harjavalta was slightly less than in 1969. Exports of pyrite in 1970 declined sharply, to 17,500 tons. Imports of elemental sulfur were slightly more than in 1969, but 12,400 tons were exported.

Production of sulfuric acid increased by 25 percent compared with 1969. The increase was due to completion of new acid plants at Kokkola and Harjavalta by Rikkihappo Oy., the only producer. Output capacity at both localities was increased by 90,000 tons per year.

MINERAL FUELS

Petroleum.—Preliminary trade statistics indicated that imports of crude oil totaled 9.75 million tons in 1970, an increase of 38 percent compared with 1969. The Soviet Union remained the principal source, and Iran supplied an estimated 30 percent.

Total imports and exports of refinery products were not appreciably different from those of 1969. Imports of heavy fuel oils were up 26 percent, to 1.14 million tons. Fuel oils made up 93 percent of total imports of refined products; exports consisted largely of gasoline.

At the Porvoo refinery of Neste Oy., construction of additional refining equipment continued. The bitumen plant was completed in 1970, and productive capacity for middle distillates will be substantially increased by 1972.

Statistics for the first 9 months of 1970 indicated that refinery processing of crude oil was about 17 percent higher than in the corresponding period of 1969.

Inland consumption of petroleum products for the last 3 years was as follows in thousand metric tons:

Product	Consumption		
	1968 [1]	1969 [1]	1970 [e 2]
Motor gasoline	823	911	977
Aviation gasoline	12	15	97
Jet fuel	49	64	
Kerosine	31	30	30
Distillate fuel oil	908	996	8,000
Residual fuel oil	5,447	6,654	
Liquefied gases	53	56	
Refinery fuel	[e] 397	420	529
Other	------	------	
Total	7,720	9,146	9,633

[e] Estimate.

[1] Organization for Economic Cooperation and Development (OECD), Paris. Statistics of Energy 1955–69, pp. 38–39, 286–293, 1971.

[2] Based on 9-month totals published by OECD (Paris), in Provisional Oil Statistics by Quarters-Fourth Quarter 1970.

Solid Fuels.—Imports of coal (3.22 million tons) and coke (843,000 tons) in 1970 were substantially higher than in 1969. The increase in coal imports was due partly to relatively low availability of hydroelectric power and consequent increased reliance on thermal plants for supplies of electricity.

Wood and wood products (mainly, solids from waste liquors of the paper industry) supplied an estimated 20 to 25 percent of Finland's energy requirements in 1970. In 1968, the latest year for which detailed statistics were available, these fuels contributed 25 percent of the energy used by industry and 33 percent of that used by households and other consumers in the domestic sector.

The Mineral Industry of France

By E. Shekarchi [1]

The mineral industry of France, during 1970, kept pace with the high level of activity in the overall economy. Although domestic demand was on somewhat of a plateau after the rapid growth of 1969, there was considerable impetus from the high European industrial activity. The gross national product (GNP) [2] at current prices was estimated at $147.6 billion [3] in 1970 compared with $131 billion in 1969. Per capita GNP, also in current prices, was up 11 percent from $2,620 in 1969 to $2,910 in 1970.

The major development in the mineral processing industry was the announcement in September 1970 by two large aluminum producers of France, Péchiney and Ugine, that they will join forces to establish a complex raw material processing facility to process aluminum, copper, special steel, new metals, and some chemical products. The effect of the new establishment is expected to be a tremendous production increase in 1972.

Another noteworthy event of 1970 was the decision taken jointly by Péchiney and Kaiser Aluminum & Chemical Corp. to set up a 1-million-metric-ton aluminum plant at Dunkirk by 1974. Details of ownership and other arrangements were not available at yearend.

A decision was announced at the end of September to organize a new company of Péchiney and Peñarroya S.A., called Affimet, in which Péchiney will have a 60-percent interest and Peñarroya a 40-percent interest. Activities of the new firm will be concentrated on refining aluminum and copper and production of their alloys. After expansion of existing facilities in 1971, Affimet will produce 70,000 metric tons of secondary aluminum and 15,000 metric tons of copper alloys.

The sixth economic plan of French industry, which covers the 1971–75 period was introduced. According to this plan, French steel production capacity would reach 35.6 million metric tons by the end of 1975. To implement the program, the floating of new shares, loans, and continuation of large self-financing has been foreseen. The sixth plan envisages that petroleum will continue to be the predominant source of energy, rising from 58.8 percent of the national energy supply in 1970 to an estimated 67.9 percent in 1975. Further projection into the 1980's indicates that the share of energy supplied by petroleum will increase to over 70 percent by 1980 but will fall below the 70-percent level by 1985. The share of coal in national energy consumption is expected to decline. Although the use of natural gas is expected to increase at a rate of about 12 percent per year, it is not anticipated that it will account for more than 10 percent of the total energy consumption before 1985. In the nuclear energy sector, the plan envisages all the growth after 1975. By 1985, nuclear power will account for over 11 percent of the total energy consumed.

PRODUCTION

The production of iron and steel, aluminum, and ferroalloys was generally higher in 1970 than in 1969. Among the fuels the coal industry showed another decline, whereas a significant increase was indicated in the production of natural gas and petroleum. In table 1 the production of primary minerals and processed metals and nonmetals is given.

[1] Physical scientist, Division of Ferrous Metals.
[2] U.S. Embassy, Paris. State Department Dispatch A–535, May 17, 1971.
[3] Where necessary values have been converted from francs (Fr) to U.S. dollars at the rate of Fr.5.55 = US$1.00.

Table 1.—France: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite, gross weight ---- thousand tons	2,713	2,773	2,992
Alumina ---- do	1,030	1,106	e 1,125
Metal:			
Primary ---- do	366	372	380
Secondary ---- do	74	89	e 87
Antimony smelter production	1,331	2,129	2,222
Arsenic, white	13,818	e 13,600	e 13,600
Bismuth ---- kilograms	64,000	65,000	72,000
Cadmium	r 552	523	528
Cobalt	800	641	304
Copper:			
Mine output, metal content	391	389	348
Metal:			
Blister (secondary)	7,820	10,380	9,100
Refined:			
Electrolytic	28,153	28,900	27,852
Other	8,238	8,040	5,675
Total	36,391	36,940	33,527
Gold:			
Mine output, metal content ---- troy ounces	58,450	54,946	e 58,000
Metal ---- do	r 60,893	47,101	56,521
Iron and steel:			
Iron ore and concentrate ---- thousand tons	55,238	55,425	56,801
Pig iron ---- do	16,075	17,784	18,735
Blast furnace ferroalloys ---- do	374	428	486
Electric furnace ferroalloys ---- do	273	309	339
Steel ingots and castings ---- do	20,409	22,511	23,773
Semimanufactures ---- do	16,771	18,408	18,727
Lead:			
Mine output, metal content	r 26,400	30,200	29,385
Metal refined:			
Primary	99,930	107,930	119,936
Secondary	22,900	19,824	18,123
Antimonial lead (lead content)	25,400	28,050	31,886
Total refined lead	148,230	155,804	169,945
Magnesium including secondary	4,480	4,414	4,611
Manganese ore and concentrate ---- gross weight	2,602	NA	NA
Nickel, content of metallurgical products (pure nickel, ferronickel, and nickel oxide)	9,209	9,606	10,952
Silicon	21,960	29,470	NA
Silver:			
Mine output, metal content ---- thousand troy ounces	2,193	2,094	e 2,100
Metal (content of final smelter products) ---- thousand troy ounces	5,723	4,135	4,823
Tin concentrate, metal content ---- long tons	r 368	252	283
Tungsten concentrate, metal content	--	22	58
Uranium:			
Mine output, uranium content	1,251	1,300	1,294
Chemical concentrate, uranium content [1]	1,642	1,716	1,764
Zinc:			
Mine output, metal content	21,806	20,100	18,600
Metal including secondary:			
Slab	207,414	253,540	227,300
Dust	6,200	6,760	NA
NONMETALS			
Alabaster	1,550	NA	NA
Asbestos	500	e 500	e 500
Barite	90,932	95,000	105,000
Bromine, elemental	14,140	14,710	e 15,000
Cement, hydraulic ---- thousand tons	25,393	27,543	28,900
Chalk ---- do	3,835	NA	NA
Clays:			
Bentonite	23,227	NA	NA
Brick and tile ---- thousand tons	10,272	NA	NA
Ceramic and pottery	495,853	NA	NA
Marl for cement industry ---- thousand tons	10,472	NA	NA
Kaolin and kaolinitic	439,868	e 470,000	e 480,000
Refractory ---- thousand tons	723	639	688
Diatomite	170,650	e 170,000	e 170,000
Feldspar and pegmatite	177,483	e 178,000	e 188,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
NONMETALS—Continued			
Fertilizer materials:			
Crude (natural):			
Phosphatic chalk	24,000	31,000	[e] 31,000
Potash:			
Gross weight ... thousand tons	11,720	11,971	11,699
K_2O equivalent ... do	1,857	1,938	1,904
K_2O equivalent (marketable) ... do	1,719	1,794	1,768
Manufactured:			
Nitrogenous nitrogen content ... thousand tons	1,386	1,406	1,383
Phosphatic:			
Superphosphate, gross weight ... do	1,520	1,433	1,220
Thomas slag ... do	2,519	2,615	2,540
Potassic ... do	1,683	1,770	1,742
Mixed, gross weight ... do	6,528	6,456	6,684
Fluorspar, marketable	260,555	[e] 275,000	[e] 290,000
Fly ash ... thousand tons	3,780	NA	NA
Gypsum and anhydrite, crude ... do	5,315	5,959	6,089
Lime, quicklime and hydrated including dead-burned dolomite ... do	4,002	4,187	[e] 4,200
Mica	1,524	[e] 1,350	[e] 1,350
Pigments, natural mineral, iron oxide	5,099	NA	NA
Pumice	592	[e] 600	[e] 600
Pozzolana and lapilli	726,202	[e] 725,000	[e] 725,000
Pyrite:			
Gross weight ... thousand tons	82	85	85
Sulfur content ... do	34	35	35
Quartz and glass sand:			
Quartz	427,656	NA	NA
Glass sand ... thousand tons	1,554	2,196	1,777
Salt ... do	4,442	4,882	5,084
Stone, sand and gravel n.e.s.:			
Building stone:			
Granite and similar rocks ... do	1,087	855	NA
Limestone ... do	2,563	2,308	NA
Marble ... do	501	NA	NA
Other ... do	56	NA	NA
Crushed limestone and granite	4,689	NA	NA
Dolomite:			
For agriculture	169,732	NA	NA
Crude for calcining	598,118	NA	NA
Other	677,701	NA	NA
Total	1,445,551	NA	NA
Limestone, agricultural and industrial:			
For agriculture ... thousand tons	491	NA	NA
For iron and steel industry ... do	4,660	NA	NA
For lime and cement ... do	26,032	NA	NA
For sugar mills ... do	652	633	NA
Total ... do	31,835	NA	NA
Road building, foundation and ballast (other than alluvial sand and gravel):			
Ballast ... do	73,046	NA	NA
Foundation material ... do	5,592	NA	NA
Ground rock for road filler ... do	93	NA	NA
Paving block and curbing ... do	145	NA	NA
Slate:			
Roof	121,268	117,600	112,000
Other	52,455	NA	NA
Other stone:			
Beach pebble	195,432	NA	NA
Lava	16,519	NA	NA
Marl	205,613	NA	NA
Mine fill ... thousand tons	11,882	NA	NA
Millstones and grindstones	1,290	NA	NA
Sand and gravel:			
Industrial sands:			
Foundry ... thousand tons	1,894	2,417	[e] 2,800
Miscellaneous ... do	530		
Other sand and gravel (alluvial):			
By dredging ... do	84,328	175,092	180,199
By other winning methods ... do	77,543		
Sulfur, elemental byproduct ... do	1,635	1,732	1,733
Talc	246,085	246,000	233,000

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS			
Bituminous asphaltic material	116,482	117,880	NA
Carbon black	118,150	137,200	e 140,000
Coal:			
Anthracite thousand tons	10,603	10,084	9,842
Bituminous do	31,308	30,499	27,511
Lignite do	3,221	2,950	2,785
Total do	45,132	43,533	40,138
Coke:			
Metallurgical do	12,341	13,539	14,149
Gashouse do	8	8	10
Total do	12,349	13,547	14,159
Coal briquets do	r 4,565	4,197	4,302
Gas natural:			
Gross production million cubic feet	304,376	346,223	e 360,000
Marketed do	r 197,832	229,756	243,000
Peat thousand tons	72	e 70	e 70
Petroleum:			
Crude thousand 42-gallon barrels	19,585	18,207	16,825
Refinery products:			
Aviation gasoline do	585	506	385
Motor gasoline do	98,383	104,266	112,273
Jet fuel do	18,203	22,742	23,294
Kerosine do	461	350	373
Distillate fuel oil do	222,017	257,697	295,893
Residual fuel oil do	130,812	157,864	183,229
Lubricants do	6,396	7,208	7,382
Liquefied petroleum gases do	23,245	25,446	28,301
Bitumen do	14,830	17,287	19,444
Other do	30,713	40,913	25,158
Refinery fuel and losses do	39,479	38,185	42,216
Total do	585,124	672,464	737,948

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Produced in part from imported raw materials.

TRADE

Details of foreign trade including total tonnage by commodities, principal sources, and destinations are given in tables 2 and 3.

Table 2.—France: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite	157,321	148,034	West Germany 77,527; United Kingdom 64,724.
Oxide and hydroxide [1]	234,063	286,529	Switzerland 125,521; Spain 42,913; Italy 32,736.
Metal including alloys:			
Scrap	16,160	14,819	Italy 9,855; West Germany 3,572.
Unwrought	186,858	179,808	West Germany 66,049; Belgium-Luxembourg 58,909; Italy 32,890.
Semimanufactures	69,726	85,959	West Germany 26,205; United States 15,322; Italy 5,970.
Antimony including scrap	r 141	194	Belgium-Luxembourg 68; Spain 50; United Kingdom 28.
Arsenic (anhydride)	13,250	11,622	United States 3,768; United Kingdom 2,346; Italy 1,402.
Beryllium	5	2	United States 1; United Kingdom 1.
Bismuth, all forms	60	72	United Kingdom 58.
Cadmium	50	58	West Germany 43; Belgium-Luxembourg 14.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Chromium:			
Chromite	298	230	West Germany 220.
Oxide and hydroxide	775	949	United States 175; Sweden 168; Belgium-Luxembourg 141.
Metal	213	343	West Germany 140; Italy 76; Sweden 45.
Cobalt	r 739	558	Mainland China 160; United Kingdom 93; Netherlands 84.
Columbium value, thousands [2]	$11	--	
Copper:			
Matte	621	911	Netherlands 637; West Germany 137; Belgium-Luxembourg 90.
Metal and alloys:			
Scrap	33,030	41,029	Belgium-Luxembourg 15,197; West Germany 14,260; Italy 8,792.
Blister and other unrefined	12,687	9,952	Belgium-Luxembourg 8,586; West Germany 1,359.
Refined	r 12,673	8,404	West Germany 3,009; Belgium-Luxembourg 2,041; Netherlands 1,500.
Semimanufactures	32,966	37,935	West Germany 12,381; United States 5,934; Netherlands 4,065.
Gallium [3] value, thousands [2]	r $194	$336	Switzerland $335.
Germanium, all forms	2	1	All to Belgium-Luxembourg.
Gold: [4]			
Metal including alloys troy ounces	91,404	96,098	Belgium-Luxembourg 20,223; Netherlands 11,156; West Germany 5,305.
Ashes and sweepings do	1,736	2,282	Switzerland 2,058.
Other metal (temporary imports and exports) do	657,835	3,179,769	Muscat and Oman 1,078,720; Laos 483,354; Saudi Arabia 344,784.
Iron and steel:			
Iron ore thousand tons	18,271	18,515	Belgium-Luxembourg 13,431; West Germany 5,059.
Pyrite cinder do	210	183	Belgium-Luxembourg 94; West Germany 89.
Metal:			
Scrap do	2,192	1,229	Italy 1,832; Belgium-Luxembourg 271; West Germany 86.
Pig iron including spiegeleisen [5] do	54	74	West Germany 32; Belgium-Luxembourg 23; Italy 16.
Ferroalloys thousand tons	290	331	Italy 89; West Germany 87; United States 66.
Shot and powder do	18	22	West Germany 8; Italy 6.
Steel:			
Primary forms including coils do	739	704	Italy 236; Belgium-Luxembourg 175; West Germany 142.
Semimanufactures:			
Bars, rods, wire rods, and sections do	2,678	2,421	United States 565; West Germany 502; Belgium-Luxembourg 234.
Plates, sheets, and universals do	2,387	2,410	West Germany 727; Italy 253; United States 162.
Hoop and strip do	241	209	West Germany 59; Italy 35; Belgium-Luxembourg 26.
Rails and accessories do	133	201	Italy 82; Iran 26.
Wire do	105	113	United States 37; West Germany 16.
Tubes, pipes, and fittings do	693	723	United States 167; Netherlands 103; Algeria 87.
Castings and forgings, rough do	8	20	Belgium-Luxembourg 11; United States 3.
Lead:			
Ore	3,612	4,333	Belgium-Luxembourg 2,288; West Germany 1,750.
Oxides	r 8,202	9,429	Netherlands 2,234; Hungary 2,020; United States 1,087.
Metal including alloys:			
Scrap	10,535	14,670	Italy 7,869; West Germany 5,719.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Lead—Continued			
Metal including alloys—Continued:			
Pig including alloys	16,774	19,095	United States 5,507; West Germany 3,281; Belgium-Luxembourg 3,146.
Semimanufactures including alloys	1,136	939	Italy 155; Norway 114; Syrian Arab Republic 100.
Magnesium, all forms	r 474	729	West Germany 174; Italy 170; Cameroon 130.
Manganese:			
Ore	504	594	Netherlands 190; Italy 125; Switzerland 120.
Oxide	720	521	Austria 138; Netherlands 130; Poland 120.
Metal, all forms	4,674	6,476	West Germany 2,130; Italy 1,671; United Kingdom 755.
Mercury ... 76-pound flasks	290	116	Belgium-Luxembourg 29; Norway 29.
Molybdenum:			
Ore	54	80	NA.
Oxide	22	27	Italy 17; West Germany 5.
Metal, all forms	15	36	West Germany 23; Italy 5.
Nickel:			
Matte, speiss, etc	r 164	154	West Germany 35; Sweden 35.
Oxide and hydroxide	152	126	Italy 32; Netherlands 31; West Germany 17.
Metal including alloys:			
Scrap	1,850	1,640	West Germany 599; Belgium-Luxembourg 546; Netherlands 261.
Ingots	5,824	4,214	West Germany 1,372; mainland China 700; Italy 519.
Semimanufactures including anodes	2,471	2,966	West Germany 802; Spain 681; Netherlands 346.
Platinum and platinum group:[4]			
Ashes and sweepings ... troy ounces	2,446,218	1,093	Switzerland 482; Gabon 322; United Kingdom 225.
Metal including alloys ... do	113,813	127,992	West Germany 26,171; Netherlands 23,888; United States 20,416.
Selenium	1	2	NA.
Silver:			
Metal including alloys thousand troy ounces	r 11,152	6,640	Spain 1,363; West Germany 1,124; Netherlands 996.
Ashes and sweepings ... do	786	552	Sweden 460; Belgium-Luxembourg 92.
Sodium	2,494	1,440	West Germany 762; Italy 675.
Tantalum, all forms . value thousands[2]	$118	$71	Italy $30; United States $19.
Thorium oxide	1	1	All to the Netherlands.
Tin:			
Ore ... long tons	r 569	365	Spain 360.
Oxide ... do	43	26	West Germany 23.
Metal including alloys:			
Scrap ... do	17	14	NA.
Ingots ... do	r 292	569	West Germany 210; Italy 122; Algeria 67.
Semimanufactures ... do	r 119	167	Cambodia 60; Belgium-Luxembourg 12.
Titanium:			
Ore	156	129	Algeria 121.
Oxide	r 10,173	9,844	United States 4,100; West Germany 1,453; Italy 807.
Metal, all forms	37	39	United Kingdom 19; Italy 14; West Germany 4.
Tungsten:			
Ore	1		
Trioxide	144	169	Austria 130; West Germany 38.
Metal, all forms	336	301	West Germany 131; United Kingdom 91; Japan 22.
Zinc:			
Ore	27,231	7,126	Spain 5,540; United Kingdom 1,586.
Matte	1,055	324	Italy 302.
Oxide	r 9,908	8,887	West Germany 1,507; Belgium-Luxembourg 1,254; mainland China 906.
Metal including alloys:			
Scrap	2,410	2,155	Italy 2,074; Belgium-Luxembourg 71.
Dust (blue powder)	1,295	2,352	Norway 1,250; Belgium-Luxembourg 620.
Slab and ingot	20,610	20,381	West Germany 10,419; Portugal 2,563; United States 1,500.
Semimanufactures	r 3,432	2,624	West Germany 1,922; Morocco 104.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Zirconium:			
Ore	160	130	Italy 89.
Oxide	51	75	Mexico 20; United States 19; West Germany 10.
Metal including nuclear grade	373	300	United States 110; Sweden 88; West Germany 82.
Other:			
Ore and concentrate	364	189	West Germany 58.
Ash and residues from nonferrous metals:			
Aluminum	4,690	5,114	Italy 3,434; West Germany 920; Spain 395.
Copper	5,584	3,222	West Germany 1,825; Belgium-Luxembourg 978; Spain 308.
Lead	10,731	8,626	Belgium-Luxembourg 8,173; West Germany 371.
Nickel	662	476	Italy 338; West Germany 99; East Germany 22.
Zinc	8,868	6,147	Belgium-Luxembourg 5,296; West Germany 493.
Other	r 33,630	33,237	Switzerland 19,121; Belgium-Luxembourg 8,929; West Germany 3,090.
Slag and ash n.e.s	185,332	170,115	Italy 100,938; West Germany 64,282; Switzerland 2,720.
Metals including alloys, all forms [6]	r 206	328	West Germany 117; Belgium-Luxembourg 93.
NONMETALS			
Abrasives, natural:			
Pumice, emery and other	r 567	622	West Germany 372.
Dust and powder of precious and semiprecious stones value, thousands [2]	$382	$407	Switzerland $133; Belgium-Luxembourg $98; United Kingdom $92.
Grinding and polishing wheels	r 2,400	2,572	West Germany 590; Italy 451; Belgium-Luxembourg 306.
Asbestos, crude	1,030	794	Algeria 586; Spain 130.
Barite including witherite	15,062	14,415	Gabon 4,087; Italy 3,321; Belgium-Luxembourg 2,637.
Borates, natural	4,109	1,478	Italy 739; West Germany 650.
Bromine	1,692	2,005	Switzerland 1,152; West Germany 607; United Kingdom 227.
Cement thousand tons	868	1,006	West Germany 203; Italy 160; Ivory Coast 143.
Chalk	r 287,412	299,452	West Germany 126,030; Belgium-Luxembourg 66,474; Netherlands 48,030.
Clays and products:			
Crude:			
Kaolin	r 60,156	63,901	West Germany 40,418; Italy 11,986; Switzerland 4,037.
Bentonite	3,523	2,205	Belgium-Luxembourg 467; Iran 298; Tunisia 276.
Refractory	339,477	366,252	Italy 208,428; West Germany 87,973; Belgium-Luxembourg 44,760.
Other	r 65,838	1,408,188	Italy 897,823; West Germany 470,933; Belgium-Luxembourg 27,779.
Clay and refractory construction materials (bricks, tile, etc.)	145,352	208,003	Belgium-Luxembourg 52,273; West Germany 43,389; Italy 19,690.
Corundum:			
Natural including emery (included in abrasives above)	109	139	NA.
Artificial	11,588	13,942	West Germany 3,710; Italy 2,551; Belgium-Luxembourg 2,020.
Cryolite and chiolite, natural	1,598	1,513	Cameroon 1,473.
Diamond:			
Industrial excluding powder value, thousands [2]	$1,459	$1,331	West Germany $651; Ireland $159; Spain $106.
Gem unset do	$5,819	$10,839	Switzerland $5,265; Republic of South Africa $2,078; Netherlands $1,527.
Diatomite	17,685	14,869	West Germany 8,729; Netherlands 1,023; Italy 1,007.
Feldspar	21,653	27,251	Belgium-Luxembourg 9,436; West Germany 8,958; Switzerland 5,628.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Nitrogenous (natural sodium nitrates)	870	141	Belgium-Luxembourg 35.
Phosphate rock	824	607	NA.
Potassic salts	56,744	59,503	Belgium-Luxembourg 38,782; Netherlands 16,914; Switzerland 3,780.
Organic	r 37,767	28,706	Switzerland 15,887; West Germany 3,426; Italy 3,335.
Manufactured:			
Ammonia, anhydrous thousand tons	7	52	West Germany 41; Greece 4; Spain 3.
Nitrogenous do	592	514	Belgium-Luxembourg 113; Morocco 69; Egypt 58.
Phosphates:			
Basic slag do	312	280	Switzerland 127; Austria 115; Italy 35.
Other do	51	53	Spain 10; Netherlands 9; U.S.S.R. 9.
Potassic do	1,145	1,026	Belgium-Luxembourg 162; Poland 162; Netherlands 97.
Flint (pebbles)	103,144	96,783	United Kingdom 25,137; West Germany 17,698, Belgium-Luxembourg 14,632.
Fluorspar	117,261	102,226	West Germany 63,367; Italy 12,301; Belgium-Luxembourg 9,888.
Graphite	1,697	1,537	West Germany 268; Austria 251; Belgium-Luxembourg 232.
Gypsum and anhydrite including plasters	863,514	922,484	Belgium-Luxembourg 385,053; Sweden 186,717; Italy 108,911.
Iodine	42	35	United Kingdom 10; Hungary 4; Italy 3.
Lime	r 287,229	355,321	Belgium-Luxembourg 208,549.
Magnesite including calcined	2,558	601	United Kingdom 284; Réunion 105; Italy 73.
Mica	r 1,921	1,572	West Germany 856; Italy 165; Switzerland 106.
Pigments, mineral including iron oxide	3,150	2,954	Algeria 468; Morocco 414; United Kingdom 324.
Pozzolan, santorin, etc	1,781	2,870	Switzerland 2,861.
Precious and semiprecious stones, except diamond [7] value, thousands [2]	$10,778	$12,705	Switzerland $8,104; United States $1,499; West Germany $825.
Pyrite, gross weight	3,145	4	NA.
Salt	r 83,501	135,113	Netherlands 29,314; West Germany 23,658; Belgium-Luxembourg 23,171.
Sodium and potassium compounds n.e.s.:			
Caustic soda	198,435	279,561	Guinea 71,598; West Germany 32,055; Brazil 20,686.
Caustic potash	9,563	8,756	Netherlands 2,687; United Kingdom 1,104; Switzerland 1,088.
Stone, sand and gravel: [8]			
Building stone:			
Crude and partly worked n.e.s.	92,810	96,307	Belgium-Luxembourg 56,570; West Germany 13,598; Switzerland 6,378.
Worked:			
Not specified	7,401	7,105	Belgium-Luxembourg 2,159; West Germany 2,154; Switzerland 693.
Slate including crude	r 18,567	19,983	Netherlands 9,757; Belgium-Luxembourg 6,617; Italy 2,147.
Dolomite, chiefly refractory grade	76,827	91,369	Belgium-Luxembourg 55,206; West Germany 19,607; Switzerland 4,605.
Gravel and crushed stone thousand tons	10,123	10,144	West Germany 6,756; Switzerland 1,656; Belgium-Luxembourg 1,076.
Limestone (except dimension)	117,144	108,433	Belgium-Luxembourg 63,694; Switzerland 43,295; West Germany 969.
Quartz and quartzite	412	904	West Germany 215.
Sand excluding metal bearing thousand tons	2,208	2,513	West Germany 961; Belgium-Luxembourg 648; Switzerland 481.
Sulfur, elemental do	r 1,063	868	United Kingdom 262; Netherlands 121; West Germany 89.
Talc and steatite	44,376	45,873	West Germany 11,805; Italy 10,520; United States 4,890.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Other:			
Nonmetals n.e.s	r 145,059	202,262	Switzerland 158,399; West Germany 30,891; Belgium-Luxembourg 10,972.
Slag, dross and similar waste, not metal bearing from iron and steel manufactures____thousand tons	947	808	West Germany 682; Belgium-Luxembourg 84; Norway 13.
Oxide and hydroxide of magnesium, strontium, and barium	6,825	9,427	U.S.S.R. 5,022; United Kingdom 1,070; West Germany 598.
Fluorine	1,349	26	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	21,244	16,182	United Kingdom 15,209.
Carbon black	r 43,862	47,338	West Germany 9,013; Italy 8,070; Spain 7,539.
Coal and briquets:			
Bituminous	r 860,231	1,102,001	Belgium-Luxembourg 447,026; West Germany 435,804; Netherlands 91,781.
Briquets of bituminous coal	14,149	43,022	West Germany 20,496; Italy 15,407; Switzerland 4,741.
Lignite	28,985	17,276	Spain 17,266.
Coke	185,322	887,991	West Germany 315,455; Belgium-Luxembourg 297,270; Algeria 44,826.
Gas including liquid petroleum gas	r 498,677	609,962	Spain 317,749; Portugal 108,744; Algeria 38,628.
Hydrogen, helium and rare gases	2,851	2,462	Belgium-Luxembourg 1,410; Spain 346; Italy 280.
Peat including briquets	1,192	2,271	West Germany 2,235.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	12,891	11,287	United Kingdom 3,534; West Germany 3,044; Switzerland 1,927.
Kerosine and jet fuel____do	3,528	3,055	Switzerland 1,387; West Germany 336; Spain 284.
Distillate fuel oil____do	19,152	22,082	West Germany 8,695; Switzerland 6,621; Netherlands 3,582.
Residual fuel oil____do	28,165	28,519	United Kingdom 6,086; West Germany 5,465; Italy 4,271.
Lubricants____do	1,979	2,702	United Kingdom 589; Netherlands 380; Belgium-Luxembourg 247.
Other, bitumen, petroleum coke, and other residues thousand 42-gallon barrels	2,922	2,565	West Germany 1,163; Algeria 407; Switzerland 400.
Chemical derivatives of coal, petroleum or gas	62,768	46,045	Switzerland 10,045; West Germany 9,389; Belgium-Luxembourg 5,193.

r Revised. NA Not available.
[1] Excludes artificial corundum.
[2] Based on par value of franc effective on January 1, 1960, of 20.2550 U.S. cents equals 1 franc. The par value of the franc was changed on August 10, 1969 to 18.0044 U.S. cents equals 1 franc.
[3] Including indium and thallium.
[4] Calculated from quantities reported in kilograms.
[5] Including cast iron and shot, grit, powder, and sponge of iron or steel.
[6] Alkali, alkaline earth, and rare-earth metals except sodium.
[7] Including synthetic and reconstituted stone but not including diamond.
[8] Not including slate, flint, or industrial limestone.

Table 3.—France: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	334,846	479,899	Australia 315,898; Greece 84,230; Guyana 47,203.
Oxide and hydroxide [1]	31,215	5,507	Canada 2,151; West Germany 1,983, United States 720.
Metal including alloys:			
Scrap	5,523	14,783	Belgium-Luxembourg 6,496; United States 3,540; West Germany 1,722.
Unwrought	r 97,859	142,275	Cameroon 37,857; Greece 21,115; United States 19,165.
Semimanufactures	r 59,214	84,484	West Germany 45,388; Belgium-Luxembourg 22,338; Italy 6,074.
Antimony:			
Ore and concentrate	2,430	4,095	Bolivia 1,489; Morocco 1,183; Republic of South Africa 703.
Metal, all forms	1,232	996	Belgium-Luxembourg 653; mainland China 164; U.S.S.R. 81.
Arsenic, anhydride and acid	21	5	NA.
Beryllium:			
Ore	36	--	
Metal, all forms value, thousands [2]	$138	$420	United States $370; United Kingdom $46.
Bismuth	943	842	Peru 309; United Kingdom 125; Japan 85.
Cadmium	349	749	Belgium-Luxembourg 201; Japan 144; United States 124.
Chromium:			
Ore	263,119	330,327	Turkey 83,682; U.S.S.R. 80,157; Iran 56,757.
Oxide and hydroxide	2,041	2,442	West Germany 1,581; United Kingdom 270; U.S.S.R. 222.
Metal	40	55	U.S.S.R. 20; United States 18; United Kingdom 16.
Cobalt:			
Ore	11,600	8,712	All from Morocco.
Oxide and hydroxide	114	136	Belgium-Luxembourg 133.
Metal, all forms	273	663	Belgium-Luxembourg 376; Finland 112; Congo (Kinshasa) 63.
Columbium:			
Ore (including tantalum ore)	560	1,163	Canada 1,041; United States 74.
Metal, all forms value, thousands [2]	r $89	$137	Belgium-Luxembourg $58; United States $40.
Copper:			
Matte	332	1,392	Belgium-Luxembourg 1,020; Italy 116; United Kingdom 102.
Metal including alloys:			
Scrap	[1] 14,813	13,147	West Germany 4,527; Belgium-Luxembourg 2,450; Switzerland 1,585.
Blister and other unrefined	16,416	15,844	Belgium-Luxembourg 10,400; Congo (Brazzaville) 3,000; Congo (Kinshasa) 2,424.
Refined	r 259,948	324,841	Belgium-Luxembourg 92,007; Zambia 67,171; Chile 52,531.
Semimanufactures	28,141	38,556	Belgium-Luxembourg 13,802; West Germany 10,772; Italy 5,030.
Germanium, gallium, etc. value, thousands [2]	$390	$445	Belgium-Luxembourg $267; Netherlands $48.
Gold: [3]			
Ashes and sweepings troy ounces	108,573	72,628	Spain 56,167; Netherlands 12,153; Switzerland 2,990.
Metal including alloys do	107,383	166,573	Netherlands 84,010; West Germany 38,517; Switzerland 25,624.
Metal, other (temporary imports and re-exports) do	r 1,327,277	3,871,137	Switzerland 2,958,668; United Kingdom 386,001; North Korea 382,529.
Iron and steel:			
Ore and concentrate except roasted pyrite thousand tons	5,017	6,941	Mauritania 1,757; Brazil 1,465; Liberia 1,222.
Roasted pyrite do	34	32	Italy 20; Spain 12.
Metal:			
Scrap do	373	465	Belgium-Luxembourg 204; United Kingdom 102; United States 50.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and steel—Continued:			
Metal—Continued:			
Pig iron, spiegeleisen and other [4] ______thousand tons__	245	249	West Germany 115; Belgium-Luxembourg 40; Finland 29.
Ferroalloys____________do____	80	107	Belgium-Luxembourg 17; West Germany 10; Norway 3.
Steel, primary forms___do____	1,278	1,945	Belgium-Luxembourg 773; West Germany 677; United States 242.
Semimanufactures:			
Bars, rods, sections [5] do____	1,443	1,832	West Germany 892; Belgium-Luxembourg 775; Italy 81.
Plates, sheets, and universals__________do____	1,731	2,278	Belgium-Luxembourg 1,265, West Germany 604; Italy 99.
Hoop and strip_____do____	269	349	Belgium-Luxembourg 222; West Germany 112; Italy 8.
Rails and accesories_do____	54	61	United Kingdom 45; Belgium-Luxembourg 10; West Germany 6.
Wire______________do____	76	104	West Germany 57; Belgium-Luxembourg 33; Netherlands 5.
Tubes, pipes, and fittings__________do____	268	285	West Germany 84; Italy 45; Belgium-Luxembourg 42.
Castings and forgings, rough___________do____	4,840	7,057	Belgium-Luxembourg 3,174; West Germany 2,269; Switzerland 1,270.
Lead:			
Ore and concentrate______________	128,384	123,735	Morocco 38,555; Ireland 36,672; Yugoslavia 11,170.
Oxides________________________	2,011	2,624	Belgium-Luxembourg 934; West Germany 808; Mexico 345.
Metal including alloys:			
Scrap______________________	3,284	4,981	Belgium-Luxembourg 3,094; West Germany 515; Algeria 443.
Unwrought__________________	47,044	58,450	Morocco 26,027; Belgium-Luxembourg 11,451; West Germany 9,062.
Semimanufactures____________	734	463	Belgium-Luxembourg 260; West Germany 91.
Magnesium including alloys:			
Scrap_________________________	18	46	NA.
Unwrought_____________________	1,299	1,183	Canada 627; United Kingdom 215; United States 153.
Semimanufactures________________	101	94	United Kingdom 26; West Germany 24; Italy 18.
Manganese:			
Ore and concentrate______________	889,959	975,841	Gabon 357,585; Republic of South Africa 329,698; U.S.S.R. 90,287.
Oxides________________________	3,093	3,886	Belgium-Luxembourg 1,837; Japan 1,650; West Germany 205.
Metal, all forms_________________	342	412	Republic of South Africa 348; Japan 52.
Mercury, all forms____76-pound flasks__	9,167	9,457	Yugoslavia 2,524; Spain 2,379; Mexico 1,944.
Molybdenum:			
Ore and concentrate______________	4,517	7,705	Canada 3,454; United States 2,822; Netherlands 731.
Oxide__________________________	3	8	Mostly from West Germany.
Metal, all forms_________________	83	105	Netherlands 33; West Germany 32; Austria 23.
Nickel:			
Matte_________________________	r 13,384	13,204	New Caledonia 7,966; Cuba 3,925; Canada 1,039.
Oxide and hydroxide______________	124	67	Canada 43; West Germany 12.
Metal including alloys:			
Scrap______________________	238	891	Czechoslovakia 403; United States 121; Belgium-Luxembourg 103.
Unwrought__________________	9,848	8,533	United Kingdom 3,238; Canada 2,647; U.S.S.R. 1,024.
Semimanufactures (including anodes)__________________	r 2,633	2,657	United Kingdom 1,034; West Germany 708; United States 310.
Platinum and platinum group:			
Ashes and sweepings__troy ounces__	21,252	35,044	Netherlands 13,343; Spain 11,381; Austria 3,440.
Metals___________________do____	215,088	413,715	Switzerland 156,863; U.S.S.R. 92,626; United Kingdom 44,368.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Selenium	27	64	United States 38; West Germany 7; Sweden 5.
Silver:[3]			
Ashes and sweepings thousand troy ounces	1,247	916	Spain 560; Netherlands 289; Belgium-Luxembourg 42.
Metal, all forms do	31,438	21,990	United States 7,020; Muscat and Oman 5,255; United Kingdom 2,878.
Tantalum, all forms	8	17	Belgium-Luxembourg 6; Italy 5; United States 4.
Thorium:			
Ore (monazite)	70	554	Australia 305; Congo (Kinshasa) 176; United States 40.
Metal value, thousands[2]	$7	$1	NA.
Tin:			
Oxide long tons	85	111	Belgium-Luxembourg 88; West Germany 18.
Metal including alloys:			
Scrap do	111	79	Switzerland 71.
Ingots do	9,639	11,140	United Kingdom 2,036; Indonesia 1,987; Thailand 1,542.
Semimanufactures do	57	34	West Germany 16; Netherlands 4; United Kingdom 4.
Titanium:			
Ore	135,066	138,730	Australia 135,275; Spain 3,455.
Oxide	17,885	19,934	West Germany 11,758; Belgium-Luxembourg 3,224; Netherlands 2,366.
Metal, all forms	490	565	U.S.S.R. 230; United Kingdom 111; Japan 106.
Tungsten:			
Ore	r 1,603	2,746	Brazil 773; mainland China 563; South Korea 533.
Trioxide	76	81	All from West Germany.
Metal, all forms	55	66	West Germany 34, Netherlands 15.
Uranium:			
Ore	2,130	1,193	All from Gabon.
Metal including alloys kilograms	1,000	--	
Zinc:			
Ore and concentrate	361,384	412,477	Canada 95,316; Peru 80,547; Ireland 63,172.
Oxide	2,313	3,021	West Germany 1,096; East Germany 975; Italy 803.
Metal including alloys:			
Scrap	19,193	18,439	Belgium-Luxembourg 8,453; Netherlands 6,961; West Germany 1,816.
Blue powder	3,048	4,366	Belgium-Luxembourg 4,146; Norway 165.
Unwrought	31,081	31,224	Belgium-Luxembourg 12,491; Netherlands 5,382; West Germany 4,145.
Semimanufactures	4,750	5,031	Belgium-Luxembourg 2,747; West Germany 1,726, Yugoslavia 300.
Zirconium:			
Ore	23,828	29,700	Australia 29,647.
Oxide	981	414	United Kingdom 200; United States 188; West Germany 26.
Metal	21	54	United States 42.
Other:			
Ores and concentrates	15,375	28,971	New Caledonia 16,801; Republic of South Africa 6,160; Iran 3,725.
Ashes and residues containing nonferrous metals:			
Aluminum	3,121	3,562	West Germany 2,103; Italy 752; Belgium-Luxembourg 499.
Copper	156	411	Belgium-Luxembourg 292; Switzerland 84.
Lead	370	86	Norway 52.
Nickel	29	57	Algeria 42.
Zinc	13,736	12,547	Belgium-Luxembourg 4,524; West Germany 4,061; Netherlands 1,311.
Other	16,116	32,230	Canada 25,044; Sikkim 4,200; Belgium-Luxembourg 878.
Metal including alloys, n.e.s., all forms	321	85	West Germany 46.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS			
Abrasives:			
Emery, natural corundum, other	2,950	28,209	Turkey 25,527; Greece 2,680.
Pumice	28,171	19,959	Italy 17,148; United States 268.
Dust of powder of precious and semiprecious stones value, thousands [2]	r $3,586	$4,791	United States $1,988; United Kingdom $1,139; Netherlands $731.
Grinding and polishing wheels	4,443	5,821	West Germany 1,433; Belgium-Luxembourg 1,352; Italy 1,054.
Asbestos	128,614	135,137	Canada 66,246; U.S.S.R. 40,872; Republic of South Africa 15,576.
Barite and witherite	80,537	79,349	West Germany 70,249; mainland China 4,110.
Boron materials:			
Crude natural borates	97,660	107,591	Turkey 60,362; United States 46,128; Netherlands 862.
Oxide and acid	915	1,931	U.S.S.R. 1,030; United States 466; Italy 254.
Bromine value [2]	$8,507	$405	NA.
Cement	100,116	91,925	West Germany 56,862; Switzerland 17,745; Italy 14,275.
Chalk	4,434	3,620	Belgium-Luxembourg 3,488.
Clays and products:			
Crude:			
Kaolin, including calcined	256,418	286,274	United Kingdom 241,842; United States 25,368; West Germany 11,904.
Bentonite	107,233	93,711	Greece 29,988; Italy 29,492; West Germany 11,078.
Refractory clays	166,002	196,220	West Germany 150,932; United Kingdom 23,609; Belgium-Luxembourg 7,204.
Clay and refractory construction materials (bricks, etc.)	465,265	553,552	West Germany 234,798; Italy 134,316; Belgium-Luxembourg 86,121.
Cryolite and chiolite, natural	1,630	2,156	Denmark 2,101.
Diamond:			
Industrial except dust value, thousands [2]	$5,833	$6,248	Ireland $3,000; Belgium-Luxembourg $1,414; United Kingdom $790.
Gem unset do	$36,097	$35,270	Belgium-Luxembourg $13,033; Switzerland $6,946; Israel $6,138.
Diatomite	7,009	6,817	United States 2,815; West Germany 2,209; Denmark 956
Feldspar	15,825	29,052	Norway 16,097; West Germany 3,614; Finland 2,105.
Fertilizer materials:			
Crude:			
Nitrogenous (natural sodium nitrate)	24,888	24,083	Chile 24,073.
Phosphate rock thousand tons	3,397	3,523	Morocco 1,601; Togo 714; Tunisia 486.
Manufactured:			
Ammonia, anhydrous	150,226	173,647	Belgium-Luxembourg 159,744; West Germany 7,493.
Nitrogenous	213,107	349,363	Belgium-Luxembourg 174,060; Romania 113,718; West Germany 22,344.
Potassic	270,970	197,767	Israel 71,462; Belgium-Luxembourg 60,963; West Germany 36,703.
Phosphatic:			
Basic slag	840,764	942,463	Belgium-Luxembourg 786,941; West Germany 155,522.
Other	361,274	381,841	Netherlands 164,833; Belgium-Luxembourg 74,181; Senegal 52,032.
Flint (pebbles)	r 629,504	486,548	United Kingdom 312,890.
Fluorspar	365	6,729	Republic of South Africa 3,241; Spain 2,000.
Graphite	4,776	5,630	Malagasy Republic 3,175; Italy 1,033; West Germany 706.
Gypsum and plaster	20,970	10,815	West Germany 8,973; Italy 1,371.
Iodine, crude	286	395	Japan 261; Chile 134.
Lime	126,241	175,616	Belgium-Luxembourg 134,891; West Germany 38,961; Switzerland 1,176.
Lithium and strontium minerals	2,655	3,899	Republic of South Africa 1,833; Netherlands 1,104; United Kingdom 806.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Magnesite including calcined	42,640	48,710	Austria 25,468 Greece 6,730; United Kingdom 5,109.
Mica	5,173	4,909	Qatar 1,465; Norway 1,305; Mozambique 1,271.
Pigments:			
Earth pigments, including iron oxide	501	1,052	Austria 495; Spain 275; West Germany 70.
Earth, other (pozzolanic, santorin, etc.)	82	367	NA.
Precious and semiprecious stones [6] value, thousands [2]	$10,759	$16,416	India $7,945; Switzerland $2,507; Brazil $1,040.
Pyrite	315,656	326,253	Cyprus 166,620; Spain 109,611; U.S.S.R. 48,367.
Salt	70,888	66,464	Algeria 27,090; Netherlands 19,752; West Germany 10,378.
Sodium and potassium salts, n.e.s.:			
Caustic soda	47,379	38,246	Belgium-Luxembourg 25,407; Italy 11,363; Netherlands 439.
Caustic potash and peroxides of potassium and sodium	180	66	Sweden 49.
Stone, sand and gravel: [7]			
Dimension stone:			
Crude and partly worked:			
Slate	2,892	3,373	Italy 1,070; United Kingdom 990; Belgium-Luxembourg 567.
Other	r 172,737	218,860	Italy 87,006; Republic of South Africa 62,515; Norway 18,953.
Worked:			
Slate	43,574	48,059	Spain 34,857; Portugal 7,603; United Kingdom 4,121.
Other	r 79,785	97,443	Italy 80,097; Portugal 7,179; West Germany 5,236.
Dolomite, chiefly refractory grade	181,460	187,728	Belgium-Luxembourg 162,702; West Germany 19,475; Norway 5,020.
Gravel and crushed stone thousand tons	r 3,460	3,771	Belgium-Luxembourg 3,230; West Germany 172.
Limestone	170,977	172,481	Belgium-Luxembourg 163,523; West Germany 8,958.
Quartz and quartzite	22,613	34,893	Italy 15,574; Belgium-Luxembourg 8,542; West Germany 6,177.
Sand excluding metal bearing thousand tons	1,609	1,822	Belgium-Luxembourg 671; Netherlands 560; West Germany 212.
Sulfur, elemental, all grades	335,627	351,519	Poland 180,825; Mexico 115,745; Canada 43,845.
Talc and steatite	9,654	9,698	Italy 4,287; Austria 1,972; Belgium-Luxembourg 1,854.
Other n.e.s	562,383	894,967	Switzerland 811,462; Greece 33,160; West Germany 20,196.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,794	1,599	United States 1,384.
Carbon black	52,655	60,649	Netherlands 23,267; United States 15,786; West Germany 10,131.
Coal and briquets:			
Coal thousand tons	11,565	12,517	West Germany 6,604; United States 1,943; U.S.S.R. 1,393.
Coal briquets do	334	261	Netherlands 163; Belgium-Luxembourg 63; West Germany 35.
Lignite and lignite briquets do	346	309	West Germany 308.
Coke do	3,520	3,290	West Germany 2,822; Netherlands 302; Belgium-Luxembourg 134.
Gas, hydrocarbon:			
Natural	1,512,130	2,389,838	Netherlands 1,785,770; Algeria 434,721; West Germany 42,903.
Manufactured	69,317	69,718	West Germany 56,841; Belgium-Luxembourg 10,658; Switzerland 2,218.
Hydrogen and rare gases	2,746	4,415	West Germany 3,822; Belgium-Luxembourg 418; United States 82.
Peat including briquets thousand tons	34	39	West Germany 23; Netherlands 11.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum:			
Crude..thousand 42-gallon barrels..	562,382	628,912	Algeria 185,308; Iraq 107,345; Libya 106,172.
Refinery products:			
Gasoline..............do....	6,565	6,739	Italy 2,967; West Germany 1,530; Romania 943.
Kerosine..............do....	244	430	United Kingdom 166; Belgium-Luxembourg 68; West Germany 55.
Distillate fuel oil........do....	22,014	23,169	Italy 11,207; U.S.S.R. 3,878; Romania 3,767.
Residual fuel oil........do....	6,204	4,423	U.S.S.R. 1,336; West Germany 1,228; Italy 883.
Lubricants............do....	373	280	Netherlands Antilles 70; United States 64; West Germany 63.
Other (vaseline, waxes, petroleum coke, bitumens, etc.) thousand 42-gallon barrels..	1,218	1,309	United States 700; West Germany 302; Venezuela 113.
Mineral tar and crude chemicals derived from coal, petroleum or gas...	223,894	289,177	United States 138,360; West Germany 63,514; Belgium-Luxembourg 12,986.

r Revised. NA Not available.
[1] Excludes artificial corundum.
[2] Based on par value of franc effective on January 1, 1960 of 20.2550 U.S. cents equals 1 franc. The par value of the franc was changed on August 10, 1969, to 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] Including wire rod.
[6] Including synthetic and reconstituted stone but not including diamond.
[7] Excludes flint and industrial limestone.

COMMODITY REVIEW

METALS

Antimony.—No antimony ore has been mined in France since 1967. Antimony ore was imported principally from mainland China. The contract with China ran out at the beginning of the year; however, enough ore stocks of high-grade ore were available in the storage houses to sustain high metal production. Antimony production in the form of regulus, oxides, and salt reached a new high in 1970 of 2.2 thousand metric tons compared with 2.1 thousand metric tons in 1969. The 4.3 percent increase in production during the year was due to the high price of antimony in the first quarter of the year.

Bauxite and Aluminum.—Unwrought primary aluminum production increased to a record amount of 380,000 metric tons in 1970 compared with 372,000 metric tons in 1969, with a moderate rise expected for 1971. Increases of note in electric smelters were as follows: L'Argentière plus 18,400 metric tons; Noguères plus 6,800 metric tons; and Saint-Jean plus 5,300 metric tons. Modernization at the Auzat smelter, which temporarily stopped production in June 1970, is expected to bring some thousands of tons of additional capacity in the 1970's.

Consumption of primary aluminum metal was estimated at 415,000 metric tons in 1970, an increase of 13.4 percent, whereas the consumption of secondary aluminum metals rose only 7 percent in 1970 compared with the 1969 level. The latest figures available on the end use of aluminum marketed in 1969 follow:

	Share of market (percent)	Change 1968–69 [1] based on recorded tonnages (percent)
Transport..................	32.7	+22.4
Mechanical engineering......	7.1	+10.9
Electrical engineering........	16.6	+25.4
Building....................	8.8	+12.7
Chemical, food and agricultural appliances...........	1.9	−4.1
Packaging..................	10.1	+24.8
Domestic and office appliances...............	7.2	+18.0
Powder consuming industries.	.8	+16.0
Iron and steel production, metallurgy...............	5.2	+29.1
Miscellaneous..............	9.6	+14.8

[1] Duesseldorf Aluminum. 1971, pp. 48–47. The aluminum industry at the turn of the year 1970–71.

Copper.—Refined copper was produced in France partly from concentrates and partly from scrap. Output of the refined metal, which meets only about 10 percent of the demand, showed a decline of about 3,000 metric tons in 1970 from the 1969 level.

A total of 16,468 metric tons of blister and cement copper and 315,377 metric tons of refined copper was imported during the year. Belgium supplied the greatest portion, 111,657 metric tons; followed by Zambia, 66,525 metric tons; Chile, 51,532; and the remaining part imported from 15 different nations.

Iron Ore.[4]—French iron ore output increased 2.5 percent in 1970 compared with 1969 production. High-grade iron ore imports totaled 9.7 million metric tons in 1970, 41 percent more than in 1969. Brazil, Mauritania, Liberia, and Sweden were the leading sources, supplying a total of 7.2 million metric tons, and 13 other countries contributed the remainder. Output by region of marketable iron ore was as follows:

Table 4.—France: Iron ore production and shipment

(Thousand metric tons)

	1968	1969	1970
PRODUCTION			
Lorraine	52,274	52,868	54,343
West	2,945	2,545	2,406
Centre-Midi	19	12	52
Total	55,238	55,425	56,801
Iron content	17,177	NA	NA
SHIPMENTS			
Domestic	36,800	37,579	NA
Other EEC countries	18,355	18,731	NA
Other countries	72	226	NA
Total	55,227	56,536	NA
Stocks	5,730	4,380	NA

NA Not available.

Iron and Steel.—Pig Iron production in 1970, increased 5.5 percent above the 1969 level. Bessemer production remained stable, whereas the production of open-hearth pig iron made from imported hematite ores went up substantially and more scrap was used in oxygen steelworks.

Steel production, in reaching 23.8 million metric tons in 1970, exceeded the objectives of the French steel producers. The pattern of production reflects a 40-percent increase in oxygen steel output and substantial growth in electric furnace producton. Open-hearth steel output by remaining stable became relatively less significant. Several Bessemer steelworks have been adapted to oxygen injection lately.

Rolled steel production increased by 3.1 percent during 1970 compared with 1969 output. Stimulated by external demand, magnetic steel sheet production increased.

Towards yearend steel end-users, and to a larger extent dealers who control two-thirds of domestic sale in France, reduced their stocks, and the slowing down of internal demand impeded imports of rolled products from foreign countries.

Trade.—French steel imports and exports in 1970 reached 6.8 and 6.4 million metric tons, respectively. Finished product imports remained stable and met 27.5 percent of local demand. The purchase abroad of standard flat-rolled products decreased but was still the biggest category of imported steel products. Hot-rolled coils were needed due to lack of appropriate rolling capacity in France, particularly acute after a fire which closed down the Sollac rolling mill in eastern France for a long period.

While France imported 5.8 million metric tons of steel from her European Economic Communities (EEC) partners, exports to those countries amounted to 3.3 million metric tons. After the devaluation of the franc, French steel exports to EEC countries increased within the limits of unused capacity. Substantial increases were noted in shipments to Italy and the Netherlands, and to African and Eastern European markets. Losses were noted in shipments to Scandinavian, Mediterranean, Asian, and South American markets. Japanese competition was generally held responsible for the losses. French exports, while increasing only 12 percent in tonnage, increased 50 percent in value in 1970 compared with 1969 values.

Prices.[5]—New French steel prices for sales within the EEC, reflecting an 8.8-percent increase, were filed on January 1, 1970. A second price schedule was sent to EEC authorities at the end of March 1970, bringing French prices up by another 6 percent. Published French prices were at that time as much as 20 percent below Belgian prices, 5 to 9 percent below German prices, and 6 percent below Italian prices. Therefore, subsequent price cuts which occurred in other EEC markets did

[4] Bulletin de la Chambre Syndicale de la Sidérurgie Française. No. 281, June 1971, pp. 10–15.

[5] U.S. Embassy, Paris. State Department Dispatch A-794, July 26, 1971.

Table 5.—France: Salient iron and steel industry statistics

(Thousand metric tons unless otherwise specified)

	1968	1969	1970
SINTER			
Production	22,796	27,160	27,904
Raw material consumption:			
Iron ore	27,259	31,254	31,898
Furnace dusts	1,016	1,117	NA
Manganese	10	40	34
Pyrite cinder	23	19	12
Other iron-bearing materials	977	1,332	NA
Limestone	690	636	NA
PIG IRON			
Number of blast furnaces:			
Available	109	99	98
In operation at yearend	74	75	74
Maximum production capacity	19,540	21,000	NA
Production:			
Thomas	12,686	13,326	13,306
Open hearth (steelmaking)	2,506	3,385	4,170
Phosphorus (foundry)	188	203	210
Open hearth (foundry)	581	721	883
Special pig iron (foundry)	115	150	166
Spiegeleisen and high-carbon ferromanganese	374	427	486
Total	16,450	18,212	19,221
Raw material consumption for pig iron production:			
Iron ore directly in blast furnaces	14,323	13,031	NA
Iron ore sinter	22,531	26,120	27,302
Manganese ore:			
In blast furnaces	687	781	902
In sintering plants	10	40	34
Metallurgical rejects	963	1,136	NA
Scrap	315	204	268
Limestone	97	125	NA
Phosphatic limestone	1	1	--
Coke in blast furnaces	11,261	11,834	12,023
STEEL			
Number of furnaces in operation:			
Thomas converters	92	77	61
Open hearth	51	49	46
Electric	107	99	99
Oxygen	10	13	NA
Maximum production capacity (all furnaces)	24,340	24,730	26,000
Production of crude steel:			
Thomas	10,507	10,664	9,771
Open hearth	4,072	4,468	4,438
Electric	2,068	2,371	2,611
Bessemer	57	61	61
Kaldo, LD, and similar	3,705	4,947	6,892
Total	20,409	22,511	23,773
Ingots	20,025	22,074	23,319
Liquid steel for casting	385	438	454
Material consumption for steel:			
Pig iron, spiegeleisen, and ferroalloy	15,646	17,027	17,510
Scrap	6,787	7,688	8,377
Liquid Thomas steel	158	166	NA
Lime	1,915	2,016	NA
Limestone	102	156	NA
Iron ore	258	321	347
Consumption per ton of crude steel:			
Pig iron kilograms	767	756	NA
Scrap do	333	342	NA
Rolled steel production: [1]			
Rails and accessories	302	319	378
Heavy structural	1,209	1,346	1,248
Wire rods	2,353	2,442	2,445
Bars	3,518	3,746	4,123
Pipe skelp	589	684	697
Other	16	18	20
Flat products:			
Wide plates	104	111	NA
Hot rolled sheets:			
Thickness, 4.76 millimeters or more	1,369	1,644	1,698
Thickness, 3 to 4.76 millimeters	488	544	NA
Thickness, less than 3 millimeters	482	426	NA
Cold-rolled sheets: Thickness, less than 3 millimeters	4,205	4,982	NA
Hot-rolled strips for tubes	1,076	1,226	1,163
Subtotal flat products [2]	7,723	8,933	NA
Total rolled steel production [2]	15,711	17,487	18,027

See footnotes at end of table.

Table 5.—France: Salient iron and steel industry statistics—Continued

(Thousand metric tons unless otherwise specified)

	1968	1969	1970
STEEL—Continued			
Tubes	1,465	1,712	NA
Galvanized and other plated sheets	516	720	NA
Condenser sheets	168	186	208
Tinplate	662	781	803
Consumption of iron and steel industry (total):			
Iron ore	41,840	44,531	NA
Manganese ore	697	821	NA
Scrap [3]	7,101	7,892	NA
Coke	12,370	12,706	NA
Coal other than coking coal	1,931	2,259	NA
Coking coal	5,543	5,977	NA
Fuel oil and gas oil	1,576	1,832	NA
Thomas slag production	2,677	2,819	NA
Average total employment (workers and staff)	108,647	108,514	110,000

NA Not available.

[1] Data presented here does not add to total shown for iron and steel semimanufactures in table 1 owing to differences in source and to the inclusion of finished castings and forgings in table 1.

[2] Data may not add to totals shown because of independent rounding.

[3] Excludes scrap used by rolling mills in tons as follows: 1967, 108,000; 1968, 107,644; 1969, 122,733; 1970, not available.

not affect drastically the competitiveness of the French steel industry.

Investment.—French steel sales amounted to $3.4 billion in 1970, leaving 16 percent for self-financing and stockpiling, 88 percent more than the 1969 level.

In 1970, investments in new construction exceeded $360 million, a 40-percent increase over the previous year. Investment in new rolling mills represented 44 percent of the total. Investment in load preparation and steelworks also increased substantially. A big coking complex was built in Lorraine by Société Lorraine de Cokéfaction. Also several French and foreign firms were engaged in building a large coking plant at Dunkirk.

According to the sixth plan (1971–75) for French steel producers, domestic crude steel consumption will reach 29.1 million metric tons by 1975, reflecting an annual increase of 5 percent. French steel production would go up to 32 million metric tons to meet both the bulk of local demand and increased exports. Main investments to take place during this sixth plan up to 1975 will include: Doubling production capacity of the Dunkirk steel mill by Usinor in northern France; completion of construction at the Fos steel complex; increase in metal production capacity at Gandrange in eastern France where present capacity of 1.5 million would be brought to 4 million; construction of the high-grade steel and steel alloy mills at Fos by Ugine-Kuhlmann; and finally, completion of an oxygen steelworks near Dunkirk.

Lead and Zinc.—The international market for metallic lead was active at higher prices until April 1970, and French production kept abreast with a price increase during the first 4 months. However, from May onwards a rise in stocks led to a moderate contraction in production and resulted in a net 9-percent rise or a total of 169,945 tons for the entire year. On the other hand, consumption of refined lead dropped by about 3 percent, from 198,500 metric tons in 1969 to 192,500 metric tons in 1970.

Zinc production, related closely to lead output, experienced a decline of about 10 percent in 1970, with a total output of 227,300 metric tons. Consumption of slab zinc also declined by 19,000 metric tons from 239,000 tons in 1969 to 220,000 in 1970.

In 1968 and 1969 total lead and zinc consumption, as reported in the August 1971 issue of World Metal Statistics (London), was as follows in thousand metric tons:

	1968	1969
Lead:		
Storage batteries	76.0	86.7
Cable sheathing	46.7	42.0
Pipe	15.8	14.0
Sheet and strip	14.0	14.0
Foil	4.4	5.0
Shot	9.2	10.0
Tetraethyl	13.0	13.5
Chemicals	22.1	22.8
Alloys	16.4	17.0
Miscellaneous	5.5	7.1
Total	223.1	232.1
Zinc:		
Galvanizing	77.2	79.4
Die-casting alloys	33.8	41.5
Copper alloy castings	4.0	4.7
Copper alloy semimanufacture	59.8	57.7
Rolled zinc	70.6	72.3
Oxides	34.7	35.5
Other chemical uses	17.7	16.0
Zinc wire and tubes	3.7	4.1
Miscellaneous	1.5	2.0
Total	300.0	313.2

Lead ore imports totaled 137,821 metric tons and were mainly from Morocco, 48,632 metric tons; Ireland, 41,655 metric tons; and the remainder from 13 different countries. Pig lead imports amounted to 41,557 metric tons from seven different nations.

Zinc ore imports during the year were 411,148 metric tons: 126,507 metric tons from Canada; 90,906 metric tons from Peru; 73,214 metric tons from Ireland; and 120,521 from 14 other countries.

Nickel.—The production of refined nickel of high purity in France during the year by the Société Le Nickel (SLN) was 10,952 metric tons, 14 percent higher than the previous year. On the other hand, consumption of refined nickel during the same period was 36,100 metric tons. Most of the consumers demand was for ferronickel products produced by the above company in New Caledonia. A large part of France's nickel production came from matte material originating in New Caledonia and from oxides supplied by Cuba. Since the contract with Cuba will end in 1971, it is expected that French production of refined metal will decrease.

Tungsten.—Mining operations on the important tungsten deposits in the Salau area of the French Pyrenées began towards the end of 1970. The Salau mine was operated by the Société Miniere d'Anglade in which Charter Consolidated, Ltd., of Great Britain and Anglo American Corporation of South Africa Ltd. hold a 40-percent interest. Even though operations were limited, the mine produced 600 tons of concentrates. Its annual capacity is expected to be about 1,000 metric tons of concentrate. Detailed information on production from Enguiates mine in the Aveyron area, operated by the Société Miniere et Métallurgique du Chaletet, was not available by the yearend.

Uranium.—Production of uranium concentrate was 1,764 metric tons of U_3O_8 content in 1970, compared with 1,716 metric tons in 1969. Of the total 1970 output, 1,252 metric tons was derived from indigenous ore and the remainder was from foreign ores.

Société Le Nickel (SLN), which acquired majority ownership of Peñarroya Mining Co. in 1969, took over complete ownership of the French uranium mining company, Compagnie de Mokta, in 1970, Thus, SLN became the most important uranium mining company for both production and trade of this commodity during the year. By yearend Peñarroya-SLN shares in the different uranium ore mining companies stood at: Compagnie D'Uranium de Franceville (COMUF) in Gabon 52.5 percent; Société Française des Mines de l'Aire, in Nigeria 24.08 percent; and Syndicat de Recherches Minieres, in Canada 45 percent.

In addition, SLN will continue to retain 57.2 percent of its shares in Compagnie Française des Minerais d'Uranium. Finally, by the mergers SLN increased its shares from 33 to 49.5 percent in Uranex, the uranium ore sales firm recently established by the French Atomic Energy Administration.

NONMETALS

Fertilizer Materials.[6]—The French chemical industry continued reorganization of its complex corporate structures. Rhône-Pouleuc announced the expected reorganization of its two 1969 acquisitions, Péchinery-Saint-Gobain and Progil. The new firm has total sales of some $720 million and employs 25,000.

Chemical imports continued to grow more rapidly than exports. Imports increased 21 percent in 1970, while exports grew only 18.5 percent. As in the past, sales of chemical and petrochemicals to the French Zone have constituted a large part of French export. Imports continued to expand at a high rate partly because the French chemical industry has been unable to expand rapidly enough to meet the increased demand of French industry and partly because of competition from EEC countries. The French chemical trade balance with EEC countries was slightly less favorable to France in 1970 than it had been in previous years. Fertilizer imports continue to pressure French fertilizer producers, particularly since Eastern European countries were exporting large amounts of potassium fertilizers as part of better trade arrangements with countries of the Common Market.

The phosphoric acid plant of the Société Chimique des Charbonnages completed its plant expansion and produced 212,000 metric tons of phosphoric acid, compared

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[6] U.S. Embassy, Paris. State Department Dispatch A-1021, Oct. 4, 1971.

with 191,000 in 1967. The production of various fertilizer materials in 1970 and 1969 was as follows:

Type of fertilizer	1969	1970
Nitrogenous:		
Ammonium sulfate (synthetic)	10,000	10,000
Lime nitrate	18,000	17,000
Ammonitrates	645,000	553,000
Ammonium nitrate (N content)	100,000	97,404
Urea	117,000	135,000
Others	449,000	504,000
Phosphatic:		
Superphosphate (normal)	281,000	245,000
Superphosphate (concentrated)	448,000	512,000
Ground phosphate (P_2O_5 content)	229,000	203,000
Mixed fertilizer	6,452,000	6,669,000
Potassic:		
Gross weight	11,971,100	11,699,000
K_2O equivalent	1,938,000	1,904,000
K_2O equivalent (marketable)	1,794,000	1,768,000

Source: U.S. Embassy, Paris. State Department Dispatch A-1021, Oct. 4, 1971.

In 1970, Péchiney-Saint-Gobain completed a large concrete storage silo for phosphate rock at its discharging quay on the Seine River, adjacent to its Grand Quevilly fertilizer plant. The silo, which has a capacity of 20,000 metric tons has been located so as to enable larger vessels to unload phosphate rock directly. With the present setup, phosphate ore can be transferred by a conveyor belt system from the dock to the silo at a rate of 750 tons per hour.

The construction of Société Chimiques des Charbonnage's new plant near Lens in northern France continued during the year. The company plans to increase its production of complex fertilizers from 500,000 to 700,000 metric tons annually by 1975. Over the same period, ammonia, production capacity will be raised from 500,000 to 650,000 metric tons per annum and nitrogenous fertilizers capacity will be increased from 1 million to 1.2 million metric tons per year. The new facility, which is due on stream in mid-1971, will have a capacity of 250,000 metric tons annually.

Output of potash salts in France[7] stood at the accepted ceiling of about 1.8 million metric tons (K_2O equivalent basis) in 1970. Due to waste disposal problems and present legislation, mine output is apparently slated to stay within this range for many years to come. Potash mines were operated by Mines Dominales de Potasse d'Alsace (MDPA), and sales were conducted by its sister organization, Société Commercial de Potasse de l'Azote (SCPA). Both companies came under the wing of the holding company, Enterprise Minière et Chimique, which also controls part of the country's nitrogen and finished fertilizer industry. The original seven mines operated by the company in the early 60's was cut to three by 1969. The changes have taken place gradually to allow full production of these mines by the end of 1970. The fertilizer refinery complexes in operation were at Marie-Louise, Amélie, and Théodore. The first part of the expansion to the refinery at Marie-Louise was completed in 1970, and the second stage should follow in 1972.

Despite all the activity in the domestic industry, French potash imports declined only slightly from the peak year of 1969 as shown below:

Imports	Product (thousand metric tons)		
	1967–68	1968–69	1969–70
Israel	--	65.1	95.8
Belgium	41.0	62.8	75.5
West Germany	11.1	110.0	35.0
Spain	42.8	59.4	8.0

Sulfur.—The increase in natural gas production brought another successful year to the sulfur industry during 1970. Crude sulfur production was up 17 percent while refined sulfur output was up only 4 percent. Production of sulfuric acid increased about 4 percent in 1970 over that of 1969. Exports of crude and refined sulfur, excluding that to the French Zone decreased in 1970, indicating higher domestic consumption.

MINERAL FUELS[8]

In 1970, petroleum accounted for 58.2 percent of total French energy consumption and according to the sixth Economic Plan's Energy Committee, it will account for 68 percent and 71 percent of France's energy needs in 1975 and in 1980, respectively. Coal's percentage of the energy mix fell from about 30 percent in 1969 to 25.7 percent in 1970, reflecting the policy of the

[7] Industrial Minerals. No. 42, March 1971, pp. 15–17.

[8] L'Industrie Française du Petrole; Petrole 1970. Elements Statistiques. (Paris, France). Pp. B39–B43.

French Government to close down inefficient mines in the country. Coal, as projected in the sixth plan, is expected to decline to 14 percent of France's energy mix in 1975 and to 8.3 percent in 1980. Natural gas represented 6.3 percent of French energy and hydraulic power around 8 percent. Nuclear energy accounted for about 1 percent.

Consumption of primary energy, the share of each source for 1965 and 1970, and estimates of consumption for the years 1975, 1980, and 1985 in percentages are as follows:

	1965	1970	1975	1980	1985
Coal including lignite	41.5	25.7	14.3	8.3	5.6
Oil	43.9	58.8	67.9	71.1	68.9
Natural gas	4.8	6.3	8.9	9.7	10.0
Hydropower	9.3	8.4	6.8	5.6	4.4
Nuclear power	.5	.8	2.1	5.3	11.1
Total	100.0	100.0	100.0	100.0	100.0

Coal.—Production of coal and lignite in France declined from 43.5 million metric tons in 1969 to 40.1 million metric tons in 1970. Stocks of coal reported as shipping coal fell from 2.9 million metric tons at the end of 1969 to 1.1 million metric tons at the end of 1970, while inventories of low-grade coal rose from 4.7 million metric tons to approximately 5.1 million metric tons at the end of 1970.

The output of the mines of Nord Pas-de-Calais, the largest producing area in France, although down about 10 percent from the 1969 level, accounted for 45.4 percent of the national coal (excluding lignite) production. The coalfields of Lorraine, France's second-largest coal basin, produced 8 percent less in 1970. The Lorraine coal basin for years has had the distinction of being France's most efficient coal producer as evidenced by the high productivity of overall 4.382 metric tons per manshift per underground worker, which is well above the national average of 2.643 metric tons per shift. Productivity for all other mines rose by almost 5 percent.

During the year, a significant reduction in the French mine labor force was noted. A

Table 6.—France: Salient statistics of the coal and lignite industry [1]
(Thousand metric tons unless otherwise specified)

	1969	1970 p
COAL (ANTHRACITE, BITUMINOUS)		
Production:		
Nord/Pas-de-Calais	18,889	16,905
Lorraine	13,906	12,788
Aquitane	1,616	1,605
Auvergne	611	704
Blansy	1,866	1,798
Cévennes	1,386	1,336
Dauphine	613	619
Loire	1,585	1,564
Others	111	34
Total	40,583	37,353
Average number of days worked	254.7	269.4
Average daily output (tons)	159.3	149.0
Number of workers:		
Underground	74,143	65,702
Overall	109,473	98,248
Production per man-shift (tons):		
Underground	2.522	2.643
Overall	1.672	1.738
Stocks at yearend:		
Shipping ore	2,917	1,136
Low-grade	4,659	5,084
LIGNITE		
Production:		
Average number of days worked	254.7	250.7
Average daily output (tons)	11.6	11.1
Number of workers	2,383	2,210
Average per man-shift (tons)	4.860	5.059
Area:		
Provence	1,635	1,550
Region Landaise	1,315	1,235
Total	1,950	2,785

p Preliminary.
[1] Source: Statistique Mensuelle (Paris). December 1969–70.

total of 11,225 workers, including 8,441 underground employees, left the coal industry during the year. The work force was reduced 10.3 percent fo the entire coal industry, while the underground work force alone was reduced by 11.4 percent.

Lignite production experienced a loss of 5.6 percent in 1970, bringing production to 2.8 million metric tons. Output per manshift for the industry averaged 5.059 metric tons, slightly above last year's level. Virtually all of the lignite production was consumed in electric powerplants or by small consumers adjacent to the producing fields.

Customs data published by the Ministère des Finançe et des Affaires Économiques indicated that the coal (anthracite and bituminous) imports into France in 1970 were 14.2 million metric tons compared with 12.5 million metric tons in the preceding year. Of the total coal imports in 1970, 11.2 million tons were bituminous, a gain of almost 16 percent over the previous year, while anthracite imports of 3 million metric tons represented an increase of approximately 5 percent over 1969. Anthracite imports from EEC countries, at 37.6 percent, were considerably below the 47.5 percent of the previous year.

Significant increases in the average landed values of anthracite and bituminous coal were noted in 1970. Bituminous values rose 21.6 percent during the year compared with an increase of 5.7 percent for anthracite; thus French importers paid an average of almost $3 per ton more for bituminous coal and $1.39 per ton more for anthracite than in the previous year.

French imports of bituminous coal and anthracite for the years 1969–70, by countries of origin and average values per ton, were as follows:

	Bituminous coal [1]			
	1970		1969	
	Metric tons	Value per ton, US dollars	Metric tons	Value per ton, US dollars
Country of origin:				
Australia	46,269	20.53	--	--
Belgium	55,277	18.67	387,433	14.85
Germany (West)	5,779,748	16.79	5,821,355	13.65
Netherlands	47,798	18.55	72,629	15.14
Poland	1,543,555	12.21	1,103,386	10.44
South Africa, Republic of	74,254	18.70	43,231	16.18
U.S.S.R.	140,158	10.23	113,506	9.09
United Kingdom	234,629	18.59	192,979	15.18
United States	3,271,163	17.83	1,926,482	14.69
Other	3,620	--	58	--
Total or average	11,196,471	[2] 16.46	9,661,059	[2] 13.54
	Anthracite			
	1970		1969	
	Metric tons	Value per ton, US dollars	Metric tons	Value per ton, US dollars
Country of origin:				
Belgium	55,475	29.44	98,755	26.75
Germany (West)	615,537	24.85	783,219	23.25
Netherlands	455,209	23.73	470,889	22.01
Morocco	7,895	29.67	10,268	27.77
South Africa, Republic of	38,103	20.23	2,571	15.48
Spain	16,602	20.53	--	--
U.S.S.R.	1,310,669	29.34	1,279,355	27.04
United Kingdom	312,391	19.25	192,533	16.31
United States	178,882	19.71	16,643	16.12
Other	1,995	--	1,625	--
Total or average	2,992,758	[2] 25.76	2,855,858	[2] 24.37

[1] Statistiques du Commerce Extérieur de la France (Paris) Annuals 1969–70.
[2] Average.

Coke and Coal Chemicals.—The production of coke and coal chemicals amounted to 18.2 million metric tons in 1970 compared with 17.6 million metric tons in 1969. Mine production of coking coal was mostly from Nord Pas-de-Calais basin with some small amount coming from other coalfields. With the 4-percent increase in domestic coal and coal chemicals output in 1970, France imported 3.3 million metric tons of these commodities, primarily from: Belgium, 130,700 metric tons; West Germany, 2.94 million metric tons; the Netherlands, 174,400 metric tons; and other countries, 44,500 metric tons. Exports of coke dropped from 887,991 metric tons in 1969 to 865,100 metric tons in 1970, reflecting the greater demand of the domestic iron and steel industry.

Production of coke and chemical fuel in France in 1969 and 1970 was as follows in metric tons:

	1969	1970
Coke-oven coke:		
Plants annexed to collieries	8,916,300	8,794,000
Iron and steel plants	4,555,100	5,204,000
Other plants	36,200	NA
Semicoke	59,800	NA
Other coke	7,800	10,800
Subtotal	13,575,200	14,008,800
Chemical fuel	4,025,800	4,241,000
Total	17,601,000	18,249,800

NA Not available.

Natural Gas.—Production of processed natural gas increased 5.8 percent in 1970, while the output of unprocessed natural gas rose by 9.6 percent compared with that of 1969. Most of the output was from Société Nationale des Pétroles d'Aquitaine (SNPA) reserves in Pyrenées. The gain in SNPA output was attributed to the fact that the new field at Meillon-Saint Faust-Pont-d'As for the first time produced during the whole year at a rate of 6 million cubic meters per day. Production of marketable natural gas from the Laeg fields declined from the 8.99 million cubic meters in 1969 to 8.06 million cubic meters in 1970.

Gas de France's $170 million investment program to increase natural gas production facilities, long distance transport, and distribution pipelines was continued during 1970. The construction of two regasification plants at Fos to handle additional Algerian gas will be completed in 1972.

According to the recommendations of the Energy Committee to the sixth economic plan, natural gas consumption is not expected to represent more than 13 percent of total energy consumption during the planned period. Natural gas consumption, which totaled 12.5 million metric tons equivalent coal in 1969, is expected to be about 25 million metric tons coal equivalent in 1975.

Petroleum.—Operation of the French domestic oil industry remained generally uneventful in 1970. The long-awaited Common Market energy policy made no progress, except that free circulation of oil products among member countries was delayed for 2 years.

Production in France continued to decline in the absence of new oil discoveries: 2.3 million metric tons in 1970 against 2.5 million metric tons in 1969. ESSO-ERAP was the main producer, with 1.9 million metric tons from the Parentis region, followed by the State-owned Enterprise de Recherches et d'Activité Petrolières (ERAP) with 230,741 metric tons. In the Aquitaine area, oil production (83.4 percent of the total domestic producton) declined by 6 percent from 1969 output. The slowdown was particularly marked for fields of Cabeil, Lavergne, Lucats, Mimizan-Nord, and Cazaux. In the Paris basin, petroleum production was reported at 332,000 metric tons, an 11.2-percent decline from the 1969 output level. No production was reported in Alsace.

Exploration.[9]—Exploration activities were characterized by a decline of 16 percent in seismic work and 48 percent in drilling. Most of the activities were centered in the Aquitaine Basine where some positive results were obtained: at Ucha I a new gasfield was discovered and in the Bay of Biscay, Ibis I, some oil and gas under tremendous pressure was found. Seismic activity, totaled 67 crew-months compared with 79.5 crew-months in 1969. Marine seismic activity was limited to a short study in the Gulf of Lyons for informational purposes only.

Drilling totaled 38,595 meters compared with 74,400 meters in 1969. Seismic drilling activity focused mainly in Aquitaine with 33,690 meters or 87 percent of the total. Seismic drilling was also performed in Savoy, 4,798 meters for 7 rigmonths. A total of 13 wildcats was drilled in 1970, including two offshore wells in the Bay of Biscay.

The total area covered by search permits was 63,476 square kilometers, compared with 58,100 square kilometers in the previous year. Eight new permits covering 10,000 square kilometers were granted

[9] Mona Palmer Publishing Co., U.S.A. 1971 World Petroleum Report. V. 17, pp. 91–92.

during 1970, while some previously awarded areas were dropped, mainly in the Paris Basin.

Extension and development wells drilled by the end of 1970 totaled 10,828 meters for 11.4 rig-months, as compared with 20,800 meters in 1969. Again most of these latter activities were centered in the Aquitaine field.

Table 7.—France: Salient statistics of petroleum and natural gas industry

(Thousand metric tons unless otherwise specified)

	1968	1969	1970
Length of hole drilled thousand meters	104	96	50
Production:			
Crude petroleum	2,688	2,499	2,309
Natural gas million cubic meters	8,630	9,779	10,284
Marketed do	5,682	6,506	6,880
Products obtained from refining natural gas:			
Liquefied products	462	554	595
Sulfur	1,608	1,732	1,766
Refining:			
Number of refineries units	20	22	23
Capacity of refineries (atmospheric distillation)	97,340	105,240	116,985
Refinery throughput	80,300	90,592	102,477
Refinery production:			
Aviation gasoline	59	58	44
Motor gasoline	11,306	12,107	13,129
Special gasolines	2,381	2,783	2,357
Kerosine and white spirits	172	160	179
Jet fuels	2,285	2,483	2,812
Fuel oil:			
Distillate	6,086	8,122	9,854
Domestic fuel oil	22,241	24,132	27,368
Residual	22,838	26,024	24,192
Bitumen	2,833	2,853	2,843
Lubricants	942	1,030	1,055
Paraffins and waxes	54	57	55
Petrochemical feedstock	1,160	1,024	2,041
Liquefied petroleum gas	2,051	2,194	2,430
Refinery gases	1,218	1,179	2,509
Other	84	143	145
Total [1]	75,711	84,345	91,013
Foreign trade:			
Imports:			
Crude:			
Algeria	24,429	25,430	26,936
Other	437	986	1,461
Total	24,866	26,416	28,397
Middle East:			
Iran	3,009	3,633	3,690
Iraq	15,160	14,731	12,486
Kuwait	7,282	8,103	10,986
Qatar	2,898	1,784	1,753
Saudi Arabia	3,986	4,848	9,430
Abu Dhabi	5,046	5,587	5,777
Total [1]	37,381	38,685	44,122
U.S.S.R	1,554	1,828	1,445
Venezuela	2,345	2,436	2,445
Libya	10,818	14,570	17,619
Other	213	2,371	6,132
Grand total [1]	77,176	86,306	100,154
Products [2]	5,118	5,258	6,356
Exports of products including bunkering	13,289	13,959	13,116
Consumption:			
Internal market	63,158	70,602	82,085
French bunkering	1,490	1,774	1,997
Other consumption including refinery and distribution losses (approximate)	7,500	8,000	8,500
Stock (capacity):			
In refinery thousand cubic meters	24,924	30,420	33,403
In distribution channels	6,622	7,757	8,978

See footnotes at end of table.

Table 7.—France: Salient statistics of petroleum and natural gas industry—Continued

(Thousand metric tons unless otherwise specified)

	1968	1969	1970
Transportation:			
Tankers:			
Units	86	85	82
Deadweight tons	4,538	5,144	5,730
Tank cars:			
Units	--	17,800	18,091
Capacity thousand cubic meters	--	915	992
Tank trucks:			
Units	15,659	17,694	19,623
Capacity thousand cubic meters	202	234	268
Employment:			
Exploration and production persons	11,343	11,266	NA
Refinery	16,425	16,725	NA
Distribution	41,300	1,800	NA
Other	1,650	1,698	NA
Investment: [e]			
Exploration and production thousand dollars	68,417	81,020	70,000
Refining storage and chemical facilities in refineries do	190,667	224,695	287,000
Distribution and storage outside refineries do	195,888	206,330	55,600
Pipelines do	55,093	20,165	37,000
Maritime transport do	64,816	57,434	80,800
Other do	34,208	33,128	20,000
Total do	609,089	622,772	550,400

[e] Estimate. NA Not available.
[1] Data may not add to totals shown because of independent rounding.
[2] Trade data differ slightly from other sources depending whether "Commerce Générale" or "Commerce Special" data are used.
Source: Comité Professionel du Petrole (Paris). Elements Statistiques. Activité de l'Industrie Petrolière. 1970.

Consumption.—Consumption of oil products, excluding bunkers, totaled 82.5 million metric tons in 1970 as compared with 70.5 million metric tons in 1979. The general increase was attributed to a particularly high increase in the sales of heavy fuels. Gasoline represented 15 percent of all petroleum product sales; gas-oil 6 percent; domestic fuel oil 36 percent; light and heavy fuel oil 28 percent.

The market shares for gasoline sales among the distribution companies for the 12-month period ending on January 31, 1971, varied little from that of 1969. The Bulletin of Petroleum on March 29, 1971, gave the following breakdown:

	Percent
Company:	
CFP	25.19
Elf-Antar	23.51
Esso Standard	15.34
Mobil Oil Française	6.43
Shell-Berre	17.38
British Petroleum	8.37
Fina France	3.45
Others	.33

Refining.—Petroleum refining capacity increased by 11.7 million metric tons to reach 117 million tons at the end of 1970. The Shell refinery at Pauillac added 4 million metric tons; Mobil's Frontignan refinery capacity was increased by 2.3 million metric tons. Only one new plant was put onstream—the Metz refinery with a capacity of 4 million metric tons per year, owned by ESSO-CFR-ELF group.

Progress was made on the expansion plan of the Société Française des Pétroles B.P. (SFBP) refinery at Lavéra to increase present capacity of 4.4 million metric tons to 11 million metric tons annually. The work is expected to be accomplished by the end of 1972. Also, construction work on the Antar's Donges refinery continued during 1970.

The refinery output in 1970 increased by 6.6 million metric tons and the 1969 level was 84 million metric tons. Exports of refined products, including bunkers, reached 13 million metric tons—only 900,000 metric tons less than the 1969 level.

Crude imports, which totaled 86.3 million tons in 1969, reached a new high of 100 million metric tons in 1970. Added to France's own crude output of 2.3 million tons, refineries processed approximately 102 million metric tons in 1970, compared with 90.6 million in 1969. Import origin was practically the same in 1970 as in 1969.

Transportation and Storage.—The South European pipe line transported 32 million metric tons of crude oil in 1970 compared with 26.6 million in 1969, half of which was destined for West Germany and Switzerland. Forecast requirements of the refineries along the line have called for an increase in capacity of the line from 35 to 90 million metric tons over the next 10 years. Construction began in 1970 and will continue in 1971, trebling the capacity between Fos and Lyons.

The Trapil line between Le Havre and Grandpuits carried 9 million metric tons of crude oil in 1970. There are three refineries which receive their feed stock from this line: Gargeville, Grandpuits, and Vernon. The pipeline from Le Havre to Paris and from Grandpuits to Paris transported 8.8 million metric tons to the Paris area and 700,000 tons to Royen. The Mediterranean-Rhône pipeline transported some 4 million metric tons of refined products from the Berra and Feyzin area to storage points along the Rhône as well as to Lyons, Grenoble, Chambery, and Annecy.

French storage capacity for refined products, which reached 7.8 million cubic meters in 1967, was increased to some 9 million cubic meters by the end of 1970. Main new installations were in Fos, 350,000 cubic meters; Saint-Herblain, 75,000 cubic meters; and Coignères, 44,000 cubic meters. Underground storage for crude earmarked for refineries feed-stock was under construction in the Berra area and that for fuel and gas-oil was under construction at Manosque in the south of France. When facilities are completed in 1974, they will provide a 5-million-cubic-meter and a 1.5 million-cubic-meter capacity, respectively. Also, it was reported that a former iron mine near Caen was to be converted to underground oil storage, which will have a 5-million-cubic-meter capacity.

On January 1, 1971, the French tanker fleet comprised of 83 vessels with an aggregated 5.9 million deadweight tons compared with 5.1 million deadweight tons in 1969. On October 1, 1970, orders were received by shipbuilders for 23 new tankers in the 220,000-to 270,000-deadweight-ton range.

The Mineral Industry of Gabon

By Henry E. Stipp [1]

Exploration for petroleum and copper deposits highlighted activity in Gabon's mineral industry. The United Nations and the Gabonese Government were cooperating on a 2-year project for mineral exploration in Eastern Gabon. The $1 million [2] project included photogeological and airborne geophysical surveys of an 8,492-square-mile area and mineral prospecting of a 1,930-square-mile area in the Makokou Region.[3]

Société des Mines de Fer de Mékambo (SOMIFER) and the Government of Gabon negotiated an agreement on investment and development of the Mékambo-Bélinga iron ore deposits and ancillary facilities. Reportedly the Government was prepared to accept every form of foreign assistance in order to develop the country's natural resources and contribute to the progress of Gabon. The Government has enacted a liberal investment code and adopted a policy of diversifying foreign investment in order to expedite natural resource development.

Construction of the deep-water port at Owendo, which began in 1969, continued. When the port is completed, it will have considerable impact on the shipment of minerals to and from Gabon.

Production of crude petroleum, gold, manganese ore, and petroleum products increased substantially in 1970. The value of minerals production in 1970 was estimated at $95 million compared with an estimated $90 million in 1969. Investment in the minerals industry during the 1966 through 1970 period was placed at $99 million. Approximately $83 million of the total investment was in the petroleum sector. Production and trade in mineral commodities are shown in the following tables.

[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from African Financial Community Francs (CFAF) to U.S. dollars at the rate of CFAF 277.71=US $1.00.
[3] Mining Journal (London). Mining Annual Review. June 1971, p. 367.

Table 1.—Gabon: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
Gas, natural:			
Gross production .... million cubic feet	[e] 900	900	1,900
Marketed production .... do	[r] 881	[r] 847	762
Gold mine output, metal content .... troy ounces	16,724	14,243	16,108
Manganese:			
Ore, 50–53 percent Mn, gross weight .... thousand tons	1,221	1,348	1,429
Battery and chemical grade pellets, 82–84 percent MnO_2, gross weight .... do	33	15	24
Petroleum:			
Crude .... thousand 42-gallon barrels	33,630	[r] 36,421	39,292
Refinery products:			
Gasoline .... do	1,019	[r] 1,036	1,218
Kerosine .... do	713	[r] 738	881
Distillate fuel oil .... do	1,255	[r] 1,333	1,386
Residual fuel oil .... do	1,911	1,938	2,604
Other .... do	26	39	52
Refinery fuel and losses .... do	220	169	190
Total .... do	5,144	5,253	6,331
Stone, limestone crushed and broken .... thousand tons	1,254	[e] 1,300	NA
Uranium oxide (U_3O_8) content of concentrate	531	540	420

[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 and gravel, and stone, was also produced, but output is not reported and available information is not adequate to make reliable estimates of output levels.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
Coal briquets	--	15,460	All to Italy.
Copper scrap	53	92	All to France.
Iron and steel, ferromanganese	7,835	--	
Manganese ore	r 680,329	808,501	France 357,585; United States 240,002; West Germany 104,274.
Metal-bearing metallurgical residues, not further described	--	81	All to France.
Petroleum:			
Crude ____thousand 42-gallon barrels	r 5,250	9,285	France 7,141; West Germany 1,085; United Kingdom 564.
Refinery products, residual fuel oil ____do	667	858	United States 405; United Kingdom 247; Sweden 141.
Uranium and thorium ores and concentrates ____value, thousands	$8,050	$7,523	All to France.

r Revised.
[1] Compiled from import data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States, and Yugoslavia.
Source: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual, v. 3 (Africa), Walker and Company, New York, 1970, pp. 581–582; 1969 Supplement to the World Trade Annual, v. 3 (Africa), Walker and Company, New York, 1971, pp. 410–411.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum and alloys, all forms	61	81
Copper and alloys, all forms	24	40
Iron and steel semimanufactures	16,626	26,818
NONMETALS		
Barite	2,095	4,087
Cement	r 40,134	45,099
Clay products nonrefractory	508	583
Crude minerals n.e.s	254	153
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Residual fuel oil	--	38
Lubricants	13	17
Other	--	2

r Revised.
[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States, and Yugoslavia.

Source: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual, v. 3 (Africa), Walker and Company, New York, 1970, pp. 583–591; 1969 Supplement to the World Trade Annual, v. 3 (Africa), Walker and Company, New York, 1971, pp. 412–418.

COMMODITY REVIEW

METALS

Copper.—Prospecting for copper was conducted in the Franceville area by the Bureau de Recherches Géologiques et Minières (BRGM) of France and Compagnie Minière de l'Ogooue (COMILOG).[4] Indications of copper were found, but no exploitable deposits. A copper and molybdenum anomaly was being investigated by drilling.

Iron Ore.—SOMIFER and the Government of Gabon negotiated an agreement which called for production of 10 million tons of iron ore from the Mékambo-Bélinga deposits during the 1978 to 1985 period.[5] A study will also be conducted in order to construct a port for loading large tonnage ships. A railroad for transporting large quantities of minerals about 350 miles to the coast was scheduled for construction. The SOMIFER consortium will be enlarged to include Japanese and British concerns.

Manganese.—The Congo (Brazzaville) Government nationalized the Congo-Ocean

[4] World Mining. Gabon. V. 6 No. 7, June 25, 1970, p. 129.
[5] Chronique des Mines et de La Recherche Minière. Gabon, No. 392, April 1970, p. 3.

Railroad late in 1970. A COMILOG built spur line runs from Moanda and feeds into the Congo-Ocean Railroad at the Gabon and Congo (Brazzaville) border. Manganese ore is transported from the mine near Moanda to the port at Pointe Noire, Congo (Brazzaville) over these rail lines. At yearend the Gabon and Congo (Brazzaville) Governments negotiated an agreement designed to improve service on the Congo-Ocean rail line. Gabon will pay part of the cost for modernizing the railroad and for increased port and warehouse charges. The Congo (Brazzaville) Government will undertake repair work and improve service on the railroad.

Uranium.—Output decreased somewhat in 1970 owing to the closing of some underground mining operations because of technical difficulties.[6] However, operation at the Oklo mine was intensified. Compagnie des Mines d'Uranium de Franceville was studying mining operations in the Mounana Region. The Commissariat à l'Énergie Atomique (CEA) of France completed a study of the Estuaire (Lambaréné) and M'bigou Regions.

NONMETALS

Diamond.—The BRGM explored for diamond in the Mitzic Region of north-central Gabon.

MINERAL FUELS

Natural Gas.—Syndicat Belge d'Entreprise à l'Etranger, SA, (Sybetra), a Belgian firm, was building a fertilizer plant at Port Gentil. The plant was designed to use gas as a raw material.

Petroleum.—New concessions were awarded from recent relinquishments to Gulf Oil Co. of Gabon, Union Carbide Petroleum Co., Gabon Oil Co., and Valmar Construction Co. The principal producing firm, Société ELF des Pétroles d'Afrique Equatoriale (ELF—SPAFE) and the Government of Gabon were negotiating on a new convention that would increase the Government's revenue derived from petroleum.

The trend of increasing activity in petroleum exploration continued with a 200-percent increase in drilling. In July Gulf Oil Co. of Gabon started exploratory drilling in its concession offshore from Libreville. The project, which was estimated to cost about $1.5 million, was carried out by Transworld Drilling Co. Gulf planned to drill another well in its concession offshore from Mayumba in late 1970. Oceanic Exploration Co. of Denver reportedly obtained a government commitment for exploration rights to an offshore concession relinquished by Gulf Oil Co. of Gabon. The tentative agreement called for Oceanic to spend $2.18 million over a 5-year period and to drill a well within 36 months.

ELF—SPAFE was testing output from its new offshore fields Anguille and Anguille North East, which were put into production in 1969. The company conducted offshore seismic work and ran aeromagnetometer surveys on its onshore concession.[7]

The Shell Oil Co. of Gabon and ELF—SPAFE partnership conducted seismic surveys onshore. The group did extensive seismic work offshore and drilled three wildcat wells off the Gamba shore.

King Resources financed three wells in the Port Gentil and Port Gentil North and South permits in a 50-percent farmout agreement with ELF—SPAFE. The wells were drilled in 1970 and traces of oil were found.

Deminex, a West German firm, financed the drilling of three wells in the Port Gentil South and Port Gentil North permits. The drilling was a requirement of a farmout agreement between Deminex and ELF—SPAFE.

ELF—SPAFE was testing a pilot subsea installation on a well in the Anguille Marine field. The subsea well head was replaced with a fixed production platform owing to technical difficulties.

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[6] Work cited in footnote 3.

[7] World Petroleum Report. Gabon. V. 17, 1971, p. 56.

The Mineral Industry of East Germany

By Joseph B. Huvos [1]

In 1970 East Germany ranked as the leading world producer of brown coal, with about 36 percent of the world's total, and ranked fifth in the production of potash, with about 15 percent of the world's total. A few other mineral commodities were also produced, but in less important quantities; they included salt, iron ore, bituminous coal, fluorspar, and, more recently, crude oil.

East German official statistics were not complete; only selected commodities were reported. East Germany's mineral processing industries continued to operate mostly on imported mineral raw materials, including most notably bauxite, aluminum, iron and steel, and crude oil.

The social product [2] of East Germany increased in 1970 by an estimated 4 to 4.5 percent. Production of the basic materials industry (excluding metal mining, metallurgy, potash, and chemical production) reportedly increased 2.8 percent; metal mining, metallurgy, and potash advanced 6.2 percent; the chemical industry, 8.3 percent.

PRODUCTION

The nitrogen fertilizer industry continued to expand, and several large-scale projects are in stages of planning and construction. The Piesteritz brown-coal-based ammonia plant was closed down, with other similar plants to follow. The reorganization of the potash industry was continued. Bituminous coal production declined further, and planned decrease of the production of brown coal continued. Exploration for oil and gas continued, but no significant results have been registered. Increased crude oil imports from the U.S.S.R. continued, by pipeline and tanker, and crude also came from the Middle East. The capacity of the Schwedt oil refinery increased to 8 million tons per year.

There were plans for phasing out lignite hydrogenation plants because of the high cost of the product. A number of petrochemical plants were in the construction stage, based on natural gas to be imported from the U.S.S.R. starting in 1972.

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[1] Foreign mineral specialist, Division of Fossil Fuels.

[2] As in other Communist countries of East Europe, East Germany does not report its gross national product (value of all final goods and services reported) but rather publishes a figure for the social product, which generally excludes all services and defense.

Table 1.—East Germany: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum:			
Alumina	[r] 53,566	53,729	[e] 53,500
Metal, primary [e]	50,000	50,000	50,000
Cadmium metal, primary [e]	12	12	12
Copper:			
Mine output, metal content [e]	[r] 19,000	19,000	20,000
Metal:			
Smelter [e]	19,000	19,000	20,000
Refined [e]	40,000	40,000	40,000
Iron and steel:			
Iron ore ... thousand tons	1,414	899	[e] 900
Pig iron (excluding ferroalloys) ... do	2,333	2,098	1,996
Crude steel ... do	4,695	4,824	[e] 5,030
Steel semimanufactures (rolled products only)	3,156	3,182	NA
Lead:			
Mine output, metal content [e]	10,000	10,000	9,800
Metal refined including secondary [e]	25,000	25,000	24,000
Silver mine output, metal content [e] ... thousand troy ounces	4,800	4,800	4,800
Tin:			
Mine output, metal content [e] ... long tons	1,000	1,000	1,000
Metal including secondary [e] ... do	1,200	1,200	1,200
Zinc:			
Mine output, metal content [e]	10,000	10,000	9,700
Metal including secondary [e]	15,000	16,000	15,700
NONMETALS			
Barite [e] ... thousand tons	30	30	30
Cement, hydraulic ... do	7,551	7,410	[e] 7,500
Fertilizer materials manufactured:			
Nitrogenous, N_2 content:			
Ammonium sulfate ... do	167	153	NA
Calcium ammonium sulfate ... do	145	155	NA
Unspecified ... do	39	83	NA
Total ... do	351	391	NA
Phosphatic, P_2O_5 content:			
Superphosphate ... do	186	193	NA
Calcined phosphate ... do	122	127	NA
Unspecified ... do	38	49	NA
Total ... do	346	369	NA
Fluorspar [e] ... do	80	80	80
Gypsum and anhydrite:			
Crude ... do	268	282	[e] 285
Calcined ... do	226	238	[e] 240
Lime and dead burned dolomite ... do	2,584	2,513	[e] 2,500
Pyrite:			
Gross weight ... do	140	[e] 140	[e] 140
Sulfur content ... do	58	[e] 58	[e] 58
Salt:			
Marine ... do	74	61	[e] 60
Rock ... do	1,896	1,911	[e] 2,000
Stone, sand and gravel:			
Crushed stone ... do	7,575	8,439	NA
Sand and gravel ... do	6,832	7,146	NA
Sulfur:			
Elemental ... do	119	110	[e] 110
Sulfuric acid ... do	[r] 1,078	1,104	NA
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite and bituminous [e] ... do	1,579	1,332	1,300
Brown and lignite ... do	247,113	254,553	260,600
Total ... do	248,692	255,885	261,900
Coke:			
From anthractie and bituminous coal ... do	2,551	2,391	[e] 2,400
From brown coal:			
High temperature ... do	5,701	5,334	[e] 5,400
Low temperature ... do	1,093	1,100	[e] 1,100
Total ... do	[r] 9,345	8,825	8,900
Fuel briquets, brown coal ... do	56,389	56,869	[e] 57,000
Gas manufactured ... million cubic feet	136,596	143,588	NA

See footnotes at end of table.

Table 1.—East Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude [e] thousand 42-gallon barrels	219	365	438
Refinery products:			
Gasoline do	16,116	16,133	NA
Kerosine, jet fuel and distillate fuel oil do	22,770	24,723	NA
Residual fuel oil do	20,826	25,841	NA
Lubricants do	2,261	2,366	NA
Asphalt do	2,842	3,236	NA
Total do	64,815	72,299	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, magnesium, nickel and peat are also produced, but information is inadequate to make reliable estimates of output levels.

TRADE

In 1969 East Germany's limited mineral exports consisted mainly of brown coal briquets, potash, rock salt, and iron and steel manufactures. As in previous years, the U.S.S.R. supplied an important part of the raw and basic materials needed by the key branches of the East German industry, such as crude oil, coal and coke, iron ore, rolled steel, nonferrous metals, and chemical products. Hungary and Yugoslavia provided bauxite.

An intensive shipbuilding program was underway in the East German Baltic ports to permit the nation to transport a larger proportion of her trade in East German flag vessels.

Table 2.—East Germany: Exports of selected mineral commodities [1]

(Metric tons unless otherwise stated)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum metal and alloys:			
Scrap [2]	3,567	1,581	Netherlands 897; Austria 606.
Unwrought [2]	13,006	8,760	United Kingdom 4,545; Norway 2,066; France 1,869.
Semimanufactures [2]	791	295	All to Sweden.
Copper and alloys:			
Scrap [2]	1,633	1,060	Netherlands 713; Sweden 237; Belgium-Luxembourg 110.
Unwrought and semimanufactures [2]	3,173	2,816	Italy 2,325; United States 282.
Iron and steel:			
Pig iron and ferroalloys [2] thousand tons	732	599	Japan 414; Italy 52; Belgium-Luxembourg 48.
Scrap [2] do	95	123	Sweden 35; Italy 30; Denmark 28.
Steel, primary forms [2] do	35	20	Finland 11; United Kingdom 7.
Steel semimanufactures [2 3 4] do	145	182	U.S.S.R. 57; Poland 53; Romania 25; Yugoslavia 13.
Lead:			
Oxides	326	1,099	Italy 699; Sweden 305.
Metal and alloys:			
Scrap [2]	98	450	All to United Kingdom.
Unwrought and semimanufactures [2]	9,308	3,605	Netherlands 3,402; France 107.
Magnesium and alloys unwrought and semimanufactures	--	101	All to United Kingdom.
Nickel and alloys, all forms	309	247	Norway 143; Netherlands 92.
Tin and alloys unwrought and semimanufactures [2] long tons	23	539	Netherlands 515.
Zinc:			
Oxides [2]	2,163	3,329	Italy 1,335; France 975; Norway 739.
Metal and alloys unwrought and semimanufactures [2]	1,319	546	Netherlands 432; United Kingdom 114.
Other, metal-bearing slag, ash and similar residues [2]	10,500	12,394	Austria 10,558; United Kingdom 999; Belgium-Luxembourg 837.

See footnotes at end of table.

Table 2.—East Germany: Exports of selected mineral commodities [1]—Continued

(Metric tons unless otherwise stated)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS			
Cement [2]	3,651	--	
Chalk	36,897	36,261	NA.
Clays and products:			
Crude kaolin	73,607	64,535	NA.
Refractory and burnt slate [5]	1,911	6,789	All to Poland.
Products:			
Nonrefractory [2]	8,164	9,381	Belgium-Luxembourg 3,822; Denmark 2,914; Austria 956.
Refractory [2]	5,474	12,556	Yugoslavia 4,473; Belgium-Luxembourg 3,632; Sweden 3,617.
Cryolite [5]	503	40	All to Poland.
Diamond:			
Gem [2] value, thousands	$135	$207	All to United Kingdom.
Industrial [2] do	$996	$637	All to Belgium-Luxembourg.
Feldspar and fluorspar [2] [5]	22,686	25,406	Poland 9,995 (all fluorspar); Austria 8,306; Yugoslavia 3,851.
Fertilizer materials:			
Nitrogenous manufactured, gross weight [2] thousand tons	2	--	
Phosphatic manufactured, gross weight [2] do	4	--	
Potassic crude and manufactured, K_2O equivalent do	r 1,621	1,656	Czechoslovakia 418; United Kingdom 135; Hungary 78.
Gypsum, calcined	72,961	67,948	NA.
Pyrite, unroasted [2]	--	2,600	All to Italy.
Salt, rock thousand tons	763	752	Czechoslovakia 560; Finland 92; Sweden 78.
Sodium and potassium compounds n.e.s:			
Caustic soda [2]	5,657	6,404	Sweden 4,251; Denmark 2,153.
Caustic potash, sodium and potassium peroxides	915	2,256	Yugoslavia 1,499.
Stone, sand and gravel:			
Dimension stone [2]	1,651	1,029	Sweden 701; Norway 328.
Crushed thousand tons	198	151	NA.
Gravel do	28	14	NA.
Sand [2] do	18	18	Austria 15.
Sulfur:			
Elemental [2]	5,838	16,323	All to Austria.
Sulfuric acid and monohydrate	13,018	14,069	NA.
Other:			
Crude nonmetals n.e.s. [2]	30,417	24,994	United Kingdom 14,362; Norway 6,087; Belgium-Luxembourg 4,545.
Slag not metal bearing	790	NA	NA.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	7,044	8,490	NA.
Coal, brown coal briquets thousand tons	3,957	3,509	West Germany (including West Berlin) 1,613; Czechoslovakia 809; Austria 285.
Coke [2] do	39	33	Sweden 23; Austria 8.
Gas (natural or manufactured not specified) million cubic feet	1,073	1,122	NA.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	4,659	3,561	NA.
Distillate fuel oil do	3,930	3,713	NA.
Residual fuel oil do	1,489	879	NA.
Paraffin do	394	422	NA.
Montan wax do	150	153	NA.
Crude chemicals from coal, gas and oil distillation	3,230	4,974	Switzerland 2,044; France 1,766; 1,766; Netherlands 999.

r Revised. NA Not available.

[1] Because East Germany publishes only limited data on mineral commodities exports, this table has been compiled from a variety of sources. Entries appearing without a source footnote are from official East German trade returns.

[2] Statistical Office of the United Nations. 1968 and 1969 editions of Supplement to the World Trade Annual. V. 1 (East Europe). Walker and Company, New York, 1970 and 1971.

[3] Compiled in part from East German data reported for trading partner countries (total not reported). Data on Bulgaria, Poland, West Germany and Romania are from this source.

[4] Official trade returns of the U.S.S.R. (imports from East Germany).

[5] Official trade returns of Poland.

Table 3.—East Germany: Imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	240,817	245,154	Hungary 182,998; Yugoslavia 59,656.
Alumina, Al_2O_3 content	44,491	64,645	West Germany 41,110.
Metal and alloys:			
Unwrought [2 3]	r 84,920	86,963	U.S.S.R. 85,900.
Semimanufactures (rolled)	26,800	29,900	U.S.S.R. 19,700 .[2]
Cadmium metal and alloys unwrought [2 4]	185	200	All from U.S.S.R.
Chromium, chromite, Cr_2O_3 content	29,153	31,891	Mainly from Turkey.[3]
Copper:			
Ore and concentrate [3]	--	1,081	All from Sweden.
Metal and alloys:			
Scrap [3]	r 299	377	All from Canada.
Unwrought [2 3]	r 48,891	2,198	U.S.S.R. 2,000.
Semimanufactures [3]	r 107	162	Spain 101; Sweden 40; Yugoslavia 21.
Iron and steel:			
Iron ore, iron content thousand tons	1,424	1,320	Mainly from U.S.S.R.
Scrap do	r 164	218	All from U.S.S.R.
Pig iron do	626	635	Mainly from U.S.S.R.
Ferroalloys	6,384	5,251	NA.
Steel semimanufactures: [5]			
Rod thousand tons	r 809	955	NA.
Hot rolled strip do	117	199	NA.
Light sheet do	410	204	NA.
Heavy sheet do	r 522	560	NA.
Cold rolled strip do	29	NA	NA.
Lead unwrought, unalloyed [2 4]	41,400	49,800	All from U.S.S.R.
Magnesium unwrought, unalloyed [2 4]	r 1,900	2,500	Do.
Manganese ore:			
Metallurgical grade [2] thousand tons	108	177	Do.
Battery and chemical grade [2] do	3	3	Do.
Mercury [3] 76-pound flasks	4,003	6,788	Italy 6,381; Spain 406.
Nickel metal, all forms [3]	12	127	Sweden 106; United States 21.
Titanium oxide [3]	270	125	All from Italy.
Tungsten ore and concentrate [3]	79	697	United States 659; Spain 38.
Zinc unwrought [2 3]	39,015	42,705	U.S.S.R. 42,000; Spain 705.
Other:			
Ores and concentrates of molybdenum, tantalum, titanium, vanadium and zirconium [3]	2,555	3,402	Finland 3,117; United States 275.
Metals and alloys n.e.s. [3]	346	142	Belgium-Luxembourg 90; United Kingdom 35; United States 17.
NONMETALS			
Abrasives, natural:			
Dust and powder of precious and semiprecious stones except diamond [3] value, thousands	$207	$158	Netherlands $139.
Grinding wheels and stones [3]	310	65	Sweden 61.
Asbestos	r 37,077	46,390	U.S.S.R. 38,485.
Boron minerals, crude [3]	13,080	12,300	All from Turkey.
Cement, hydraulic [2] thousand tons	--	156	All from U.S.S.R.
Clays and products:			
Kaolin, crude	29,771	28,717	Czechoslovakia 12,665.
Products:			
Nonrefractory [3]	--	386	Yugoslavia 245.
Refractory [3]	181	1,061	Denmark 742; France 218; Italy 101.
Diamond:			
Gem [3] value, thousands	$683	$175	All from United Kingdom.
Industrial [3] do	$1,480	$1,081	All from Belgium-Luxembourg.
Feldspar and fluorspar [3]	18,232	26,756	Norway 12,547; Yugoslavia 7,257; Sweden 2,585.
Fertilizer materials:			
Crude phosphate rock and apatite concentrates, P_2O_5 content thousand tons	456	445	Mainly from U.S.S.R.
Manufactured:			
Nitrogenous, N_2 content do	157	124	West Germany 78.
Phosphatic, P_2O_5 content do	41	47	NA.
Graphite	5,761	5,164	NA.
Magnesite, crude [3]	13,056	8,537	Turkey 5,920; Yugoslavia 1,695; Austria 922.
Mica	1,166	1,238	NA.
Precious and semiprecious stones, except diamond [3] value, thousands	$135	$84	France $51; United Kingdom $33.
Pyrite, sulfur content	109,432	108,478	NA.
Talc and related materials [3]	3,006	1,452	All from Austria.

See footnotes at end of table.

Table 3.—East Germany: Imports of selected mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	21,141	26,482	NA.
Coal:			
Anthracite [2] thousand tons	102	99	All from U.S.S.R.
Bituminous do	6,284	6,750	U.S.S.R. 3,205; Poland 1,901; Czechoslovakia 889; West Germany 695.
Coke do	2,843	2,777	U.S.S.R. 1,194; Poland 789; Czechoslovakia 702.
Petroleum:			
Crude [6] thousand 42-gallon barrels	59,087	68,149	U.S.S.R. 64,166; United Arab Republic 3,320.
Refinery products, gasoline [7] do	r 310	196	NA.
Crude chemicals from coal, gas, and oil distillation [3]	2,897	5,562	Sweden 4,885; Netherlands 677.

r Revised. NA Not available.

[1] Because East Germany publishes only limited data on mineral commodity imports, this table has been compiled from a variety of sources. Entries appearing without a source footnote are from official East German trade returns.

[2] Official trade returns of the U.S.S.R. (exports to East Germany).

[3] Statistical Office of the United Nations. 1968 and 1969 editions of Supplement to the World Trade Annual. V. I (East Europe). Walker and Company, New York, 1970 and 1971.

[4] Erroneously reported in previous edition as "metal, all forms"; data actually does not include scrap or semimanufactures.

[5] Partial figures only; several classes of steel semimanufactures are not reported in official East German sources.

[6] Totals converted from data reported in metric tons using a conversion factor of 1 metric ton equals 7,350 barrels.

[7] Partial figure; data on other refinery products not reported.

COMMODITY REVIEW

METALS

Aluminum.—The Hungarian Aluminum Industry Planning Co. (ALUTERV) was working on the expansion and reconstruction of an aluminum semimanufactures plant and an alumina plant situated at unspecified locations in East Germany.

Iron and Steel.—Production of iron ore was essentially unchanged, and production of pig iron declined 5 percent; steel production increased 4 percent and, according to plans, should reach 6 million tons by 1975 and 7 million tons by 1980. Most of the iron ore used was imported from the U.S.S.R., and almost 9,000 tons came from the Goa area of India.

East Germany was contracting to import $6 million worth of steel from Japan. Bookings included 30,000 tons of hot coil for pipe, 1,500 tons of tinplate, 1,000 tons of electrical sheet, heavy plate for steel pipes, and some ferroalloys.

Japanese steel imports are to be paid for in East German goods. East Germany reportedly intends to meet entirely from imports the expected increase in domestic steel demand during its third 5-year plan, beginning in 1971.

The East German Industrie Import Anlagen (Industrial Plant Imports Co.) has concluded a contract with the French Heutley Company for design and construction of a continuous galvanizing plant at Eisenhüttenstadt. The new plant will come into operation in 1972 with a capacity of 210,000 tons per year.

Tin.—Among European countries, East Germany ranked third in production of mine tin. Among many East German tin deposits, only those of the Saxon Erzgebirge were workable. There were three types of tin deposits: (1) Deposits of Pre-Variscan geosynclinal mineralization represented by submarine hydrothermal-sedimentary occurrences; (2) deposits of Variscan mineralization, connected with intrusions of granites, predominantly pegmatitic-pneumatolytic and, to a lesser extent, hydrothermal deposits; and (3) tin placer deposits, a product of post-Variscan weathering. Tin occurs as cassiterite or stannite. The most important deposit is that of Altenberg. Others are at Zinnwald, Sadisdorf, and Geyer. Much of the Altenberg ore extracted assays about 0.3 percent tin.

NONMETALS

Fluorspar.—East Germany produces an estimated 88,000 tons of mostly metallurgical grade fluorspar from mining operations in the Harz Mountains, near Rottlerberode, in the Thuringian Forest district (at Steinbach, Ilmenau) and in Saxony at Schönbrunn. About 50 percent is exported, mostly to Poland, which does not produce any metallurgical grade fluorspar.[3]

Nitrogenous Fertilizer.—Expansion of the nitrogen fertilizer industry continued, but East Germany still remained a net importer of nitrogenous and phosphatic fertilizer.

The East German Government had a 1,360-ton-per-day ammonia plant under construction at the DIA Chemie Anlagen (DIA Chemical Plants) at Leuna. Toyo Engineering Co. of Japan, contractor for the construction, used the technology developed by M. W. Kellogg Co., the completion date is set for 1974. A 400,000-ton-per-year urea plant, which is to use the Stamicarbon N.V. process, is also under construction at the same location. Feedstock for both plants will be natural gas.

The East German Government has plans to build a 1,360-ton-per-day ammonia plant and a 700,000-ton-per-year urea plant at Piesteritz. Tentative completion date is set for 1974. Feedstock will be natural gas imported from the U.S.S.R.

The Piesteritz ammonia plant has been shut down because it does not operate on natural gas. It has been learned that another ammonia plant of 440,000 ton-equivalent-nitrogen-per-year capacity probably will be closed for similar reasons.

Phosphatic Fertilizer.—This industry is based on imported phosphate, mainly from the U.S.S.R. The bulk of phosphatic fertilizer produced in East Germany is superphosphate. A new hemihydrate phosphoric acid process was developed by the VEB Vereinigte Phosphatdüngerwerke Bad Köstritz WTZ,[4] which is oriented chiefly towards producing calcium sulfate byproduct for the manufacture of sulfuric acid and cement.

Potash.—The administrative structure of the East German potash industry has been reorganized, with the formation of VEB Kombinat Kali, which took over the functions of VVB Kali in January 1970 and assumed control over the organizations of the potash industry. Modernization of the industry continued.

About 42 percent of the potash mined in East Germany in 1970 came from the operations of the Werra combine in the Suhl district. Existing mines were modernized there, and one new mine was opened. The Bischofferede mine in the southern Harz Mountains was expanded. New shafts were sunk at Kaiseroda, Hambach, and Bad Salzungen. The most important event was the development of a new mine and refinery at Zieliz, in the Womirstedt district, north of Magdeburg. Two shafts were being sunk to 800 meters to permit the extraction of sylvanite from the Rönnenburg horizon. Reserves of 16 to 17 percent potassium oxide equivalent ore in the Womirstedt district are estimated at 70 million tons. East German output of marketable potash salts is expected to exceed 3.3 million tons of equivalent potassium oxide by 1975.[5]

MINERAL FUELS

Coal and Lignite.—East German bituminous coal production declined further in 1970, making necessary imports of bituminous coal and metallurgical coke in amounts of 8 to 10 million tons per year. East Germany was the leading producer of brown coal on a worldwide basis. To optimize the development of the energy economy, the absolute tonnage of brown coal mined is expected to decline in the future, but in 1980, brown coal would still account for about 50 percent of the total energy supply, compared with 78 percent in 1967. This reduction in the proportion of brown coal is the result of concentration of the industry as well as increased use of the liquid and gaseous hydrocarbons. It is officially hoped that improvements in the technology and organization of this industry will reduce operating costs by 25 percent.

During the winter months of 1969–70, there were power shortages caused by the severe weather; it was recommended by the authorities to economize energy in industry and households; there were also shortages of household fuel caused by difficulties in transportation because of the cold spell, insufficient reserves, and increased consumption by about 500 pounds of fuel per household.

A 3,860-megawatt thermal power station was under construction at Cottbus, about 40 miles south of Berlin. The plant will

[3] Industrial Minerals, June 1970, p. 25.
[4] Phosphorus and Potassium. No. 48, June–August, p. 15.
[5] Phosphorus and Potassium. New Plants and Projects. No. 50, November–December 1970, p. 60.

be fueled by brown coal deposits in the area. The first stage will include six sets with a total capacity of 1,600 megawatts; the second stage, six sets totaling 1,260 megawatts; and the third stage, two 500-megawatt sets.

Natural Gas.—In 1970 exploratory drilling centered on Thuringia, the right bank of the Elbe River, Rügen Island, Salzwedel, and the left bank area of the Oder River, between Frankfurt and Berlin. The first successful result of this exploration was the recent discovery of natural gas at Magdeburg.

Natural gas from the U.S.S.R. will flow through East Germany to West Germany through a pipeline. The pipeline is to be commissioned in 1973. East Germany is supplying 90-centimeter- (35½-inch) diameter pipe and it can be assumed that this same line will supply East Germany with natural gas from the U.S.S.R. In 1972 the Leuna works will switch from using lignite to natural gas from the U.S.S.R.

Petroleum and Petrochemicals.—Exploration for hydrocarbons in East Germany has so far been unsuccessful, except for the discovery of some quite minor gasfields and of the small Reinkenhagen oilfield, near the Baltic coast, with an estimated annual production of 60,000 tons. Some encouragement, however, may have been taken from recent discoveries of valuable oil- and gas-bearing strata in the Soviet Baltic area, which, according to Russian assessments, may extend into Polish and East German territory. An agreement signed in 1969 insures continued Russian technical assistance in East German search operations.[6]

Consumption of petroleum products increased only to about one-seventh of total energy requirements. No plans were published to indicate probable growth of petroleum consumption in the future, but there are estimates that a consumption level of 15 million tons per year will be reached before 1975, and 27 million to 28 million tons per year will be reached in 1980.

Motor transport, in particular private motor transport, has been developing at a modest rate. Production of motor gasoline has increased, gasoline imports have been replaced by exports, and emphasis in refining has been placed on black oils, in particular heating fuels.

There are two main refining and hydrogenation centers in East Germany—Schwedt-on-Oder near the Polish border, with a modern refinery and petrochemical complex, and the Halle-Leipzig area, which has various plants, mainly at Leuna, Bohlen, and Lützkendorf; some were built before World War II and were then exclusively used for the hydrogenation of lignite. In 1970 the Schwedt refinery, commissioned in 1964, attained a capacity of 8 million tons per year, which will be raised soon to 10 million tons per year. A later expansion to about 20 million tons or more per year has been envisaged.

The plants in the Halle-Leipzig area have, at present, an estimated crude oil refining capacity of over 4 million tons per year, including 2.5 million tons at Leuna. Some still continue to operate on a lignite raw material base.

It is estimated that in 1969 about 1 million tons of products were made from lignite. According to East German official information, hydrogenation of lignite is not economical, and it is planned to follow the example of Czechoslovakia, where similar operations were discontinued recently.

East German refineries are well served by pipelines. The Schwedt refinery is located at the terminal of the northern branch of the Friendship pipeline, for the westward transportation of crude oil from the U.S.S.R. Another pipeline links Schwedt to the East German seaport of Rostock on the Baltic. Another line leads from Schwedt to Leuna, so that crude can be delivered to all the main refineries of the country from the U.S.S.R., as well as from Rostock. Work has also started on a new parallel line, the Friendship II, to handle the increased quantities of the seventies. A products line links Schwedt to East Berlin, and may be extended further south to Dresden.

From 1966 to 1970, increasing amounts of crude oil were imported from the United Arab Republic and varying amounts from Albania and Algeria. According to a contract signed in 1970, East Germany will buy 700,000 tons of crude each year from the West Berlin mineral oils company, the Rex-Handelsgesellschaft.[7]

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[6] Petroleum Press Service. V. 38, No. 3, March 1971, p. 90.
[7] Page 89 of work cited in footnote 6.

East Germany has granted a loan equivalent to \$84 million to Iraq for the purchase of machinery and vehicles. The loan will be repaid in crude oil and other Iraqi products. Talks were also conducted with Libya to secure crude oil imports.

According to arrangements concluded in 1970, crude imports are dispatched in 80,000-dead-weight-ton tankers to Rotterdam and hence, after temporary storage, in Europort tanks; 20,000-dead-weight-ton vessels are used to ship the oil to Rostock. The port of Rostock cannot accommodate larger tankers at present, though there are tentative plans to build an artificial island nearby with unloading facilities for 100,000-ton vessels. Some U.S.S.R. crude was shipped by tanker to the East German port of Rostock while the Friendship II pipeline is being built. There are also tentative plans to acquire 200,000-deadweight-ton tankers.

Some of the major petrochemical projects, excluding fertilizers, are a 6,000-ton-per-year fluorhydrocarbon plant under construction at Nünchritz, near Dresden; a 2,500-ton-per-year maleic anhydride plant and a 9,000-ton-per-year pthalic anhydride plant at Schkopau, with the West German Lurgi Gesellschaft and Vickers-Zimmer Company as contractors; a 20,000-ton-per-year acrylonitrile and therephthalic acid plant at Schwedt, which was in the planning stage; a 300,000-ton-per-year ethylene and a 108,000-ton-per-year propylene plant, at Böhlen, at the DIA Industrieanlagen plant were due for completion in 1973, with Voest, Sybetra, and the Linde companies as contractors; and finally, a 30,000-ton-per-year high-density polyethylene plant at Schkopau, at the VEB Chemische Werke Buna, was due for completion in early 1971, with the Vickers-Zimmer Company as contractor.

A cooperation agreement was signed between East Germany and Czechoslovakia for building a 140-kilometer pipeline from the Böhlen ethylene plant to supply feedstock for Czechoslovak plants in northwest Bohemia.

The Mineral Industry of the Federal Republic of Germany

By Frank J. Cservenyak [1]

The West German economy in 1970 continued the high level of activity which started in 1968 and the gross national product (GNP) estimated at $185 billion,[2] marked a 12.4-percent increase in current prices and 4.7 percent increase in constant prices.

West German exports in 1970 totaled $34.2 billion, representing a 10.3 percent increase over those of 1969. Imports to West Germany in 1970 also increased by 11.9 percent for a total of $29.9 billion. Exports to the United States in 1970 increased by 7.4 percent for a total of $3.1 billion whereas imports from the United States totaled $3.3 billion, an increase of 17.7 percent.

The 1970 growth in gross wages and salaries was 17.3 percent and unit wage costs in Western Germany were reported to be rising more rapidly than for any other major industrial nation. Total industrial prices in 1969 and 1970 increased by about 10 percent, as much as the total increase in the previous 12 years.

The Federal Cabinet in July initiated measures designed to counteract price increases. The Bundestag at its session on July 10 and 11 approved a law providing for a 10-percent surcharge on income, wage, and corporation taxes liable for payment between August 1, 1970, and June 30, 1971. Moreover the Federal Government on October 22, 1970, approved "Guiding data for macro-economic development in 1971" to facilitate greater harmony, in the interest of stability, between the conduct of the autonomous groupings, trade unions and employer's associations, and the Government's economic policy in support of a normalization process following a prolonged boom. The guiding data showed the limits that may not be overstepped either by public authorities or autonomous groupings without adding to the risks existing in the fields of price performance and ultimately, employment. Among other things the Federal Government assumed that, because of steep wage and salary increases in 1970, earnings may rise in 1971 by an average 7 to 8 percent.

Although industrial employment in 1970 increased by about 4 percent to 8,650,000, employment in the mineral industry, as shown in table 1, declined almost 1 percent to 876,000. Decreased employment in mines and quarries was partially offset by an increase of about 10,000 at processing plants.

West German industrialists were showing increasing concern about the future development of international mineral markets. The country is dependent on foreign suppliers for large amounts of important raw materials and although it consumes about 10 percent of the Western World's mining production, West German domestic producers can meet only a small percent of industrial demand. Programs were underway at yearend to improve raw material supply by exploring ocean floors for metal ores, creating crude oil bases abroad, participating in programs to store crude oil, natural gas, and other raw materials and devising ways for long-term acquisition of greater quantities of metallic and nonmetallic ores. Any government assisted projects aimed at exploring for minerals within Western Germany would have to be balanced against the availability of economic minerals in foreign countries.

[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from Deutsche Marks (DM) to U.S. dollars at the rate of DM3.66 = US$1.00.

Table 1.—Federal Republic of Germany: Employment and turnover in the mineral industry

	Average 1970 employment (thousand persons)	Turnover (million dollars)			
		1969		1970	
		Domestic	Foreign	Domestic	Foreign
MINES					
Iron	4	38	--	40	--
Nonferrous metals	3	26	2	27	1
Potash and salt	14	164	61	184	64
Other nonmetallic minerals	1	10	4	11	5
Coal	253	1,433	r 465	1,699	560
Lignite	24	251	14	245	15
Peat	4	30	4	31	5
Oil and gas	6	248	3	299	3
Total	309	2,200	r 553	2,536	653
QUARRIES					
Stone	19	342	5	400	5
Sand and gravel	15	257	13	314	15
Slate, clays, other	7	r 53	10	56	13
Cement	17	464	17	534	17
Refractories	16	164	46	196	52
Lime, gypsum, chalk	15	235	18	272	19
Limestone, sandstone	5	111	--	127	--
Pumice	7	113	1	140	2
Total	101	r 1,739	110	2,039	123
PROCESSING PLANTS					
Iron and steel	335	5,526	r 1,721	6,344	2,007
Nonferrous plants	92	2,068	395	2,124	476
Petroleum refineries	35	r 4,669	r 182	5,069	207
Coal chemicals	4	r 71	23	72	22
Total	466	r 12,334	r 2,321	13,609	2,712
Grand total	876	r 16,273	r 2,984	18,184	3,488

r Revised.

PRODUCTION

The index of industrial production continued to rise in 1970. The increase of 6.1 percent to 156.6 (1962 = 100) was about one-half the rate of increase for the past several years. The increasing trend in nonferrous metals was interrupted with virtually no change shown in 1970. The increase in the index of production for petroleum and natural gas, iron and steel, and stone and sand industries was higher than the industrial average.

Industry sector	Index of production (1962 = 100)		Change (percent)
	1969	1970	
Mining	r 96.8	99.8	3.1
Coal	86.5	86.0	-.6
Metal ores:			
Iron	46.8	42.7	-8.8
Other	r 117.8	116.0	-1.5
Potash and salt	137.2	145.4	6.0
Crude oil and gas	195.8	231.6	18.3
Iron and steel	145.2	160.9	10.8
Nonferrous metals	r 160.2	159.1	-.7
Petroleum refined	199.7	219.3	9.8
Stone and sand industries	r 126.0	134.8	7.0

r Revised.

Table 2.—Federal Republic of Germany: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
METALS			
Aluminum:			
Bauxite, gross weight	3,349	3,207	--
Alumina ... thousand tons	[r] 651	680	757
Metal:			
Primary ... do	257	263	309
Secondary:			
Unalloyed ... do	28	34	26
Alloyed ... do	204	237	232
Bismuth, smelter [e]	150	250	350
Cadmium, smelter	342	792	1,035
Cobalt, smelter	809	850	826
Copper:			
Mine output, metal content	1,338	1,444	1,274
Metal:			
Blister and anodes:			
Primary	95,700	92,900	84,400
Secondary	96,100	91,600	133,200
Refined including secondary:			
Electrolytic	304,182	302,537	307,240
Fire refined	103,215	99,595	98,600
Gold:			
Mine output, metal content [e] ... troy ounces	1,000	1,000	1,000
Metal including secondary ... do	84,846	192,583	101,789
Iron and steel:			
Iron ore and concentrate ... thousand tons	6,447	6,060	5,532
Pig iron and blast furnace ferroalloys ... do	30,305	33,764	33,627
Electric furnace ferroalloys ... do	209	251	269
Steel ingots and castings ... do	41,159	45,316	45,041
Semimanufactures ... do	[r] 33,317	35,268	38,377
Lead:			
Mine output, metal content	52,496	39,313	40,509
Metal unalloyed:			
Primary	120,019	125,808	112,400
Secondary	153,422	179,449	193,100
Magnesium metal and alloys:			
Unwrought, secondary only	2,560	2,130	[e] 2,000
Castings	[r] 37,810	40,137	40,179
Mercury, secondary only ... 76-pound flasks	[r] 2,437	1,944	[e] 2,000
Molybdenum	220	346	251
Nickel including secondary [1]	300	500	564
Platinum ... troy ounces	[r] 1,897	1,479	1,736
Silver:			
Mine output, metal content ... thousand troy ounces	1,769	1,684	1,773
Metal including secondary ... do	21,918	27,066	24,382
Tin including secondary ... long tons	[r] 2,438	2,381	2,165
Tungsten	798	819	966
Zinc:			
Mine output, metal content	110,392	110,739	122,676
Metal unwrought, unalloyed, and primary	144,348	147,141	150,224
NONMETALS			
Barite	[r] 423,666	437,474	412,586
Bromine, fluorine, and iodine	[r] 2,496	3,626	3,991
Cement, hydraulic ... thousand tons	33,443	35,078	38,325
Chalk ... do	86	118	NA
Clays:			
Fire exclusive of Klebsand ... do	3,933	4,256	NA
Kaolin, marketable ... do	[r] 409	436	447
Bleaching ... do	429	566	NA
Other, Schieferton ... do	68	68	NA
Corundum, artificial ... do	79	103	106
Diatomite and similar earths, marketable	91,852	97,113	91,557
Feldspar, marketable	287,803	361,279	[e] 370,000
Fertilizers:			
Crude potassic:			
Gross weight ... thousand tons	20,187	20,310	21,030
K_2O equivalent ... do	2,561	2,626	2,645
Manufactured:			
Nitrogenous, nitrogen content:			
Nitrogen fertilizers ... do	1,170	1,172	1,143
Mixed fertilizers ... do	[r] 398	422	425
Total ... do	1,568	1,594	1,568
Phosphatic, P_2O_5 content:			
Superphosphate ... do	62	70	50
Thomas slag fertilizer ... do	340	302	313
Other phosphatic fertilizers ... do	99	110	117
Mixed fertilizers ... do	404	429	432
Total ... do	905	911	912

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
NONMETALS—Continued			
Fertilizers:—Continued			
Potassic, K_2O equivalent:			
Marketable crude thousand tons	34	37	40
Chemically processed do	2,186	2,246	2,266
Total do	2,220	2,283	2,306
Content of mixed fertilizers [2] do	463	474	504
Mixed fertilizers, gross weight do	2,945	3,087	3,136
Fluorspar, marketable	87,744	84,766	87,247
Graphite	12,843	13,035	e 13,200
Gypsum inclusive of anhydrite thousand tons	r 1,522	1,826	1,473
Lime, quicklime and hydrated including dead-burned dolomite do	10,634	10,938	10,716
Pigments, natural mineral do	r 14	16	NA
Pumice:			
Crude and washed do	r 6,711	7,149	7,054
Marketable do	r 3,560	4,001	4,214
Pyrite, marketable:			
Gross weight do	r 616	640	554
Sulfur content do	r 251	266	242
Quartz, quartzite, and glass sand:			
Quartzite do	230	250	NA
Quartz sand ground do	r 937	1,080	1,144
Quartz sand unground and glass sand do	r 4,946	5,586	5,682
Salt, marketable:			
Rock do	6,125	6,781	9,933
Marine and other do	1,929	2,078	
Stone, sand and gravel n.e.s.:			
Dimension stone thousand cubic meters	219	235	257
Limestone, industrial thousand tons	r 54,392	59,623	63,465
Crushed and broken do	r 101,115	105,819	117,611
Slate: [3]			
Roofing for office and industry do	r 29	28	23
Splittings and ground do	77	82	79
Basalt lava and lava sand do	6,843	7,634	NA
Calcite do	31	22	NA
Grinding and whetstone cubic meters	271	278	NA
Printing stone thousand cubic meters	33	37	31
Tuff thousand tons	3	2	NA
Industrial sands:			
Molding sand do	890	959	1,000
Other, Klebsand do	131	163	172
Sand and gravel do	r 178,231	188,234	206,473
Sulfur, elemental byproduct do	127	129	176
Talc including talc schist do	28	45	44
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	177,994	215,103	237,452
Coal:			
Anthracite thousand tons	11,346	10,607	e 9,700
Bituminous do	100,666	101,023	101,571
Pech do	834	763	671
Lignite do	101,516	107,424	107,766
Total do	214,362	219,817	219,708
Coke:			
Metallurgical do	36,242	39,011	39,937
Gashouse do	2,327	2,406	2,536
Total do	38,569	41,417	42,473
Fuel briquets:			
Anthracite and bituminous do	r 3,706	3,907	3,725
Lignite do	10,357	10,499	9,571
Gas:			
Manufactured gas (excluding that from petroleum refineries):			
Blast furnace gas million cubic feet	478,759	517,993	518,134
Coke oven gas [4] do	610,199	641,806	644,807
Other gas do	280,574	275,524	259,279
Total do	1,369,532	1,435,323	1,422,220
Natural:			
Gross production do	229,119	314,722	446,987
Marketable production do	224,000	310,732	e 440,000

See footnotes at end of table.

Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude thousand 42-gallon barrels	57,655	56,886	54,427
Refinery products:			
Gasoline, aviation and motor do	97,532	99,396	110,843
Jet fuel do	8,806	10,281	9,196
Kerosine do	656	639	716
Distillate fuel oil do	233,908	252,006	276,722
Residual fuel oil do	187,942	173,304	221,749
Lubricants do	5,648	7,196	7,384
Liquefied petroleum gas do	21,140	22,693	29,477
Bitumen do	26,265	27,263	28,509
Other do	67,205	96,268	51,885
Refinery fuel and losses do	31,398	33,731	45,534
Total do	680,500	722,777	782,015

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 Exclusive of slate recovered from mine dumps.

4 Includes water gas and generator gas from coke ovens.

TRADE

Details on total tonnage by commodities, principal sources, and destinations appear in tables 3 and 4.

Table 3.—Federal Republic of Germany: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite	2,187	2,332	Austria 1,416; Belgium-Luxembourg 371; Netherlands 164.
Alumina	86,562	108,434	Austria 94,328; Italy 2,013; France 1,752.
Aluminum hydroxide	48,317	59,205	Sweden 12,381; Netherlands 12,203; Belgium-Luxembourg 10,533.
Metal and alloys:			
Scrap	7,785	6,757	Italy 2,847; Netherlands 2,354; France 1,314.
Unwrought	23,140	35,812	France 13,136; Italy 8,441; Netherlands 4,333.
Semimanufactures	118,353	150,337	France 28,766; Netherlands 13,063; Italy 8,921.
Antimony	119	71	Italy 27; France 15; Netherlands 8.
Bismuth	81	113	Poland 38; Belgium-Luxembourg 38; France 9.
Cadmium, all forms	69	157	France 35; Netherlands 30; United Kingdom 21.
Chromium:			
Chromite	1,316	3,310	Netherlands 1,259; France 791; Austria 391.
Oxides and hydroxides	6,507	7,445	NA.
Metal	19	30	Netherlands 15; Italy 6; United States 2.
Cobalt including alloys, all forms	181	198	Japan 75; Spain 39; Netherlands 16.
Columbium including alloys, all forms kilograms	2,113	1,828	Canada 907; Japan 102.
Copper:			
Ore and matte	7,519	--	
Metal and alloys:			
Scrap	31,722	30,940	Italy 12,505; Belgium-Luxembourg 6,003; France 4,776.
Blister	11,541	1,201	Yugoslavia 507; Netherlands 449; Austria 184.
Refined unalloyed	139,050	95,471	France 20,565; mainland China 14,625; United Kingdom 13,609.
Master alloys	736	573	Belgium-Luxembourg 369; United Kingdom 127; Switzerland 36.
Other alloys	2,077	3,723	Switzerland 2,186; Italy 644; Austria 450.
Semimanufactures	92,735	98,290	United States 18,867; Netherlands 16,236; France 10,791.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Gold and alloys:			
Bullion_____thousand troy ounces__	802	890	Switzerland 558; United Kingdom 102; Italy 50.
Wrought_________________do____	151	143	Belgium-Luxembourg 39; Denmark 27; Italy 17.
Iron and steel:			
Ore and concentrates:			
Roasted pyrite_thousand tons__	22	12	Austria 9; Belgium-Luxembourg 2.
Other_________________do____	18	17	Netherlands 6; United Kingdom 4; Austria 3.
Scrap____________________do____	1,846	1,830	Italy 1,595; Belgium-Luxembourg 120; Netherlands 30.
Pig iron__________________do____	815	976	Italy 426; France 108; Belgium-Luxembourg 108.
Sponge iron, powder and shot do____	11	14	Netherlands 3; Switzerland 2; France 1.
Spiegeleisen______________do____	14	11	Belgium-Luxembourg 7; Austria 1; Italy 1.
Ferroalloys:			
Ferromanganese________do____	75	45	United States 21; Italy 5; France 4.
Other_________________do____	39	48	Sweden 36; Belgium-Luxembourg 9.
Primary forms:			
Ingots________________do____	127	269	France 207; Italy 40; Belgium-Luxembourg 11.
Blooms, billets, and slabs do____	1,041	630	France 263; Italy 120; Denmark 47.
Coils for rerolling ______do____	1,410	1,067	United States 275; Italy 205; Netherlands 178.
Semimanufactures:			
Wire rod______________do____	753	602	United States 168; France 93; Netherlands 56.
Other bars and rods____do____	1,328	715	France 225; Netherlands 101; United States 82.
Sections_______________do____	1,392	1,253	France 260; Netherlands 238; United States 200.
Plates and sheets:			
Heavy____________do____	1,507	1,516	France 317; Netherlands 202; Switzerland 129.
Medium__________do____	133	159	France 22; Denmark 21; Italy 16.
Thin uncoated_____do____	1,916	1,965	U.S.S.R. 283; France 128; Belgium-Luxembourg 105.
Tinned____________do____	180	334	United States 54; Spain 39; France 23.
Other coated_______do____	396	284	United States 139; mainland China 51; Netherlands 17.
Hoop and strip_________do____	509	611	Netherlands 160; France 108; Switzerland 61.
Rails and accessories____do____	139	139	Italy 36; Netherlands 25; Switzerland 16.
Wire__________________do____	255	165	France 47; Netherlands 22; United States 13.
Tubes, pipes, and fittings do____	1,728	1,855	Netherlands 351; U.S.S.R. 337; United States 146.
Castings and forgings, rough do____	35	2	Netherlands 1.
Lead:			
Ore and concentrates_____________	5,398	7,598	Belgium-Luxembourg 4,998; Italy 2,050.
Oxides_________________________	7,486	8,235	Netherlands 3,147; France 838; Yugoslavia 595.
Metal:			
Scrap______________________	10,164	7,628	Italy 3,893; Belgium-Luxembourg 2,611; Netherlands 586.
Unwrought__________________	44,282	39,455	France 8,516; Belgium-Luxembourg 5,472; Switzerland 5,436.
Semimanufactures____________	8,310	8,211	Finland 1,116; Switzerland 938; Belgium-Luxembourg 602.
Magnesium:			
Oxides and hydroxides____________	2,031	2,642	Italy 608; Austria 395; Poland 213.
Metal:			
Scrap______________________	906	2,177	Italy 1,046; Norway 713.
Unwrought and semimanufactures__________________	393	299	Netherlands 67; Sweden 51; Austria 45.
Manganese:			
Ore___________________________	3,772	2,545	Belgium-Luxembourg 2,014; Austria 263; Italy 104.
Metal including alloys, all forms____	32	70	Netherlands 46.
Mercury____________76-pound flasks__	972	513	Switzerland 121; Belgium-Luxembourg 61; Netherlands 61; United Arab Republic 61.
Molybdenum_______________________	113	167	Japan 91; France 35.
Nickel:			
Matte and speiss_________________	6	27	All to Netherlands.
Metal and alloys:			
Scrap______________________	1,404	1,985	United Kingdom 635; Norway 532; Netherlands 304.
Unwrought__________________	1,053	756	Netherlands 255; Switzerland 145; France 104.
Semimanufactures____________	6,806	9,642	Netherlands 1,847; United Kingdom 1,014; Italy 905.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Platinum group, all forms thousand troy ounces	462	372	Mainland China 83; France 61; Japan 49.
Silicon	121	259	Italy 170; United States 57.
Silver:			
Ashes kilograms	9,637	12,749	Belgium-Luxembourg 12,628.
Metal and alloys:			
Unwrought thousand troy ounces	23,980	27,736	Belgium-Luxembourg 6,227; United Kingdom 6,013; Italy 4,381.
Semimanufactures do	11,120	12,125	Switzerland 2,035; Sweden 1,958; Netherlands 1,210.
Tantalum, all forms kilograms	6,177	23,175	United Kingdom 4,806; Finland 4,541; Japan 3,220.
Tin:			
Ore and concentrate long tons	42	56	All to United Kingdom.
Metal alloys:			
Scrap do	r 48	81	United Kingdom 57; Netherlands 16.
Unwrought do	1,512	1,490	France 790; Netherlands 314.
Semimanufactures do	249	290	Netherlands 40; Switzerland 35; Italy 31.
Titanium:			
Ores (ilmenite and rutile) thousand tons	692	528	Romania 190; Switzerland 157; Austria 155.
Metal	r 321	626	United Kingdom 229; Sweden 96; Italy 85.
Tungsten:			
Ore	123	206	Sweden 131; United Kingdom 34.
Metal, all forms	r 301	319	Switzerland 92; United States 61; Sweden 46.
Vanadium including alloys, all forms kilograms	3,500	300	All to the United States.
Zinc:			
Ore	116,842	60,327	Belgium-Luxembourg 35,812; Netherlands 10,621; France 9,851.
Metal including alloys:			
Scrap	5,682	5,705	Italy 2,687; France 1,395; Netherlands 1,101.
Zinc dust	3,675	3,470	Netherlands 1,642; Belgium-Luxembourg 1,187; Switzerland 425.
Unwrought	37,791	35,507	Italy 14,464; Switzerland 5,379; France 2,991.
Semimanufactures	8,316	6,482	France 1,778; mainland China 1,171; Sweden 755.
Zirconium	17	67	France 17; United States 16; Sweden 7.
Other:			
Metalliferous nonferrous waste n.e.s	145,926	88,925	Netherlands 23,837; Belgium-Luxembourg 23,583.
Oxides and hydroxides of barium and strontium	1,500	2,578	France 1,049; U.S.S.R. 500; United Kingdom 275.
Metals and metalloids:			
Alkali, alkaline earth, rare earth metals	12	22	Italy 9; Japan 8; Netherlands 4.
Arsenic and tellurium	7	7	India 4; France 1.
Boron nitrogen	1,907	2,247	Switzerland 1,913; Austria 218.
Selenium and phosphorus	8,211	11,826	NA.
Uranium and thorium kilograms	600	1,300	Belgium-Luxembourg 200; Poland 200; United States 200.
Ferrocerium and pyrophoric alloys	169	167	NA.
Other	2	2	All to Japan.
NONMETALS			
Abrasives:			
Natural:			
Pumice, emery, and other natural abrasives thousand tons	516	544	Netherlands 360; Belgium-Luxembourg 174.
Industrial diamond thousand carats	205	90	Netherlands 40; Belgium-Luxembourg 15; mainland China 10.
Dust and powder of gem stones including synthetic stones do	189	166	Netherlands 56; U.S.S.R. 40; United States 20.
Manufactured (grinding stones)	8,577	9,993	France 1,299; Italy 1,013; Netherlands 950.
Artificial:			
Corundum	28,343	35,716	Sweden 3,802; France 3,676; United Kingdom 3,466.
Silicon carbide	8,156	7,479	NA.
Boron materials:			
Crude	1,325	4,313	Italy 2,248; Sweden 1,452; Netherlands 335.
Boric oxide and acid	116	151	Yugoslavia 40; Switzerland 19.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Cement, portland, hydraulic, and other types ____ thousand tons __	1,384	1,649	Netherlands 1,320; Belgium-Luxembourg 66; France 58.
Chalk, crude ____	5,378	7,243	Netherlands 2,880; Denmark 2,867; Switzerland 966.
Clays and products:			
Crude:			
Kaolin ____ thousand tons __	77	91	Italy 32; Austria 18; Belgium-Luxembourg 13.
Fire ____ do ____	355	383	Netherlands 85; Italy 85; France 74.
Andalusite, dinas and other do ____	668	763	Netherlands 351; Belgium-Luxembourg 143; France 111.
Products, construction materials:			
Refractory ____ do ____	250	263	Belgium-Luxembourg 56; France 39; Italy 29.
Nonrefractory value, thousand dollars __	$55,210	$64,676	France $30,160; Netherlands $8,083; Austria $5,662.
Diamond and other gem stones:			
Diamond except powder, dust, crude, or rough cut thousand carats __	40	45	NA.
Other worked ____ do ____	85	80	Belgium-Luxembourg 40; Netherlands 20.
Other precious or semiprecious:			
Crude or rough cut _ kilograms __	r 25,609	94,334	Japan 19,718; Italy 17,939; Hong Kong 12,364.
Other ____ do ____	23,706	25,607	United States 9,208; France 3,091; Saudi Arabia 1,654.
Diatomite and other infusorial earths ___	5,314	5,889	United Kingdom 1,001; France 811; Saudi Arabia 619.
Feldspar ____	12,918	14,981	Czechoslovakia 3,646; Belgium-Luxembourg 3,361; France 2,313.
Fertilizer materials:			
Crude, natural:			
Phosphatic ____	23,724	2,458	Switzerland 2,229.
Potassic ____	50,314	48,308	Belgium-Luxembourg 23,450; Netherlands 19,714; United Kingdom 5,108.
Organic including guano ____	5,586	12,231	Netherlands 10,307; France 824.
Manufactured:			
Nitrogenous ___ thousand tons __	1,636	1,553	Brazil 177; mainland China 116; Ceylon 35.
Phosphatic:			
Basic slag ____ do ____	215	230	France 172; Austria 28; Netherlands 15.
Other ____ do ____	42	19	Cuba 9; Chile 3; Indonesia 2.
Potassic ____ do ____	1,960	1,782	Belgium-Luxembourg 232; Poland 173; Netherlands 151.
Mixed ____ do ____	933	889	Cuba 162; France 85; Spain 80.
Ammonia, anhydrous ____ do ____	135	80	Poland 47; Czechoslovakia 8; France 8.
Fluorspar ____	9,341	9,956	Austria 3,758; Belgium-Luxembourg 2,025; Yugoslavia 987.
Graphite, natural, crude or ground ____	r 21,306	7,580	Italy 2,262; United States 1,461; France 481.
Gypsum and plasters ___ thousand tons __	301	314	Netherlands 131; Belgium-Luxembourg 71; Switzerland 46.
Lime, hydraulic or slaked ____ do ____	410	498	Netherlands 431; Belgium-Luxembourg 37.
Magnesite ____	9,679	12,057	France 4,232; Belgium-Luxembourg 2,740; Austria 1,623.
Mica:			
Crude including splittings and waste ____	66	69	NA.
Worked including agglomerated splittings ____	589	839	Switzerland 333; Iran 130; Sweden 122.
Pigments:			
Earth colors, natural ____	9,178	10,978	Netherlands 3,578; Sweden 2,286; Denmark 2,244.
Iron oxides and hydroxides thousand tons __	95	100	France 15; United States 13; United Kingdom 12.
Pyrite (gross weight) ____	147	227	United Kingdom 45; France 39; Austria 34.
Salt ____ thousand tons __	1,169	1,237	Belgium-Luxembourg 586; Sweden 272; Denmark 167.
Sodium and potassium compounds n.e.s.:			
Caustic soda ____ do ____	238	213	Hungary 37; United States 36; Netherlands 33.
Caustic potash, sodium and potassium peroxides ____	10,488	10,381	U.S.S.R. 2,800; United States 1,103; Switzerland 980.
Stone and sand and gravel:			
Dimension stone:			
Unworked and partly worked:			
Marble and other calcareous _ thousand tons __	4	4	Austria 2; Netherlands 1.
Slate ____ do ____	23	23	Netherlands 9; Belgium-Luxembourg 4; Sweden 4.

See footnotes at end of table.

Table 3.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Stone and sand and gravel—Continued			
Dimension stone—Continued			
Unworked and partly worked—Continued			
Granite, porphyry and other ___ thousand tons __	583	601	Netherlands 580; France 8; Switzerland 8.
Worked, all types including paving blocks ________ do ____	40	36	Netherlands 14; Belgium-Luxembourg 9; Denmark 6.
Dolomite, chiefly refractory grade do ____	74	74	Netherlands 29; France 23; Belgium-Luxembourg 11.
Gravel and crushed rock (macadam) ______________ do ____	10,652	10,667	Netherlands 8,870; Switzerland 927; Belgium-Luxembourg 790.
Limestone, except dimension _ do ____	74	96	Netherlands 82; Belgium-Luxembourg 9.
Quartz and quartzite crude and partly worked ___________ do ____	47	49	Austria 12; Italy 10; Belgium-Luxembourg 9.
Sand excluding metal bearing _________________ do ____	6,403	6,876	Netherlands 6,000; Switzerland 216.
Sulfur:			
Elemental including colloidal and precipitated ____________________	45,898	35,834	Austria 9,152; Thailand 2,704; Indonesia 2,616.
Other elemental __________________	2,077	2,291	United Kingdom 624; India 270; Republic of South Africa 185.
Sulfur dioxide ____________________	13,280	14,286	Belgium-Luxembourg 7,477; Sweden 2,277; Italy 1,731.
Talc, soapstone and steatite ___________	4,054	5,550	Denmark 1,943; Netherlands 1,519; United Kingdom 306.
Vermiculite, chlorite, and perlite _______	184	562	Sweden 185; France 100; Netherlands 80.
Other:			
Bromine and fluorine _____________	155	78	Netherlands 56.
Slag dross and similar waste not metal bearing:			
From iron and steel manufactures _____ thousand tons __	1,412	1,602	Netherlands 1,283; France 287; Belgium-Luxembourg 27.
Other ________________ do ____	203	265	Netherlands 195; France 58.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural __________	1,553	1,980	Belgium-Luxembourg 1,098; Switzerland 283; Austria 219.
Coal, coke, briquets:			
Anthracite and bituminous coal thousand tons __	20,249	17,552	France 5,905; Belgium-Luxembourg 3,318; Netherlands 3,253.
Bituminous coal briquets ____ do ____	159	153	Italy 41; France 34; Belgium-Luxembourg 27.
Lignite and lignite briquets __ do ____	1,058	988	France 328; Austria 217; Italy 159.
Peat and peat briquets ______ do ____	201	214	Netherlands 98; Switzerland 41.
Coke and semicoke from coal _ do ____	9,273	9,582	Belgium-Luxembourg 4,301; France 2,865; Netherlands 582.
Carbon black ________________________	46,528	50,168	Netherlands 10,747; France 9,889; Belgium-Luxembourg 7,313.
Gas, natural ___________ thousand tons __	r 287	289	Netherlands 97; Belgium-Luxembourg 85; Denmark 58.
Hydrogen and rare gases ______________	4,282	6,479	France 3,883; United Kingdom 1,288; Belgium-Luxembourg 421.
Petroleum:			
Crude and partly refined thousand tons __	32	121	All to Austria.
Refinery products (including bunkers):			
Gasoline ______________ do ____	1,697	1,168	Switzerland 495; Austria 209; Denmark 111.
Kerosine ______________ do ____	704	755	Bunkers 698; Switzerland 18.
Distillate fuel oil _______ do ____	1,588	1,414	Switzerland 768; bunkers 295.
Residual fuel oil ________ do ____	4,496	3,960	Bunkers 1,516; Netherlands 868; Austria 559.
Lubricants _____________ do ____	292	314	Belgium-Luxembourg 80; Netherlands 46; United Kingdom 40.
Mineral jelly and wax ___ do ____	81	96	Italy 13; Denmark 9; Netherlands 8.
Nonlubricating oils n.e.s. _ do ____	170	20	Republic of South Africa 7; France 3.
Pitch and pitch coke ____ do ____	261	(1)	
Petroleum coke ________ do ____	187	203	Netherlands 48; Italy 46; France 33.
Petroleum and shale oil residues ___________________	8,305	8,090	Netherlands 1,937; France 1,098; Switzerland 1,116.
Bitumen and asphalt mixtures thousand tons __	15	34	Denmark 13; Belgium-Luxembourg 5; Netherlands 4.
Tar, minerals, and other crude chemicals from coal, petroleum, and natural gas _________________________	r 421,184	349,494	Netherlands 138,712; United Kingdom 56,316; France 54,596.

r Revised. NA Not available.

[1] Included elsewhere.

Table 4.—Federal Republic of Germany: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite thousand tons	1,978	2,019	Yugoslavia 571; Australia 542; Sierra Leone 346.
Alumina	48,474	84,416	Guinea 67,858; Surinam 10,083.
Aluminum hydroxide	1,629	1,312	United States 1,195.
Metal including alloys:			
Scrap	67,091	80,717	United States 9,152; Netherlands 5,741; Austria 3,424.
Ingots	292,225	421,776	Norway 130,298; France 69,359; United States 43,465; Surinam 27,604; Netherlands 27,560.
Semimanufactures	69,282	102,089	France 26,501; Belgium-Luxembourg 26,420; Netherlands 18,943.
Antimony:			
Ore and concentrate	3,376	4,378	Turkey 2,310; Bolivia 807; Thailand 532.
Metal, all forms	1,442	1,601	Belgium-Luxembourg 675; mainland China 440; Italy 222.
Arsenic, hydroxide	1,023	959	Belgium-Luxembourg 740; Sweden 90.
Bismuth, all forms	150	236	Peru 46; United Kingdom 35; Netherlands 29.
Cadmium, all forms	1,526	1,753	Belgium-Luxembourg 581; Japan 320; U.S.S.R. 202.
Chromium:			
Chromite	361,329	488,585	Republic of South Africa 197,677; U.S.S.R. 126,938; Turkey 83,248.
Oxides and hydroxides	265	1,445	U.S.S.R. 1,037; Czechoslovakia 230.
Metal, all forms kilograms	236,700	383,500	France 145,300; United Kingdom 110,300; Netherlands 53,700.
Cobalt including alloys, all forms	1,183	1,595	Belgium-Luxembourg 540; Congo (Kinshasa) 284; Finland 242.
Copper:			
Ore and concentrate	206,112	205,802	Chile 84,531; Cyprus 45,915; Nicaragua 21,931.
Matte	1,208	674	United Kingdom 323; Burma 184.
Metal including alloys:			
Scrap	110,624	123,184	United States 20,032; Netherlands 17,537; Canada 16,998; France 14,123.
Unwrought:			
Blister	146,384	145,476	Republic of South Africa 48,716; Chile 25,899; Zambia 24,495.
Refined	323,841	355,944	Chile 106,145; Zambia 68,466; Belgium-Luxembourg 59,140.
Alloys	52,788	61,643	United Kingdom 24,203; Netherlands 5,798; Sweden 4,596.
Master alloys	1,169	1,549	United Kingdom 750; Switzerland 513; United States 130.
Semimanufactures	57,196	75,884	Belgium-Luxembourg 26,540; France 12,586; Netherlands 7,904.
Gold:			
Ashes, residues, and scrap thousand troy ounces	2,002	2,442	Sweden 1,120; Peru 258; France 237.
Metal:			
Unwrought do	4,195	4,018	Republic of South Africa 1,742; Switzerland 1,676; United States 169.
Semimanufactures do	36	75	Switzerland 47; United States 22.
Iron and steel:			
Ore and concentrate:			
Iron ore thousand tons	39,644	43,421	Sweden 15,021; Liberia 6,666; Brazil 6,382.
Roasted pyrites do	1,789	1,635	Spain 664; Belgium-Luxembourg 270; Italy 242.
Metal:			
Spiegeleisen	3,210	778	France 527; U.S.S.R. 203.
Pig iron including cast iron thousand tons	199	165	Canada 49; France 33; Norway 24.
Powder and shot do	19	27	Sweden 11; France 8; United Kingdom 3.
Ferroalloys:			
Ferromanganese do	111	144	France 48; Norway 40; Belgium-Luxembourg 29.
Other do	262	284	Norway 104; Republic of South Africa 42; France 35.
Scrap do	1,644	1,208	Netherlands 500; Belgium-Luxembourg 213; United Kingdom 114.
Steel, primary forms:			
Ingots do	117	173	Netherlands 103; United States 46; Poland 11.
Blooms, billets, and slabs do	538	686	Belgium-Luxembourg 350; Netherlands 234; United States 95.
Coil for rerolling do	789	932	Austria 382; U.S.S.R. 215; Belgium-Luxembourg 126.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and steel—Continued			
Semimanufactures:			
Wire rod ------ thousand tons --	843	725	Belgium-Luxembourg 334; France 271; Netherlands 25.
Other bars and rods ---- do ----	1,171	574	Belgium-Luxembourg 293; France 93; Italy 51.
Sections:			
Large ------------- do ----	489	898	Belgium-Luxembourg 608; France 158.
Small ------------- do ----	r 203		
Plates and sheets:			
Heavy ------------ do ----	1,002	996	Belgium-Luxembourg 411; Austria 163; Sweden 69.
Medium ----------- do ----	226	225	Belgium-Luxembourg 53; France 37; Austria 13.
Thin uncoated ----- do ----	1,462	1,494	Belgium-Luxembourg 491; France 412; Netherlands 200.
Coated:			
Tinned -------- do ----	119	155	France 68; Netherlands 24; Belgium-Luxembourg 17.
Other --------- do ----	109	131	Belgium-Luxembourg 50; United States 31.
Hoop and strip --------- do ----	467	495	Belgium-Luxembourg 341; Netherlands 74; France 57.
Railway track materials - do ----	16	25	Netherlands 11; Belgium-Luxembourg 6.
Wire ----------------- do ----	93	85	Belgium-Luxembourg 39; France 13; Austria 7.
Tubes, pipes, and fittings do ----	228	328	Netherlands 100; Belgium-Luxembourg 60; Italy 44.
Lead:			
Ore and concentrate --------------	249,914	231,747	Ireland 52,990; Sweden 47,617; Canada 38, 519.
Metal and alloys:			
Scrap -----------------------	8,985	20,828	France 6,674; Belgium-Luxembourg 3,788; Netherlands 3,500.
Unwrought -----------------	90,857	112,245	United Kingdom 38,590; Belgium-Luxembourg 14,262; Netherlands 12,106.
Semimanufactures ------------	2,042	2,104	Finland 1,081; Switzerland 605.
Magnesium:			
Oxide and hydroxide --------------	2,976	2,524	United States 1,133; France 633; United Kingdom 626.
Scrap --------------------------	586	1,054	Netherlands 424; Sweden 137; Belgium-Luxembourg 86.
Unwrought ---------------------	41,261	49,027	Norway 22,589; United States 13,855; U.S.S.R. 4,783.
Semimanufactures ---------------	111	230	Netherlands 67; Sweden 51; Belgium-Luxembourg 15.
Manganese:			
Ore and concentrate thousand tons --	r 962	711	Republic of South Africa 464; Gabon 104; U.S.S.R. 29.
Metal, all forms ------------------	4,292	4,889	France 2,256; Republic of South Africa 1,151; Japan 506.
Mercury ------------ 76-pound flasks --	15,133	22,481	Spain 11,632; Italy 4,119; Mexico 3,017.
Molybdenum ------------------------	226	445	Austria 240; U.S.S.R. 66; Netherlands 48.
Nickel:			
Ore and concentrate --------------	NA	187	Turkey 40.
Matte and speiss ----------------	2,596	2,244	Canada 1,614; United Kingdom 264; Belgium-Luxembourg 250.
Metal and alloys:			
Scrap ----------------------	8,719	15,327	United States 7,119; United Kingdom 1,299; Netherlands 1,019.
Unwrought -----------------	31,360	28,415	United Kingdom 7,904; Norway 6,520; U.S.S.R. 5,586.
Semimanufactures -----------	2,188	3,379	United Kingdom 1,067; France 740; United States 736.
Platinum group:			
Ashes, residues, and scrap thousand troy ounces --	3,177	(1)	
Metal, all forms ------------ do ----	688	833	United States 229; U.S.S.R. 204; United Kingdom 156.
Silicon ----------------------------	23,799	29,555	France 10,491; Norway 8,800; Switzerland 3,762.
Silver:			
Ashes, residues, and scrap thousand troy ounces --	15,434	[2] 11,306	Switzerland 2,391; Netherlands 2,075; France 1,841.
Unwrought --------------- do ----	59,991	78,126	NA.
Semimanufactures ---------- do ----	899	2,048	Italy 1,615; France 251; Switzerland 92.
Tantalum, all forms -------- kilograms --	26,547	58,131	United States 35,137; Switzerland 10,837; United Kingdom 2,917.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Thorium, uranium, and rare earth compounds	408	400	France 114; United Kingdom 95; Austria 65.
Tin: Ore and concentrate ____ long tons	7,989	7,655	Bolivia 7,451; Malaysia 202.
Oxides ____ do	148	189	Brazil 31; Italy 29; France 18.
Metal and alloys:			
Scrap ____ do	186	201	Netherlands 87; Switzerland 23; Yugoslavia 21.
Unwrought ____ do	12,383	15,286	Netherlands 3,932; Indonesia 3,805; Malaysia 2,614.
Semimanufactures ____ do	112	141	Netherlands 44; Italy 36; Belgium-Luxembourg 31.
Titanium:			
Ore and concentrate	457,411	616,126	Norway 275,632; Canada 236,508; Australia 82,870.
Oxides	3,077	7,896	Italy 3,005; Netherlands 2,750; France 1,337.
Metal including alloys, all forms	1,323	2,191	U.S.S.R. 1,008; United States 799.
Tungsten:			
Ore and concentrate	5,574	8,943	United States 2,466; Bolivia 1,260; mainland China 1,200.
Metal, all forms	684	751	Sweden 132; France 121; Netherlands 120.
Uranium and thorium:			
Ore	279	5,155	France 5,145.
Metal ____ kilograms	6,000	39,500	France 17,600; United States 14,700; United Kingdom 7,200.
Zinc:			
Ore	236,023	350,588	Canada 209,405; Sweden 45,793; Australia 20,126.
Metal including alloys:			
Scrap	816	966	Denmark 437; Sweden 199; Netherlands 120.
Zinc dust	8,377	11,613	Belgium-Luxembourg 10,428.
Unwrought	187,018	182,475	Belgium-Luxembourg 88,214; Congo (Kinshasa) 19,311; Netherlands 16,242.
Semimanufactures	15,817	15,319	Yugoslavia 9,967; Belgium-Luxembourg 2,485; France 1,836.
Zirconium, all forms ____ kilograms	57,500	123,500	France 82,300; United States 28,100.
Other:			
Nonferrous ore and concentrates n.e.s	1,465	3,696	Bolivia 1,722; United States 1,219; Australia 579.
Metalliferous waste	166,812	176,525	United States 31,367; Spain 24,051; Netherlands 12,673.
Arsenic and tellurium	64	68	Sweden 40; Belgium-Luxembourg 13.
Columbium ____ kilograms	929	3,947	Switzerland 1,751; Belgium-Luxembourg 1,281; United States 864.
Phosphorus and selenium	15,134	15,804	NA.
Pyrophoric alloys	45	63	NA.
NONMETALS			
Abrasives:			
Natural, excluding diamond:			
Diatomite and other siliceous earths	63,417	64,762	Denmark 47,216; France 8,685; United States 7,805.
Manufactured (grinding stones)	2,987	3,923	Austria 948; France 574; Sweden 482.
Artificial:			
Corundum	5,942	10,918	Austria 5,125; France 2,879; Netherlands 1,280.
Silicon carbide	11,377	15,134	Norway 9,864; U.S.S.R. 2,192; Italy 1,553.
Asbestos:			
Crude or partially worked	188,111	164,729	Canada 82,150; U.S.S.R. 29,937; Republic of South Africa 23,712.
Asbestos cement products	107,015	108,133	Belgium-Luxembourg 31,169; Austria 26,353; Sweden 13,572.
Barite and witherite	44,094	60,546	Mainland China 10,132; Turkey 8,480; France 1,198.
Boron salts, natural	102,649	107,775	United States 87,300; Turkey 13,738; Netherlands 6,187.
Boric oxide and acid	13,476	15,936	United States 5,900; France 5,541; Turkey 2,096.
Cement, hydraulic ____ thousand tons	440	532	France 207; Belgium-Luxembourg 134; Switzerland 64.
Chalk ____ do	114	101	France 82; Denmark 13.
Clays, crude:			
Kaolin ____ do	506	543	United Kingdom 343; United States 75; Czechoslovakia 42.
Fire ____ do	214	[3] 241	Czechoslovakia 88; Republic of South Africa 71; France 41.
Andalusite [4] ____ do	[r] 226	248	Netherlands 54; France 35; Belgium-Luxembourg 33.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Cryolite and chiolite	1,548	2,852	Denmark 2,851.
Diamond:			
Gem:			
Crude or rough cut thousand carats	315	310	NA.
Other do	205	260	Belgium-Luxembourg 135; Israel 70; Netherlands 30.
Industrial:			
Stones do	675	755	Belgium-Luxembourg 265; Republic of South Africa 200; Netherlands 195.
Dust including dust of other precious stones do	1,994	3,792	United States 1,292; Netherlands 919; Belgium-Luxembourg 485.
Feldspar	57,647	71,641	Norway 40,566; Italy 14,021; France 8,562.
Fertilizer materials:			
Crude, natural:			
Phosphatic thousand tons	2,588	2,726	United States 1,285; U.S.S.R. 893; Morocco 255.
Nitrogenous	2,213	1,985	All from Chile.
Organic including guano	18,681	17,268	Netherlands 10,825; France 2,749; Peru 2,284.
Manufactured:			
Nitrogenous	249,805	292,332	Belgium-Luxembourg 259,100.
Phosphatic:			
Basic slag	516,413	424,350	Belgium-Luxembourg 393,068; United Kingdom 21,167; Sweden 10,114.
Other	28,525	30,511	United States 19,910; Netherlands 5,342.
Potassic	83,008	88,467	Canada 58,824; France 16,057.
Other	147,056	256,504	Belgium-Luxembourg 218,442; France 34,396.
Ammonia, anhydrous	30,121	242,172	Netherlands 133,586; France 40,478; Belgium-Luxembourg 38,122.
Fluorspar	153,486	163,022	Spain 27,818; Mexico 17,974; Italy 7,579.
Gem stones precious and semiprecious excluding diamond:			
Natural kilograms	r 660,160	1,630,812	Brazil 1,052,154; Republic of South Africa 180,715; Madagascar 66,183.
Manufactured do	21,597	20,699	Switzerland 13,764; France 3,527; United States 2,010.
Graphite, natural	20,937	21,306	Austria 5,494; mainland China 3,291; Madagascar 2,772.
Gypsum	124,002	121,807	Austria 93,984; France 27,003.
Lime hydraulic or slaked	146,708	183,700	France 179,838; Austria 3,147.
Magnesite:			
Crude	1,460	1,351	Austria 528; Netherlands 498; Greenland 316.
Caustic calcined, sintered or fired	399,765	104,417	Austria 51,422; Greenland 27,822; India 7,661.
Magnesite, etc	36,258	35,819	Austria 35,234; Yugoslavia 456.
Mica:			
Crude including splittings and waste	8,101	8,557	India 2,318; Republic of South Africa 2,032; United Kingdom 1,339.
Worked including agglomerated splittings	290	458	France 235; Belgium-Luxembourg 110; India 38.
Pigments:			
Earth colors, natural	3,454	2,746	Austria 1,690; Sierra Leone 774.
Iron oxides and hydroxides	1,408	1,320	France 678; United States 244; Netherlands 169.
Pyrite (gross weight) thousand tons	1,892	1,803	Spain 596; Norway 401; U.S.S.R. 327.
Salt	146,126	177,194	Netherlands 151,931; France 23,783.
Stone, sand and gravel:			
Dimension stone:			
Crude:			
Marble thousand tons	174	218	Italy 67; Austria 60; Portugal 20.
Slate do	7	7	Norway 2; France 1; Italy 1; Portugal 1.
Granite do	507	502	Sweden 193; Denmark 112; Republic of South Africa 65.
Worked:			
Building and monumental stone do	198	236	Italy 205; Spain 9; Switzerland 8.
Paving blocks and flagstone do	143	143	Portugal 91; Poland 18; Romania 11.
Slate do	7	10	Italy 6.
Dolomite do	305	468	Belgium-Luxembourg 301; Austria 134.
Gravel and crushed rock do	10,173	12,015	France 581; Norway 483; Sweden 347.
Limestone except dimension do	1,287	1,372	Austria 1,012; Sweden 195; Belgium-Luxembourg 94.

See footnotes at end of table.

Table 4.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Quartz and quartzite	59,330	67,764	Belgium-Luxembourg 20,418; Sweden 16,207; Yugoslavia 7,924.
Sand excluding metal bearing thousand tons	2,115	2,268	France 1,462; Netherlands 459; Belgium-Luxembourg 287.
Sulfur:			
Elemental do	251	321	United States 166; France 93; Poland 30.
Elemental, collodial	196	483	United States 319; Italy 131.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	19,943	18,117	Trinidad 14,306; United States 3,709.
Carbon black	37,057	39,160	Netherlands 14,328; France 9,204; United States 7,876.
Coal, lignite, peat:			
Anthracite and bituminous thousand tons	5,588	6,340	United States 3,094; United Kingdom 1,388; Poland 563.
Bituminous briquets do	311	448	Netherlands 375; Belgium-Luxembourg 41; France 30.
Lignite and lignite briquets do	1,179	1,170	Czechoslovakia 1,163.
Peat and peat briquets do	27	33	Netherlands 17; Poland 8; Denmark 4.
Coke, except petroleum coke do	353	729	France 313; Belgium-Luxembourg 102; United Kingdom 84.
Gas, natural do	2,313	4,074	Netherlands 3,960; Belgium-Luxembourg 63.
Petroleum:			
Crude and partly refined, including shale oil do	84,071	91,454	Libya 40,483; Saudi Arabia 11,993; Algeria 8,485.
Refinery products:			
Gasoline do	3,597	2,130	Italy 532; France 404; Netherlands 373.
Kerosine do	425	470	Belgium-Luxembourg 166; Netherlands 135; Italy 47.
Distillate fuel oil do	12,569	16,185	Netherlands 4,606; Italy 3,788; France 1,402.
Residual fuel oil do	2,807	3,301	Netherlands 1,496; France 921; bunkers 357.
Lubricants do	174	176	Netherlands 38; Italy 30; United Kingdom 25.
Mineral jelly and wax do	54	83	United States 39; Netherlands 28.
Nonlubricating oils do	170	70	Netherlands 61.
Pitch and pitch coke do	37	(5)	
Petroleum coke do	324	451	United States 445.
Petroleum and shale oil residues do	276	594	Sweden 223; United States 151.
Bitumen and asphalt mixtures do	14	15	Netherlands 10; United Kingdom 3.
Tar, mineral, and other crude chemicals from coal, petroleum, and natural gas	325,328	421,184	Netherlands 126,568; United Kingdom 77,806; United States 57,495.

r Revised. NA Not available.
1 Included with silver ashes, residues, and scrap.
2 Including ashes, residues, and scrap of platinum-group metals.
3 Dinas earth included with andalucite.
4 Includes dinas earth.
5 Included elsewhere.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Aluminum smelters continued to operate at high levels, increasing domestic production of primary aluminum to 309,338 tons, an increase of 17.5 percent over 1969. This significant increase resulted from the start-up of new smelter operations which augmented 1969 production by 46,000 tons. Imports, however, which expanded in 1969 by 44 percent increased in 1970 by only 2.6 percent to 433,318 tons. Consumption of aluminum was approximately 895,000 tons reflecting an increase of only 1.7 percent compared with the growth rates of 22.9 and 22.6 percent respectively, attained in 1968 and 1969.

New smelter capacity in 1970 included 22,000 tons per year from Gebrueder Giulini G.m.b.H. at Ludwigshafen and 45,000 tons per year from the first expansion of the Vereinigte Aluminium Werke (VAW) facility at Norf near Düsseldorf. This expansion increased VAW's annual rated smelter capacity to 245,000 tons, nearly 80 percent of West Germany's total ingot production. Ingot capacity in 1971 may increase by as much as 200,000 tons and if current planned projects are completed, total smelter capacity should total 800,000 tons annually by the end of 1973. At that time over 50 percent of all primary aluminum will be produced in North Rhine-Westphalia with the remainder coming from Northern Germany (Hamburg, Stade) and the South (Toeging, Rheinfelden, Ludwigshafen).

Kaiser-Preussag Aluminium G.m.b.H., a joint venture of Kaiser Aluminum & Chemical Corp. and Preussag A.G., completed its first stage of 64,000 tons per year of aluminum at its smelter in Voerde/Dinslaken and planned to construct a second stage, raising the annual capacity to 128,000 tons to be completed by 1973. Kaiser-Preussag also plans to participate in one of several large alumina projects under consideration.

Leichtmetall G.m.b.H. (LMG), a joint venture of Metallgesellschaft A.G. and Schweizerische Aluminium A.G. (Alusuisse), started production from its first two potlines, with an annual capacity of 84,000 tons, at its Essen smelter. A third potline under construction will increase primary capacity to 126,000 tons per year when completed in 1972. LMG plans to expand the primary metal plant into a fully integrated aluminum complex.

Alusuisse Atlantik G.m.b.H., a new wholly owned subsidiary of Alusuisse, plans to construct and operate a large alumina and chemical complex at Wilhelmshaven. The alumina production plant, with a capacity of 1 million tons per year, is estimated to cost over $275 million and is scheduled for operation in 1975.

VAW began construction of the third stage of its Rheinwerk facilities at Norf. The new addition scheduled for completion late in 1971 will increase aluminum production capacity from 90,000 to 140,000 tons per year. VAW is also constructing a new aluminum smelter in the State Industrial Park near Hamburg. The first stage, scheduled for completion in 1973, will have a capacity of 60,000 tons per year.

Reynolds Aluminium Hamburg G.m.b.H., a joint venture of Reynolds International, Inc. (90 percent interest), and the city of Hamburg (10 percent interest) began construction of a fully integrated aluminum complex in the Hamburg Harbor area in the fall of 1970. The company is building a plant to produce plate and sheet which is scheduled to start production in 1972. Plans call for the construction of additional fabricating facilities for the manufacture of cans and other end products. In addition the company is planning to construct a 100,000-ton-per-year aluminum reduction plant scheduled to start operating in 1973.

Gebrueder Giulini G.m.b.H. of Ludwigshafen, the only family-owned aluminum smelter in the Federal Republic of Germany, completed construction of a $18 million aluminum smelter at Ludwigshafen in September 1969 and started production of primary aluminum in January 1970. The smelter has a rated annual capacity of 22,000 tons and the company plans to expand annual capacity to 44,000 tons by the end of 1972. When the second stage is completed Giulini will supply aluminum in molten form in addition to aluminum ingot.

Recovery of secondary aluminum from new and old scrap, which increased 17 percent in 1969, dropped to 258,461 tons, a decrease of 4.8 percent, in 1970. Imports of secondary aluminum in 1970 were estimated as 25,000 tons and exports amounted to 15,000 tons. Imports of scrap dropped about 17 percent in 1970 to an estimated 66,885 tons.

The 1970 production of rolled and extruded aluminum products dropped 1.7 percent to 554,318 tons, compared with the impressive growth rates of 24.7 and 18.7 percent attained in 1968 and 1969, respectively. Rolled products accounted for 62.5 percent of the total and extruded and drawn products including pressings and forgings for 37.5 percent. Aluminum foundries increased their output from 223,281 tons in 1969 to 235,484 tons in 1970, an increase of 5.5 percent.

Production of aluminum semifabricated and fabricated products in 1969 and 1970, in metric tons follows:

Material	1969	1970
Sheet, strip, disks, and slugs	333,331	317,902
Rods and sections	147,905	153,482
Pipe and tube	23,217	22,806
Wire (small diameter)	4,212	3,706
Electrical conductors	44,311	45,587
Drop and other forgings	10,839	10,835
Total	563,815	554,318

Imports of semifabricated products declined by nearly 10 percent to 81,754 tons and exports dropped 16.3 percent to 85,847 tons.

The Federal Republic received 86,500 tons of the European Economic Community (EEC) annual 1970 import quota of 130,000 tons of primary aluminum for which the import duty was reduced to 5 percent. From the EEC's additional 1970 import quota of 210,000 tons, for which the import duty was fixed at 7 percent, 154,000 tons went to the Federal Republic retroactive to March 31, 1970, when the first allocation was depleted. Effective January 1, 1971, all quotas for primary aluminum were to be abolished and the EEC external tariff rate was to be reduced from 9 to 7 percent.[3]

Iron Ore.—Domestic production of iron ore in 1970 continued the decline recorded in recent years. Iron ore production of 5,532,000 tons was 8.7 percent less than 1969 output. Domestic ore (1,820,000 tons) accounted for only 5.5 percent of the 32,618,000 tons of contained iron in all raw materials consumed in the production of pig iron.

Iron and Steel.—West Germany's steel boom came to an end in 1970. Production of pig iron of 33,627,000 tons and crude steel output of 45,041,000 tons represented only fractional decreases compared with 1969 rates. The 45 million tons of crude steel produced in West Germany in 1970 represented 41 percent of the output of the EEC and 6.9 percent of world production. Both percents are fractionally less than the comparable 1969 rates. Facility additions of about 4 million tons together with stable output resulted in a drop of crude steel capacity utilization rate from 90 percent in 1969 to an estimated 83 percent in 1970. Basic oxygen steel accounted for 56 percent of total crude steel production; open hearth steel for 26 percent; electric furnace steel for 10 percent; and Bessemer steel for 8 percent in 1970.

The bottlenecks in basic mineral supplies, especially coke and ore disappeared in the latter part of 1970, but prices of these materials as well as other purchased goods continued their strong upward trend. The number of man-hours worked in the steel industry remained almost unchanged as a minor increase in the average employment figure was offset by the decline in overtime work and by higher absenteeism. The industry's total wage and salary bill increased by about 21 percent following a 15 percent rise in 1969. Investment expenditures in steel mills which increased from $225 million in 1968 to $310 million in 1969 was estimated to have increased to over $500 million in 1970.

Trade in iron and steel by principal categories in 1970 was as follows, in million tons:

	Imports	Exports
Ferrous scrap	1.4	2.2
Pig iron and ferroalloys	.3	.9
Steel:		
Semifinished steel including coils	2.2	1.7
Finished rolled and forged steel	6.5	9.3
Total steel	8.7	11.0

The export surplus in steel categories continued to decline in 1970 and amounted to about 2.3 million tons compared with 3.2, 4.8, and 6.7 million tons in 1969, 1968, and 1967, respectively. Numerous plant expansions were underway and extensive investment plans were announced by the major West German steelmakers in 1970.

Plant investment by August-Thyssen Huette A.G. (ATH) during the period from October 1969 to September 1970 reached a record $270 million, most of which was used for its iron and steelworks in the Duisberg area. A blast furnace with an annual production capacity of 2 million tons was completed in July 1970 at the Ruhrort works and about $100 million was approved for the new Schwelgern works, where the world's largest blast furnace, 46 feet in diameter and with an annual production capacity of 3 million tons, is under construction. Ore treating facilities have been built at Schwelgern and at the Huettenbetriebe works and a new coking plant was under construction. In addition, a third converter for the Beeckerwerth basic oxygen plant and capacity additions of the hot wide strip mills there and at the Bruckhauser works were completed in 1970.

The expansion of steel rolling capacity by Hoesch A.G. in the Dortmund area absorbed most of its increased expenditure of $82 million in 1970. The company's hot wide strip mill at its Westfalenhuette works was being enlarged from 1.8 to 3.2 million tons. A second cold-rolling mill rated at 1.2 million tons per year was expected to be completed at the end of 1972 and a third similar mill was being con-

[3] U.S. Consulate, Düsseldorf. State Department. Dispatch A-62, Apr. 23, 1971.

structed at the Hohenlimburg works. A new continuous casting plant was being constructed at the Phoenix works and the slabbing mill is being increased from 2.4 to 2.9 million tons per year. The company's plan to build a large integrated steel mill in the Netherlands in cooperation with a Netherlands company was held up pending resolution of environmental problems.

Plant investment by Kloeckner-Werke A.G. during October 1969 to September 1970 totaled $58 million for the gradual extension of the modern steelworks at Bremen. The basic oxygen steel mill was being enlarged to a capacity of 3.1 million tons per year and a 39-foot-diameter blast furnace was planned for addition to the two existing smaller furnaces. The largest individual project is the $100 million hot wide strip mill with an initial production capacity of 3 million tons per year. Another major project is the enlargement of special steel facilities at the Georgsmarienhuette works to about 700,000 tons per year. Most of the new facilities at Bremen are expected to be completed by mid-1972.

Plant investment by Mannesmann A.G. was increased to about $410 million. The largest project is a continuous seamless pipe unit at Muelheim which will be completed at the end of 1972 and which will increase capacity from 20,000 to 54,000 tons per month. The pig-iron production bottleneck will be eliminated at Duisberg-Huckingen by modernizing and expanding the ore sintering facilities and by completion late in 1972 of a new blast furnace with a rated monthly capacity of 120,000 tons. The continuous casting facility has already been increased from 100,000 to 150,000 tons per month and plans were under way to enlarge the basic oxygen steel plant, No. 1, from 180,000 tons to 230,000 tons per month.

A new basic oxygen steel plant at the Heinrichshuette works in Hattingen was completed by Rheinische Stahlwerke in October 1970. The new plant was estimated to cost $15 million and in full production will produce about 1 million tons per year of high-grade carbon steel. The company plans to close the existing six furnaces of its open-hearth plant.

Korf Industrie und Handel G.m.b.K.G. and a U.S. partner, Midland-Ross Corporation, was constructing an ore dressing plant, a steel plant and rolling mill in the Hamburg Harbor area. Upon completion the facility will have a capacity of 450,000 tons of steel per year.[4]

[4] U.S. Consulate, Düsseldorf. State Department Dispatches A-77, 1970; A-72, A-77, and A-83, 1971. U.S. Consulate, Hamburg. State Department Dispatch A-45, 1971.

Table 5.—Federal Republic of Germany: Scrap supply and consumption

(Thousand metric tons)

	1968	1969	1970
Source:			
Iron and steel plants	10,134	10,640	10,096
Foundries	2,479	2,738	2,857
Purchases:			
Domestic	6,945	8,265	8,269
Imported	1,566	1,141	1,384
Other including variation in stock estimates	2,684	2,305	3,224
Total, new supply	[1] 23,807	25,089	25,830
Consumption:			
Iron and steel plants	17,043	18,379	18,439
Iron and steel foundries	4,620	5,088	5,233
Consigned for export	1,825	1,757	2,149
Stocks at yearend	2,071	1,936	1,944

[1] Data may not add to total shown because of independent rounding.

Table 6.—Federal Republic of Germany: Salient statistics of the iron and steel industry

(Thousand metric tons unless otherwise specified)

	1968	1969	1970
PIG IRON			
Producing plants ......number..	25	25	24
Blast furnaces available ......do....	123	110	104
Blast furnaces in operation at yearend ......do....	88	91	80
Maximum production capacity	r 38,000	r 37,000	40,000
Production:			
Thomas	14,248	15,344	13,729
Open hearth	13,929	15,857	17,391
Foundry	279	305	324
Spiegeleisen and blast furnace ferromanganese	328	238	251
Other	1,522	2,020	1,932
Total	30,305	33,764	33,627
Blast furnace charge:			
Iron ore:			
Domestic	1,435	1,525	1,258
Iron content	517	509	443
Imported	14,724	18,548	18,026
Iron content	8,791	11,255	10,882
Sinter and briquets	32,354	34,147	34,858
Iron content	17,859	18,854	19,349
Manganese ore	707	542	508
Iron content	83	72	65
Other iron-bearing materials:			
Slag, scale, cinder, dust	3,356	3,728	3,485
Scrap	499	518	533
Limestone	1,280	1,139	1,209
Phosphate rock	202	186	213
Coke:			
Total	17,546	19,038	18,787
Kilograms per ton of pig iron produced	577	563	558
STEEL			
Converters:			
Basic Bessemer:			
Total ......number..	43	34	18
In operation at end of year ......do....	36	29	18
Oxygen:			
Total ......do....	31	34	43
In operation at end of year ......do....	26	25	31
Furnaces:			
Open hearth:			
Total ......do....	134	121	114
In operation at end of year ......do....	95	92	79
Electric:			
Total ......do....	185	183	176
In operation at end of year ......do....	172	165	151
Maximum production capacity (all furnaces)	r 48,000	r 51,000	54,000
Production of crude steel:			
Basic Bessemer	7,664	6,807	3,640
Oxygen	15,258	r 20,838	25,136
Open hearth	14,544	13,515	11,819
Electric	3,684	4,146	4,436
Other	10	10	9
Total	[1] 41,159	45,316	[1] 45,041
Ingots	40,526	44,599	44,317
Liquid steel for castings	633	717	725
Furnace feed for ingot steel:			
Pig iron:			
Total	27,722	30,860	30,469
Kilograms per ton crude steel	(684)	(692)	(688)
Scrap:			
Total	16,536	17,855	17,882
Kilograms per ton crude steel	(408)	(400)	(404)
Preblown Thomas and other presmelted steels	17	r 52	120
Ferroalloys and alloying metals	354	409	435
Other iron bearing materials	972	1,113	1,152
Iron and manganese ores	1,010	990	879
Total iron-bearing materials	[1] 46,612	51,279	50,937
Limestone	3,113	3,379	3,309
CASTINGS			
Iron and steel foundries in operation ......number..	881	NA	NA
Production of iron and steel castings	4,156	4,659	4,877

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)

	1968	1969	1970
CASTINGS—Continued			
Consumption of raw materials:			
Pig iron	1,790	2,101	2,269
Scrap	4,620	5,088	5,233
Ferroalloys and other metals	77	83	102
Total	[1] 6,485	7,272	7,604
EMPLOYMENT			
In coking plants of smelters persons	1,892	2,196	2,834
Blast furnace, steel mills, hammer and forge shops do	364,870	371,622	374,428
Foundries do	149,167	NA	NA

r Revised. NA Not available.
[1] Data may not add to total shown because of independent rounding.

Table 7.—Federal Republic of Germany: Raw materials consumed in the production of pig iron

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970
Iron ore:			
Domestic	6,310	5,980	5,752
Imported	37,721	43,325	43,732
Total	44,031	49,305	49,484
Manganese ore	851	665	702
Pyrite cinder	3,907	3,879	3,663
Slags and plant scales	5,589	6,322	6,130
Blast furnace dust	1,492	1,687	1,635
Scrap	500	518	533
Total metallic raw materials (gross weight)	[1] 56,369	62,376	62,147
Iron content of total metallic raw materials:			
Iron ore:			
Domestic	2,011	1,916	1,820
Imported	21,517	24,853	25,205
Manganese ore	94	77	75
Pyrite cinder	1,919	1,894	1,789
Slags and plant scales	2,240	2,730	2,687
Blast furnace dust	542	629	621
Scrap	414	412	421
Total iron content	28,737	32,511	32,618
Limestone	3,108	3,425	3,844
Per ton of product	103	101	114
Phosphate	204	186	213
Total gross weight of metallic raw materials, limestone, and phosphate	59,681	65,987	NA
Coke	17,546	19,038	18,787

NA Not available.
[1] Data may not add to total shown because of independent rounding.

Table 8.—Federal Republic of Germany: Production and consumption of sinter

(Thousand metric tons unless otherwise specified)

	1968	1969	1970
Production:			
Gross weight	32,280	34,159	35,008
Iron content	17,839	18,882	19,459
Consumption of raw materials:			
Iron ore	28,016	29,353	30,394
Cinder	3,860	3,840	3,624
Slags and scale	2,285	2,635	2,684
Blast furnace dust	1,487	1,686	1,635
Limestone	1,828	4,286	NA
Iron content of materials consumed:			
Iron ore	14,231	15,010	15,710
Cinder	1,909	1,885	1,781
Slag and scale	1,202	1,425	1,487
Blast furnace dust	540	628	621
Total	17,882	18,948	19,599

NA Not available.

Table 9.—Federal Republic of Germany: Production of finished steel

(Thousand metric tons)

	1968	1969	1970
Wire rods	3,122	3,394	3,520
Bars and rods	5,563	6,306	6,315
Angles, shapes, sections (excluding rails)	2,155	2,423	4,639
Universal plates	465	565	524
Other heavy plates and sheets (more than 4.75 millimeters thick)	4,025	4,671	4,786
Medium plates and sheets (3 to 4.75 millimeters)	521	643	533
Thin plates and sheets (less than 3 millimeters)	6,199	6,937	6,860
Hot rolled strip including skelp	2,642	3,075	2,793
Hot rolled wide strip	2,013	1,993	2,121
Rails and railway track material	374	445	511
Seamless steel tubes	1,618	1,794	1,810
Total finished steel	28,697	[1] 32,247	34,412
Selected semimanufactures:			
Tin plate	626	720	749
Galvanized and ternplate	893	1,000	1,003
Steel pipe welded	1,222	1,556	1,584
Extrusions and forgings	600	677	688
Steel castings	325	378	391

[1] Data may not add to total shown because of independent rounding.

Uranium.—A contract for the delivery by April 1971 of 208 tons of uranium enriched in the United States was signed by the Federal Ministry for Education and Science. The contract partners are the United States Atomic Energy Commission, the European Atomic Energy Community (EURATOM) procurement agency, and the Federal Republic of Germany represented by the Nuclear, Chemical and Metallurgic Corporation (NUKEM) in Hanau. The cost of the enrichment amounts to about $27.3 million. Another $27.3 million will be needed for costs of natural uranium, transportation, etc.

An agreement signed in July 1969, concerning the settlement of the foreign exchange costs for the U.S. military forces in Germany, provides, among other points, that the Federal Republic of Germany, through EURATOM's procurement agency, will procure enriched uranium worth $54.6 million for storage in Germany. The Federal Minister for Education and Science had charged the NUKEM/Uranium Mining Corp./Uranium Corp. (Uranerzbergbaugesellshaft/Urangesellschaft) with the implementation of the agreement.

With the procurement of the enriched uranium, the Federal Republic made provision for the continuation of the German nuclear reactor program and in the long run, especially, for guaranteed supplies for German nuclear powerplants. Drawing on supplies is permitted not only for meeting emergency requirements of German nuclear powerplants but also for meeting emergency situations in other EURATOM countries.[5]

Zinc.—Preussag, A.G., and a French company, Peñarroya, announced the formation of a new company, Preussag Weser Zink, G.m.b.H., with Preussag having a 75-percent interest and Peñarroya owning the remaining 25 percent. Peñarroya, with sales of $200 million in 1968, specializes in nonferrous metals. Preussag, with sales of about $450 million in 1970, accounts for about one-half of the Federal Republic's lead and zinc production and also is a large producer of light, rare, and high-purity metals, oil and gas, coal, and chemicals. Preussag also has significant projects under way in the alluvial and marine mining sectors to develop new sources for world metal supplies. The new zinc smelting plant to be located at Preussag's Weser River facilities will cost about $30 million and have an initial annual capacity of 90,000 tons when operations start in 1972.

NONMETALS

Potash.—Production by the West German potash industry in 1970 was 2.306 million metric tons valued at $118.8 million, virtually the same as in 1969. Exports of potash in 1970 were 1.033 million tons, also about the same as in the previous year. Export prices strengthened with the introduction of the Canadian prorationing plan, which provided for limited capacity utilization in Saskatchewan and a fixed Canadian price, resulting in stability in the world potash market. Despite the intense competition of recent years, production by the West German potash industry continued to increase slightly and domestic con-

[5] U.S. Embassy, Bonn. State Department Dispatch A-914, Aug. 7, 1970.

sumption also increased after a decline in 1968 when a value added tax was imposed. Western European markets continued to absorb more than one-half of the potash exports. Sales to Eastern Europe, all to Poland, remained at about 170,000 tons per year. Shipments to North America have decreased; however, South America is an expanding market.

An important development in 1970 was the integration of the German potash industry. Wintershall A.G. of Celle/Kassel and Salzdetfurth A.G. of Hannover, combined their potash and rock salt interests under the management of their jointly owned company, Gesellschaft fuer Kali—Interessen m.b.H., Kassel, which was renamed Kali-und Salz G.m.b.H. (K&S) with its headquarters in Kassel. Plans were underway at the end of 1970 to incorporate the West German potash industry's sales organization, Verkaufsgemeinschaft Deutscher Kaliwerke G.m.b.H., of Hannover into K&S. The new entity will continue to handle all West German potash sales, as well as sales of other mineral products of K&S including rock salt, magnesium salts and other chemicals. The new potash and rock salt mining unit was created to facilitate modernization of operations and strengthen the company's position in the competitive potash market. Based on past performances of Wintershall and Salzdetfurth, the new unit will account for 85 percent of the country's annual potash production. Sales of the combined companies are expected to total over $215 million in 1971. The remaining 15 percent of potash production is held by Kali Chemie A.G., Hannover, which is controlled by Deutsche Solvay-Werke G.m.b.H., Solingen.

Sulfur.—Germany produced a total of 418,007 tons of contained sulfur in 1970, an increase of 22,566 tons above 1969 production. Sulfur production, consumption, and trade in tons were as follows:

	1969	1970	Percentage change
From pyrites:			
Production	266,370	242,137	−9.1
Consumption [1]	1,050,210	972,242	−7.4
Imports	783,942	730,226	−6.9
Exports	102	121	+18.6
From other sources:			
Production	129,071	175,870	+36.3
Consumption [1]	413,988	432,253	+4.4
Imports	320,751	291,518	−9.1
Exports	35,834	34,135	−4.7

[1] Computed without considering stockpiles.
Source: Federal Statistical Office, Wiesbaden; Metallgesellschaft A. G., Frankfurt; and Farbenfabriken Bayer A. G., Leverkusen.

Sulfur production in 1970 was influenced by excess worldwide supplies and by declining domestic prices. Sulfur imports and production of sulfur from pyrites will be reduced significantly in the future with the start of large byproduct hydrogen sulfide operations from natural gas reserves in lower Saxony. Sulfur production from these reserves will total 750,000 tons per year by 1975.

Exploration of natural gas reserves and construction of sulfur extraction plants is the responsibility of Norddeutsche Erdgas Aufbereitungs G.m.b.H. (NEAG) of Hannover, equally owned by Mobil Oil A.G. of Hamburg and Gewerkschaft Elwerath of Hannover. In 1970 the initial two stages of the companies extraction facilities in Sulingen, in the Diepholz area (NEAG plants I and II) produced 360 tons of sulfur per day, or an estimated 85,000 tons for the entire year. Production from these companies is expected to increase to 100,000 tons in 1971. A third stage (NEAG III), with an additional annual capacity of 170,000 tons, was scheduled for completion in the fall of 1972. Another planned expansion stage (NEAG IV) will increase the total capacity of the company's sulfur producing facilities to over 400,000 tons per year by the end of 1975. Sulfur extraction facilities are also being constructed in Grossenkneten, south of Oldenburg, by Gewerkschaft Brigitta, Hannover, and Mobil Oil A.G. Construction has started on a plant with an initial capacity of 40,000 tons by the fall of 1972 (Grossenkneten I). Subsequent to operating the first stage, production will be increased to 170,000 tons by the end of 1973. Further expansion (Grossenkneten II) scheduled for the end of 1974 or early in 1975 will increase total production capacity of the company to 350,000 tons per year.[6]

MINERAL FUELS

Energy consumption in 1970 increased 8 percent to 340.7 million tons of standard coal equivalent (SCE). Petroleum continued to account for more than half the consumption of primary energy. The shares of the different energy sources and

[6] U.S. Consulate, Düsseldorf. State Department Dispatch A-73, Apr. 28, 1971.

the corresponding 1969 figures were as follows:

Energy source	Percent of total primary energy consumption	
	1969	1970
Bituminous coal and anthracite	32.3	29.2
Lignite	9.5	9.3
Petroleum	50.9	52.6
Natural gas	4.2	5.7
Hydroelectricity	2.1	2.1
Nuclear energy	.5	.6
Other	.5	.5
Total	100.0	100.0

Coal's share in the total consumption of energy continued to fall. In 1970 it amounted to less than one-third compared with more than two-thirds in 1956.

Coal.—Coal production in West Germany in 1970 was 111.3 million tons compared with 111.6 million tons in 1969. Coal sales of 115 million tons in 1970 again exceeded output, resulting in a large reduction of stocks at the pit head. Data covering the coal and lignite industry are shown in table 10.

Table 10.—Federal Republic of Germany: Coal and lignite industry

(Production, productivity, and employment)

	1968	1969	1970
BITUMINOUS AND ANTHRACITE			
Production: [1]			
Ruhr ... million tons	91.0	91.2	91.0
Saar ... do	11.3	11.1	10.6
Aachen ... do	7.3	6.7	6.9
Lower Saxony ... do	2.4	2.6	2.8
Total ... do	112.0	111.6	111.3
Output per man-shift:			
Ruhr:			
Underground ... kilograms	3,644	3,774	3,843
Total mining ... do	2,872	2,986	3,068
Federal Republic average:			
Underground ... do	3,526	3,665	3,755
Total mining ... do	2,794	2,913	3,001
Employment:			
Ruhr:			
Underground ... thousand persons	117.5	111.0	109.2
Mine surface ... do	32.9	31.6	31.5
Cleaning ... do	17.2	15.8	12.8
Total including other workers and salaried employees ... do	216.1	206.0	198.9
Federal Republic total:			
Underground ... do	150.6	140.6	137.7
Mine surface ... do	40.6	38.6	38.4
Cleaning ... do	20.6	19.1	16.1
Total including other workers and salaried employees ... do	272.2	257.7	249.7
LIGNITE AND SUBBITUMINOUS			
Production:			
Rhineland ... million tons	87.9	92.7	93.0
Helmstedt, Hesse, and Bavaria ... do	13.6	14.7	14.7
Total ... do	101.5	107.4	[2] 107.8
Employment:			
Rhineland:			
Open pit ... thousand persons	7.4	6.5	4.7
All other ... do	10.9	10.5	11.4
Total ... do	18.3	17.0	16.1
Helmstedt, Hesse, and Bavaria ... do	7.9	7.4	7.0
Total ... do	26.2	24.4	23.1
PITCH COAL			
Production ... million tons	.8	.8	.7
Employment ... thousand persons	2.3	1.9	1.4

[1] Excludes small mines and leases.
[2] Data may not add to total shown because of independent rounding.

The principal users of coal continued to be the power industry with consumption of 36 million tons and the iron and steel industry with consumption of 25 million tons.

In 1970 coal mines with a daily salable output of 6,000 tons or over accounted for slightly under three-fourths of the output and the average production of all mines reached 6,500 tons per day.

The reorganization of the coal mining industry initiated by establishment of the Ruhrkohle-Aktiengesellschaft was completed in 1970. The last two coal mines, Sophia Jacoba and Auguste Victoria, which had not been included in one of the four parent companies (Ruhrkohle A.G., Saarbergwerke A.G., Eschweiler Bergwerks-Verein, and Preussag A.G.), concluded agreements with the appropriate parent company thereby making possible the uniform planning of production, investments, sales, and employment.

Under the consolidation program of Ruhrkohle A.G., a number of mines will be closed and some of the more efficient operations will be expanded, however, total annual production will be reduced by about 5 million tons over the next 5 years. The principal features of the program include raising total production of about 13 of the most productive mines by 7.5 to 9.5 million tons per year by complete utilization of available capacity or by capacity expansion. Also nine pits will be consolidated to form four large efficient operating units, and 10 marginal pits or pits approaching exhaustion, with present total coal production of 13 to 14 million tons per year, will be closed by 1975. The management of Ruhrkohle A.G. announced that the above measures will result in a decrease of annual coal production from 85 million tons in 1970 to an estimated 80 million tons in 1976. Further reductions in production will be dependent on market conditions.

Lignite.—Production of lignite in 1970 was 107.8 million tons and represented a slight increase of only 0.4 million tons over 1969. Lignite accounted for 40 percent of power generation in public powerstations in 1970.

Increased production at the largest lignite mine (Fortuna open pit mine) is planned and orders were placed for excavators, belt conveyors, and spoil disposal machines. Increased production of lignite to about 125 million tons per year may be obtained in the future and it appears that lignite will continue to remain a competitive energy source for power generation for a long time. Technical progress in the Rhenish open pit mines is permitting the extraction of deeper-lying coal, and it was reported that total reserves of 55,000 million tons of lignite in open pit mines up to a depth of 600 meters can be economically recovered.

Natural Gas.—Natural gas production increased by 46 percent from 8.2 billion cubic meters in 1969 to almost 12 billion cubic meters in 1970. Another 680 million cubic meters were obtained from oilfields as a byproduct, 6 percent less than in 1969. Home production provided about two-thirds of domestic natural gas consumption with the remainder, 5.5 billion cubic meters, being imported chiefly from the Netherlands. West German proven and probable reserves of natural gas in 1970 were estimated at 395 billion cubic meters of which 293 billion were classified as proven and 102 billion as probable. The sharp increase in natural gas production in 1970 represents a significant energy advance for West Germany. This trend in natural gas production was expected to continue during the next few years.

Petroleum.—West Germany continued in 1970 to be the largest consumer of crude oil and petroleum products in Western Europe. The Federal Republic of Germany continued to rank first, as it has for a number of years, among West European crude oil producing countries. Although slightly under the 1969 level, imports rose about 13 percent.

A total of 7,535,221 metric tons of crude oil was produced in 1970, a decrease of 4.3 percent under 1969 production. The decreased production was attributed to the failure of production from new discoveries to balance the decrease resulting from the exhaustion of older fields. The steady decrease in crude oil prices over past years was also believed to be a factor. A Petroleum Producers' Association study estimated that as of December 31, 1970, West German proven and probable petroleum reserves had increased to 81 million metric tons with the proven reserves estimated as 57 million tons and probable as 24 million tons. The main area that was more favorably rated was the region between the Weser and the Ems, in which the prolific

Gross Lessen oilfield was discovered in 1969.

West German oil consumption (including the refineries own consumption) increased 12 percent, from 109 million metric tons in 1969 to 122.1 million metric tons in 1970. Consumption was expected to continue to increase in the coming decades.

Refineries in West Germany processed a total of 105,547,818 metric tons of crude oil in 1970, consisting of 7,330,957 tons of domestic and 98,216,861 tons of foreign crude oil. A total of 104,566,429 metric tons of finished petroleum products was produced, representing an increase of 8.6 million tons or 9 percent above 1969 production. Refinery capacity in 1970 was estimated at 112.5 million tons, which was not sufficient to meet future West German requirements. The growth rate of refinery production in 1970 was below the rate at which petroleum consumption increased thereby necessitating increased imports of finished products.

During 1970 West German refineries received a total of 98.8 million tons of foreign crude oil imported through foreign and domestic ocean terminals. A total of 81 percent was brought in through large crude oil pipelines and 19 percent was discharged directly at the processing plants located in the receiving ports or transported to inland refineries by inland tankers or rail tankcars.

The Federal Government initiated action in 1970 to increase its permanently accessible stocks of crude oil from 65 to 90 days requirements. The cheapest and safest storage method was determined to be in underground storage caverns.

The Nord-West Kavernengesellschaft m.b.H. (NWKG), which was founded by Esso A.G., BP Benzin und Petroleum, A.G., Union Kraftstoff Wesseling, Veba-Chemie A.G. and Fina to construct and operate underground storage facilities near the terminal of the Nord-West Oelleitung (NWO) pipeline, has completed and filled seven of the 10 caverns planned for the first construction stage of the underground facilities in the Ruestringen salt domes near Wilhelmshaven. The caverns will have a total capacity of 2 million cubic meters. Plans were made to start drilling in 1971 for the first three caverns in the second construction stage, which calls for 10 additional caverns with a capacity of 150,000 cubic meters each. Upon completion of the entire project in 1974, a total of 5.5 million cubic meters underground storage facilities will be available. The Federal Government also plans its own reserve facilities in North Germany for 10 million tons of crude oil. The throughput capacity of the NWO pipeline at Wilhelmshaven was increased to 24.5 million tons in 1970. This increase of 4 million tons in the pipelines throughput capacity required investments of almost $10 million.

West German exports of petroleum in 1970 increased 13 percent to a total of 8.5 million tons. Heavy fuel oil continued to be the most important petroleum export, and it increased by 15.3 percent, with Greece being the leading importer. Naphtha, which was the second largest petroleum export, increased by about 50 percent, and light fuel oil increased by 38.6 percent compared with that of 1969. England was the largest market for naphtha, and Switzerland led in the purchase of light fuel oil.

In 1970 West Germany imported 129.8 million tons of crude oil and petroleum products, an increase of 13 percent over 1969. The eastern bloc, excluding East Germany and Yugoslavia, provided 5.3 percent of total imports, and deliveries from East Germany amounted to 803,524 metric tons. More than four-fifths of West Germany's overall oil imports in 1970 consisted of crude oil, which totaled 98,786,448 metric tons, an increase of 10.3 percent above that of 1969. Libya continued to be the leading crude oil supplier with Saudi Arabia in second place, followed by Iran, Algeria, Nigeria, Abu Dhabi, and Kuwait. Over 50 percent of the processed petroleum products imported by West Germany during 1970 was accounted for by light heating oil, totaling 16,395,954 tons. Heavy fuel oil imports increased by 3 percent above those of 1969 and amounted to 3,293,694 tons. The Netherlands, Italy, and the Soviet Union were the main suppliers of light fuel oil, while most of the heavy heating oil imports came from the Netherlands and France.

Following time-consuming and difficult negotiations, a contract was signed in September 1970 between West Germany, Denmark, and the Netherlands according to which about 12,000 square kilometers of North Sea Shelf will be separated from the original exploration region of the other countries in favor of Germany, thereby increasing the German shelf region to more than 35,000 square kilometers.

Widespread exploration activities were undertaken in 1970 by the Deminex Group, consisting of eight German companies, for common oil and gas search abroad with financial aid from the Government. Exclusively or together with foreign partners, Deminex received concessions in Canada, Indonesia, Guyana, Trinidad, and Nigeria and has started negotiations with the Governments of Iran and Venezuela. Deminex also continued activities in Jordan, where a concession was gained in 1969. No gas or oil find was made in 1970; however, most activities were not scheduled to start until mid-1971.

About 175,000 meters were drilled in Germany in 1970, almost 20 percent less than in 1969; however, the rate of oil and gas discoveries was very high. From 60 wells completed by November, 32 struck oil or gas. Most of the drilling was directed at natural gas; however, some of the extension drilling struck oil. The majority of drilling took place between the Weser and Ems Rivers where the most successful discoveries were made.[7]

[7] Mining Journal (London). Mining Annual Review. June 1971, pp. 451–452. U.S. Consulate, Hamburg. State Department Dispatch A-43, May 24, 1971. World Petroleum. World Petroleum Report 1971. V. 17, pp. 92–94.

Table 11.—Federal Republic of Germany: Petroleum and natural gas production by areas

Area	1968	1969	1970
PETROLEUM (THOUSAND TONS)			
North German basin:			
North of Elbe (Schleswig-Holstein)	893	883	800
Between Elbe and Weser	2,407	2,360	2,247
Between Weser and Ems	1,945	1,954	1,891
Ems Estuary	--	--	2
West of Ems (Emsland)	2,112	2,092	2,002
Upper Rhine Valley	192	189	199
Alpine Foreland (Bavaria)	433	398	393
Total	7,982	7,876	[1] 7,535
NATURAL GAS (MILLION CUBIC METERS)			
Between Elbe and Weser (Hannover)	63	62	69
Between Weser and Ems (Hannover)	3,250	4,336	5,906
Ems Estuary	1,118	2,050	3,611
West of Ems (Emsland)	715	883	1,280
Upper Rhine Valley	48	34	26
Alpine Foreland (Bavaria)	592	823	1,084
Total	5,786	[1] 8,187	[1] 11,977

[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	1968	1969	1970
Domestic sales:			
Gasoline, all kinds	17,054	18,213	19,548
Kerosine including turbofuel	1,232	1,421	1,781
Diesel oil	8,488	8,744	9,640
Fuel oils	53,319	61,892	69,983
Liquefied petroleum gas	1,834	2,035	2,203
Lube oil and greases	891	976	1,087
Petroleum coke	340	543	973
Bitumen	4,315	4,397	4,730
Refinery gases	2,302	2,593	2,571
Other products	882	1,270	2,040
Total [1]	90,656	102,083	114,411
Consumption by refineries:			
Fuel oil	3,752	4,271	4,544
Refinery gas	2,173	2,390	2,896
Petroleum coke	224	212	230
Total [1]	6,149	6,874	7,671
Bunker deliveries:			
Gas and diesel oil	883	880	846
Fuel oil	2,857	3,146	2,882
Lubricants	37	37	44
Total [1]	3,727	4,063	3,773
Exports	7,841	7,478	8,453
Other shipments	1,272	1,451	1,624
Changes in refinery stock	+1,085	+399	+335
Balancing factor [2]	+79	−273	+656
Total products available	110,809	122,075	136,923

[1] Data may not add to totals shown because of independent rounding.
[2] Apparently changes in nonrefinery stocks.

The Mineral Industry of Ghana

By Henry E. Stipp[1]

Activity in the mineral industry consisted mainly of aluminum, gold, diamond, bauxite, and manganese ore production. The minerals industry accounted for only about 5 percent of the gross domestic product of $2,546 million[2] in 1970. Approximately 24,250 persons were employed by mining companies out of a total employment of about 390,000 persons.

In January, the Bank of Ghana established a credit guarantee plan to assist small Ghanaian firms, including mining businesses, with an original investment in plant and machinery not exceeding $49,000. The Government of Ghana reported that new procedures and legislation to increase gold and diamond production and encourage foreign enterprises to exploit bauxite resources would be adopted. Also the Government announced it would not nationalize private mines operating in Ghana. However, a policy of increasing Government participation in mineral industry activity through negotiation would be initiated.

The Petroleum Division of the Ministry of Lands and Mineral Resources, a Government agency, was scheduled for expansion because of increasing oil activity.

PRODUCTION

Ghana's mineral commodity output generally increased in 1970 compared with that of 1969. However, the value of mineral production decreased slightly to an estimated $120.6 million compared with $120.9 million in 1969. Lower prices for diamonds and manganese ore in world markets contributed to the decrease in overall mineral production value. Output of the following commodities increased: Manganese, 22 percent; bauxite, 10 percent; diamond, 6 percent; and cement, 4 percent. Production of gold declined about 0.4 percent. The largest decrease in output was recorded for salt, down 55 percent. The major commodities, valuewise, continued to be aluminum, $63.5 million; gold, $24.5 million; diamond, $12.6 million; and manganese ore, $7.0 million.

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[1] Physical scientist, Division of Ferrous Metals.

[2] Where necessary, values have been converted from Ghanaian currency to U.S. dollars at the rate of 1 new Ghana cedi = US$0.98.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite	284,705	269,502	296,719
Metal smelter production	108,902	113,109	113,039
Gold thousand troy ounces	r 740	707	704
Iron and steel semimanufactures e	12,000	7,360	NA
Manganese ore and concentrate	413,329	332,756	405,364
Silver troy ounces	-------	2,649	NA
NONMETALS			
Cement	230,440	407,513	422,487
Diamond			
Gem e thousand carats	245	239	252
Industrial e do	2,202	2,152	2,271
Total do	2,447	2,391	2,523
Salt	e 29,000	35,923	16,123
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	1,185	1,353	1,349
Kerosine do	457	474	550
Distillate fuel oil do	1,456	1,613	1,819
Residual fuel oil do	2,012	2,305	1,982
Other do	39	37	50
Refinery fuel and losses do	408	300	332
Total do	5,557	6,082	6,082

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

[1] In addition to the listed commodities, a variety of crude construction materials is undoubtedly produced for local use, but no data on such production are available.

TRADE

Foreign mineral commodity trade in 1969 consisted mainly of exports of aluminum, valued at $43.0 million; gold, valued at $25.2 million; diamond, valued at $13.6 million; manganese ore and concentrate, valued at $7.0 million; residual fuel oil valued at $2.0 million; and bauxite, valued at $1.6 million. In 1968 exports of these commodities were valued at $26.2 million, $25.3 million, $17.1 million, $10.5 million, $1.6 million, and $1.5 million, respectively. The value of total exports and reexports in 1969 was $326.6 million, compared with $332.0 million in 1968. Destinations of mineral commodities are shown in table 2.

Table 2.—Ghana: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite and concentrate	241,000	287,968	All to United Kingdom.
Metal including alloys, unwrought	76,705	126,090	United Kingdom 32,975; Japan 26,387; Netherlands 24,212.
Gold bullion thousand troy ounces	735	713	All to United Kingdom.
Iron and steel:			
Ore and concentrate	-------	611	Do.
Semimanufactures	-------	607	Do.
Scrap	-------	2,486	Do.
Manganese ore and concentrate	445,900	329,401	Norway 134,169; United States 73,177; Spain 32,728.
Nonferrous metal scrap n.e.s	3,105	716	United Kingdom 583; West Germany 67; Belgium-Luxembourg 66.
NONMETALS			
Diamond, all grades thousand carats	2,997	2,477	United Kingdom 1,548; Belgium-Luxembourg 531; Netherlands 367.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	-------	(1)	Mainly to Liberia.
Refinery products, residual fuel oil do	1,379	1,821	Sweden 1,296; Senegal 385.

[1] Less than ½ unit.

Source: External Trade Statistics of Ghana, 1968. V. 18, No. 12, 252 pp. External Trade Statistics of Ghana, 1969. V. 19, No. 12, 252 pp.

Imports of mineral commodities in 1969 were mainly aluminum oxide, valued at $14.7 million; crude petroleum, valued at $14.2 million; petroleum refinery products, valued at $7.9 million; iron and steel semimanufactures, valued at $7.7 million; and cement products, valued at $4.2 million. Mineral imports in 1968 were valued at $17.0 million, $13.4 million, $7.5 million, $5.8 million, and $3.9 million, respectively. The value of total imports in 1969 was $347.3 million and $307.8 million in 1968.

Table 3.—Ghana: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	691,744	209,781
Metal:		
Unwrought	237	168
Semimanufactures	1,865	2,019
Copper including alloys, all forms	464	614
Gold unworked and partly worked ... troy ounces	2,500	-------
Iron and steel:		
Scrap	-------	2,069
Pig iron, ferroalloys, etc	1,399	501
Steel, primary forms	122	415
Semimanufactures	38,240	36,937
Lead including alloys, all forms	160	274
Magnesium and beryllium, all forms	45	5,521
Platinum-group:		
Waste and sweepings ... troy ounces	32,668	-------
Metal, all forms ... do	20,327	-------
Tin, all forms ... long tons	107	250
Zinc, all forms	36	1,992
Other n.e.s.:		
Ores and concentrates	24	13
Scrap	17	36
Metal including alloys	20	62
NONMETALS		
Abrasives, natural:		
Pumice, emery, natural corundum	18	17
Grinding and polishing wheels and stones	1,122	354
Asbestos	-------	56
Cement:		
Clinker	249,946	395,145
Portland	84,910	5,124
Chalk	25	33
Clays and products (including refractory):		
Clays n.e.s	378	1,300
Products	2,474	7,520
Diatomite and other infusorial earths	(1)	(1)
Fertilizer materials:		
Crude	351	616
Manufactured	5,011	6,235
Gypsum and plasters	7,764	18,961
Lime	3,560	3,167
Salt and brines	432	1,628
Sodium and potassium compounds, caustic soda	6,967	4,406
Stone, sand and gravel	1,252	1,167
Sulfur:		
Sulfur and unroasted iron pyrites	50	90
Sulfuric acid	867	902
Talc, steatite, and pyrophyllite	3,159	368
Other n.e.s., mica, meerschaum, amber jet	53	(2)
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke including briquets ... thousand tons	[3] 23	18
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	6,270	5,467
Refinery products:		
Gasoline ... do	78	16
Kerosine and jet fuel ... do	147	332
Distillate fuel oil ... do	50	(4)
Lubricants ... do	105	111
Other ... do	454	310

[1] Unspecified quantity valued at $29,146 (1968) and $28,588 (1969).
[2] Unspecified quantity valued at $456.
[3] Adjusted by Bureau of Mines.
[4] Less than ½ unit.

Source: External Trade Statistics of Ghana, 1968. V. 18, No. 12, 252 pp. External Trade Statistics of Ghana 1969. V. 19, No. 12, 252 pp.

COMMODITY REVIEW

METALS

Aluminum.—Volta Aluminum Co., Ltd. (VALCO) was adding a fourth potline and a carbon bake compressed air storage facility to its smelter at Tema.[3] The expansion will increase production capacity by 32 percent from 110,000 tons to 145,000 tons per year.

Bauxite.—Reportedly, more than 88 million tons of high-quality bauxite have been found at Kibi.[4] An additional 130 million to 140 million tons was indicated. Deposits also occur near Awaso, Nyenahin, and Cjuamena. The Government has been trying to interest foreign firms in developing these bauxite resources. A group of technicians from Japan's Light Metal Smelters Association was conducting a survey of Ghana's bauxite resources and preparing a feasibility report on establishing an alumina plant in Ghana.[5]

A proposal to develop Ghana's bauxite resources into an integrated aluminum industrial complex was submitted to the Government by a consortium of foreign firms.[6] The consortium of firms from Canada, Romania, Netherlands, and Ghana, would be represented in Ghana by a holding firm, Ghana Bauxite and Aluminum Co.

Gold.—The Ashanti Goldfield Corp. Ltd., a subsidiary of London and Rhodesia Mining and Land Corp., completed installation of a new shaft at its mine near Obuasi.[7] Construction of the shaft was part of a 5-year expansion program scheduled to cost $9.8 million. Up to September 1970 the Ashanti mine milled 620,000 tons of ore producing 488,000 ounces of gold.[8] Output was expected to increase to 516,000 ounces of gold in 1971 and continue to rise in the future.

Bibiani Gold Mines, a subsidiary of the State Mining Corp., reportedly discovered a 200,000-ton ore body at the main mine. Additional deposits were discovered near Donkoto, north of Bibiani.[9]

NONMETALS

Diamond.—Production by Consolidated African Selection Trust Ltd. (CAST) in the year ended June 30, 1970 totaled 2,423,951 carats, a decrease of 37,366 carats compared with fiscal 1969.[10] Value of diamond sales was $12,129,600, a decrease of $1,389,600 from fiscal 1969. The principal reason for the drop in value was low prices attributed to weakness in the world diamond market, especially for some types of Ghana diamonds. CAST continued to mine alluvial diamonds by open-pit methods in its Akwatia and Birim concessions. Gravels were processed at three treatment plants in the Akwatia concession and two in the Birim concession. Approximately 1,589,810 cubic yards of gravel was processed in fiscal 1970, compared with 1,530,220 cubic yards in 1969. Overburden removed totaled 1,082,150 cubic yards in fiscal 1970, compared with 734,800 cubic yards in fiscal 1969. The improved performance was attributed to increased productivity and to the increased experience of Ghanaian supervisors and operators. Electric power for the mine and ancillary facilities was obtained from the Volta River hydroelectric station. CAST employed about 2,600 persons in fiscal 1970.

A technical and financial study was being made on the low-grade deposits on the lower Birim River. The possibility of mining these deposits was being investigated.

Salt.—A plant for salt production was scheduled for development in Ada, Eastern Region, by the Panbros Salt Co.[11] Production would reach 200,000 tons per year at full capacity.

MINERAL FUELS

Petroleum.—On June 11 a consortium, consisting of Signal Oil and Gas Co., Occidental Petroleum Corp., and Amoco Ghana Exploration Co., discovered oil in a well drilled in 90 feet of water 8 miles offshore

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[3] Engineering and Mining Journal. Ghana. V. 171, No. 12, December 1970, p. 116.
[4] World Mining. What's Going On in World Mining. V. 6, No. 4, April 1970, p. 50.
[5] Mining Journal (London). Development. V. 276, No. 7067, Jan. 29, 1971, p. 85.
[6] Engineering and Mining Journal. Ghana. V. 172, No. 2, February 1971, p. 161.
[7] Standard Bank Review (London). Ghana. April 1970, p. 14.
[8] World Mining. What's Going On in World Mining. V. 7, No. 3, March 1971, p. 52.
[9] American Metal Market. Ghana Reports Gold Ore Find. V. 77, No. 128, July 7, 1970, p. 15.
[10] Consolidated African Selection Trust Ltd. (London). Annual Report 1970, p. 5.
[11] Standard Bank Review (London). Ghana. June 1970, p. 13.

from Saltpond, central Ghana.[12] The well tested at 2,300 barrels per day of 37° API gravity crude oil with a ¾-inch choke from a depth of 8,500 feet. The discovery was considered a significant development, and the consortium was evaluating the commercial potential of the well at year-end. Plans were made to drill a confirmation well 4.5 miles to the northeast, in a concession held by the consortium and Chevron Oil Co., (Ghana). About six wells were to be drilled by various firms in 1970. Mobil Exploration Ghana, Ltd. and Texaco Ghana Petroleum Co., Ltd., started drilling offshore from Takoradi in June. Organizations holding concessions in Ghana were Israel National Oil Co., Ltd. and Mayflower Petroleum Corp., 1,488 square miles; Signal, Occidental, Amoco, and Simmons Royalty Corp., 1,059 square miles; Texaco Ghana Petroleum Co. Ltd., 2,000 square miles; Mobil Exploration Ghana, Ltd., 1,642 square miles; Jack Grynberg and Associates, Chevron, Texas Gas Exploration Corp., West Coast Petroleum Co. Ltd., Omnirex, and White Shield Corp., 1,569 square miles; Union Carbide Petroleum Co., Frontier Ghana Oil, Ltd., Amerada-Hess Petroleum Corp., and Ashland Oil Co., 1,286 square miles.[13]

The Volta basin, a 40,000-square-mile area in southestern Ghana, was offered to private companies for petroleum exploration.[14]

New refinery installations will enable the Ghana-Italian Petroleum Co. (GHAIP) to begin producing aviation fuel in 1971.[15]

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[12] Petroleum Press Service. Notes of the Month. V. 37, No. 7, July 1970, pp. 266, 267.
[13] World Oil. Africa. V. 171, No. 3, Aug. 15, 1970, p. 158.
[14] Petroleum Legislation Report. Ghana. No. 68, Feb. 22–June 1, 1970, p. 23.
[15] Standard Bank Review (London). Ghana. July 1970, p. 18.

The Mineral Industry of Greece

By John D. Corrick [1]

The Greek economy remained viable in 1970, growing at a rate of 7.5 percent in an atmosphere of relative wage and price stability. Although the industrial production growth rate decreased from 10.9 percent in 1969 to 7.9 percent in 1970, it put Greece on target for the 5-year plan's growth projection of 7.5 percent in 1970. The reduced growth rate was attributed to a mid-1970 cutback in bank credit for housing construction. Mining and manufacturing industries remained strong, as indicated by the rise in production of base metals (23 percent) and metal products (12 percent). Average industrial wages and salaries rose 10 percent, and unemployment dropped from 6.6 percent in 1969 to 6.0 percent in 1970. Special tax and other incentives in 1970 resulted in 159 new foreign enterprises opening regional supervisory offices in Greece, 45 of which were U.S. firms.

The investment structure of Greece showed definite signs of change in 1970 with increased amounts of money being channelled away from residential construction and toward industrial and basic infrastructure investments. Significant investment developments were scored by the Greek Government in 1970 when commitments were obtained from two private Greek investors to invest $800 million [2] in Greek projects, among which were a 7.5-million-ton petroleum refinery, an alumina-aluminum smelter, a thermal power station, expansion of the Aspropyrgos petroleum refinery to 4.5 million tons, a 100,000-ton lubricating oil refinery, expansion of the Hellenic Shipyards, and a marine diesel engine plant. Authorized foreign investment proposals in 1970 totaled $851 million, of which $24.1 million was from the United States. The Greek Government also was successful in obtaining longer term financing; a 6-year, $60-million-Eurodollar loan from a consortium of American and Canadian banks to the Bank of Greece; and 10-to 15-year equipment credits, totaling $235 million, from a British and French bank to the Hellenic Industrial Development Bank.

PRODUCTION

Appreciable gains were made in many segments of the Greek mineral industry in 1970. Among those mineral commodities showing increases in 1970 were bauxite (18 percent), lead (33 percent), silver (63 percent), zinc (2 percent), nitrogenous fertilizers (29 percent), crude magnesite (32 percent), pyrite (10 percent), lignite (17 percent), petroleum refinery products (10 percent), and manufactured gas (13 percent). Mineral commodities showing a decrease in 1970 were chromite (6 percent), barite (35 percent), and phosphatic fertilizers (5 percent).

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[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from Greek Drachma (Dr) to U.S. dollars at a rate of G Dr1 = US$0.0333.

Table 1.—Greece: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum:			
Bauxite, gross weight ____ thousand tons	r 1,836	1,948	2,292
Alumina ____ do	223	287	313
Metal, primary	r 76,300	83,153	87,481
Chromium, chromite concentrates, gross weight	r 13,073	60,610	56,782
Iron and steel:			
Iron ore and concentrates	12,000	--	--
Pig iron and blast furnace ferroalloys	e 270	290	300
Ferroalloys, electric furnace, ferronickel	14,104	18,473	NA
Crude steel	218	450	435
Steel semimanufactures	400	450	e 400
Lead:			
Mine output, metal content	r 9,067	8,665	9,227
Smelter, primary (refined)	r 7,124	10,700	14,263
Manganese ore and concentrate, gross weight	6,744	6,464	6,590
Nickel:			
Mine output, metal content	r 4,326	e 5,820	e 9,100
Metal, electrolytic	264	74	--
Silver smelter or refinery output ____ thousand troy ounces	r 261	258	420
Zinc mine output, metal content	r 10,412	9,188	9,367
NONMETALS			
Abrasives, natural, emery	7,600	7,100	7,000
Barite, concentrates	r 66,031	83,141	54,091
Cement, hydraulic ____ thousand tons	r 4,079	4,840	4,900
Clays:			
Bentonite:			
Crude	130,000	206,861	192,941
Processed	NA	2,979	10,542
Kaolin	r 78,919	61,405	48,274
Fertilizers manufactured, gross weight:			
Nitrogenous ____ thousand tons	220	293	379
Phosphatic ____ do	790	648	617
Gypsum and anhydrite	r 230,294	271,654	308,553
Magnesite:			
Crude	r 441,000	570,725	755,176
Dead burned	100,000	168,518	219,366
Caustic calcined	28,000	51,114	57,338
Perlite, crude	129,000	148,616	168,508
Pumice	283,000	375,231	450,774
Pyrite:			
Gross weight	r 211,234	245,529	270,341
Sulfur content	98,000	114,000	117,600
Salt, all types ____ thousand tons	99	75	e 80
Stone, dimension, marble ____ cubic meters	e 50,000	57,000	59,000
Talc	r 2,513	6,074	e 6,000
MINERAL FUELS AND RELATED MATERIALS			
Coal, lignite ____ thousand tons	5,728	6,734	7,858
Coke, gashouse ____ do	15	14	e 14
Fuel briquets (lignite briquets) ____ do	100	90	81
Gas manufactured ____ million cubic feet	335	343	388
Petroleum refinery products:			
Gasoline ____ thousand 42-gallon barrels	3,954	4,420	4,947
Jet fuel ____ do	2,598	2,624	2,424
Kerosine ____ do	686	721	775
Distillate fuel oil ____ do	9,793	10,698	12,227
Residual fuel oil ____ do	11,678	10,643	11,668
Lubricants ____ do	84	126	119
Other ____ do	2,031	2,707	3,327
Refinery fuel and losses ____ do	1,594	1,731	1,503
Total ____ do	32,418	33,670	36,990

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

[1] In addition to the commodities listed, cobalt and a variety of crude construction materials, such as clays, sand and gravel, and stone, are produced, but output is unreported and available information is inadequate to make reliable estimates of output levels. Cobalt production is as a byproduct of iron-nickel ore processing.

TRADE

Greece, being a developing country, faces chronic trade deficits. Greek imports in 1970 cost $1,705 million, an 18.9-percent increase over 1969. Exports covered a portion of this; they increased 15.5 percent from 1969, reaching $612 million. Mining and metallurgical enterprises accounted for about 23 percent, or $140 million of the total Greek exports. Exports of mineral commodities in 1969 that increased significantly over 1968 were chromite (69 percent), roasted pyrites (71 percent), zinc (13 percent), and magnesite (23 percent). The European Economic Community (EEC) continued to receive the major portion of Greek exports. The Government continued its policy of competitive pricing to stimulate exports while trying to divert the flow of imports into more productive channels and encourage import substitutions.

Mineral commodity imports accounted for 17 percent of total commodity imports by value in 1969. As in 1968, crude petroleum, petroleum products and iron and steel made up the bulk of mineral imports. Liquid fuels accounted for 40 percent or $108.4 million of the mineral imports in 1969, while 30 percent was attributed to iron and steel. The EEC remained Greece's principal supplier of mineral imports in 1969. The relationship of mineral trade to total commodity trade in recent years follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1967	78.6	495
1968	90.0	468
1969	110.0	554
Imports:		
1967	216.3	1,186
1968	218.3	1,393
1969	270.9	1,594

Table 2.—Greece: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	1,190	1,309	U.S.S.R. 522; West Germany 295; Netherlands 103.
Oxide and hydroxide do	r 72	119	U.S.S.R. 38; Italy 30; Poland 27.
Metal including alloys:			
Unwrought	63,702	67,670	France 22,045; Belgium-Luxembourg 18,680; Italy 12,225.
Semimanufactures	1,650	5,804	Italy 3,283; West Germany 791; Portugal 275.
Chromite	15,331	25,862	West Germany 17,619; Norway 7,059.
Copper:			
Metal including alloys:			
Scrap	1,696	NA	NA.
Semimanufactures	1,494	1,479	France 770; Netherlands 159; West Germany 150.
Iron and steel:			
Roasted pyrite	34,720	59,235	Netherlands 36,410; West Germany 22,825.
Steel, primary forms	19,101	59,338	Spain 17,742; Italy 10,445; United States 5,306.
Semimanufactures:			
Universals, plates, and sheets	r 6,351	123,471	Yugoslavia 96,431; Bulgaria 14,154; Spain 4,871.
Tubes, pipes, and fittings	r 807	2,058	Cyprus 1,611.
Lead ore and concentrate	13,167	11,618	Italy 8,618; West Germany 2,000; France 1,000.
Manganese ore and concentrate	6,010	5,017	West Germany 2,941; France 1,450.
Nickel including alloys, all forms	75	261	Italy 136; United States 110.
Silver including alloys value, thousands	$174	NA	NA.
Zinc ore and concentrate	15,073	17,095	France 8,625; Poland 4,000; Italy 3,200.
Other, ash and residues containing nonferrous metals	948	1,831	Belgium-Luxembourg 713; West Germany 519; Spain 273.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	r 190,636	214,251	United States 206,096; France 3,022.
Cement	344,461	618,302	Libya 383,186; Yugoslavia 113,701; Italy 53,656.
Clays and products:			
Crude clays, n.e.s.	r 159,018	156,771	Canada 41,804; Libya 30,895; France 26,651.
Products:			
Refractory (including nonclay bricks)	1,862	NA	NA.
Nonrefractory	1,860	2,630	Cyprus 599; West Germany 487.
Fertilizer materials manufactured:			
Phosphatic	84,358	NA	NA.
Other	56,452	29,839	Bulgaria 12,924; Italy 12,820; Cyprus 4,095.
Magnesite	r 190,905	235,721	West Germany 73,313; United States 64,473; United Kingdom 35,793.
Pyrite (gross weight)	4,037	NA	NA.
Stone, dimension crude and partly worked	r 27,041	28,430	West Germany 13,483; Italy 11,171; France 1,108.
Sulfur, elemental	23,137	25,076	United Arab Republic 10,210; Turkey 5,500; Yugoslavia 3,738.
Other nonmetals, crude	167,969	106,035	France 34,430; West Germany 29,172; United Kingdom 23,745.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline including natural thousand 42-gallon barrels	318	166	Cyprus 123; Netherlands 30; Italy 11.
Kerosine and jet fuel do	1,205	971	Lebanon 539; United Arab Republic 234; Netherlands 102.
Distillate fuel oil do	458	647	West Germany 302; Turkey 121; United Arab Republic 118.
Residual fuel oil do	93	233	United Arab Republic 114; Liberia 56; Yugoslavia 35.

r Revised. NA Not available.

Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys:		
Unwrought	1,624	1,053
Semimanufactures	1,187	2,539
Copper including alloys:		
Unwrought	8,978	9,931
Semimanufactures	512	454
Iron and steel:		
Ore and concentrate	368,747	471,084
Metal:		
Pig iron including cast iron	32,986	26,119
Ferroalloys	1,955	3,522
Steel, primary forms ... thousand tons	145	176
Semimanufactures:		
Bars, rods, angles, shapes, sections ... do	163	201
Universals, plates, and sheets ... do	139	122
Hoop and strip ... do	40	35
Rails and accessories ... do	6	1
Wire ... do	8	9
Tubes, pipes, fittings ... do	16	18
Castings and forgings, rough ... do	2	1
Lead:		
Ore and concentrate	9,466	14,717
Oxides	820	217
Metal including alloys:		
Unwrought	2,602	4,783
Semimanufactures	154	NA
Mercury ... 76-pound flasks	NA	261
Nickel including alloys, all forms	r 58	47
Platinum-group and silver including alloys:		
Platinum-group ... value, thousands	$49	$32
Silver ... do	$292	$533
Tin including alloys, all forms ... long tons	316	195
Titanium oxides	2,761	3,183
Tungsten including alloys, all forms ... value, thousands	$148	$140
Zinc including alloys:		
Unwrought	7,275	10,763
Semimanufactures	329	230
Other base metals including alloys, all forms	86	56
NONMETALS		
Abrasives, natural, n.e.s.:		
Grinding stones	230	239
Asbestos	8,465	11,614
Cement	r 1,145	1,159
Clays and products (including refractory brick):		
Crude, refractory	r 27,741	34,254
Products:		
Refractory (including nonclay bricks)	19,440	24,540
Nonrefractory	5,337	4,044
Diatomite and other infusorial earths	930	1,343
Feldspar and fluorspar	2,085	2,498
Fertilizer materials:		
Crude phosphatic ... thousand tons	394	319
Manufactured:		
Nitrogenous ... do	135	115
Phosphatic ... do	NA	NA
Potassic ... do	25	32
Other including mixed ... do	6	2
Ammonia ... do	11	8
Magnesite	NA	688
Pigments, mineral, including processed iron oxides	1,166	1,102
Pyrite (gross weight)	NA	26,380
Salt and brines	NA	47,483
Sodium and potassium compounds, n.e.s	22,606	21,780
Stone, sand and gravel:		
Dimension stone	105	114
Dolomite, chiefly refractory grade	1,424	1,686
Sand excluding metal bearing	44,220	47,160
Sulfur:		
Elemental, all forms	100,297	144,792
Sulfuric acid, oleum	7,322	9,839
Talc, steatite, soapstone, and pyrophyllite	2,001	1,947
Other nonmetals, n.e.s.:		
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s	6,920	2,974
MINERAL FUELS AND RELATED MATERIALS		
Carbon, black	1,037	1,987
Coal and coke including briquets ... thousand tons	r 285	370
Gas, hydrocarbon	24,130	20,632

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS—Continued		
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	28,453	33,991
Refinery products:		
Gasoline including natural do	689	613
Kerosine and jet fuel do	98	65
Distillate fuel oil do	2,157	2,523
Residual fuel oil do	4,614	6,128
Lubricants do	341	390
Other do	335	258

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—At the end of 1970 about 2.3 million tons of bauxite was mined from the Parnassos and Helikon regions near the Gulf of Corinth, and the Lamia region. This was an increase of 18 percent over 1969. The Government of Greece spent $2.51 million in 1970 on mineral research which included, among other things, prospecting and assessing the size of new and known bauxite deposits. The mineral research expenditure for this program in 1971 was set at $2.46 million. Additional deposits of bauxite, totaling 3.5 million tons, were proven at Dhistomon and Andoronianoi during 1970. The country's verified bauxite deposits were estimated at 100 million tons. Bauxite exports in 1970 totaled 1.2 million tons valued at $9.6 million, compared with 1.3 million tons in 1969 valued at $9.8 million. The 1971 export quota for bauxite was fixed at approximately 1.3 million tons, broken down by country of destination as follows: EEC countries—450,000 tons; U.S.S.R.—450,000 tons; all other countries—395,000 tons (including 75,000 tons for the United States).

Parnassos Bauxite S.A. (Eliopoulos), which produced about 60 percent of the domestic bauxite and supplied 50 percent of the needs of Péchiney's Aluminium de Grèce S.A., had a $6 million investment program underway to increase production and loading facilities to 2 million tons per year by 1975. The investment included a beneficiation plant. Parnassos' proven reserves were reported at 70 to 80 million tons. Elikon Bauxite S.A. had a $3.4 million investment program to raise annual output from the present 350,000 tons to 500,000 tons of bauxite by the end of 1971. Eleusis Bauxite S.A. (Skalistiris) improved its facilities by building a 1,000 ton-per-hour-capacity loading jetty at Aghia Marina costing $530,000, and expanding the capacity of its Itea loading jetty to 600 tons per hour, at a cost of $350,000. Eleusis reported discovery of new bauxite deposits at Elatia, Locris.

The International Finance Corporation (IFC) of the United States and Péchiney of France (majority stockholder of Aluminium de Grèce S.A.) concluded financing arrangements for a $26 million expansion of the Greek alumina-aluminum smelter at Aspra Spitia, Dhistomon. The project was completed at the end of 1970. The plant's production capacity will be increased from the present estimated 250,000 tons of alumina and 75,000 tons of aluminum per year to between 450,000 and 475,000 tons alumina and 90,000 tons aluminum. Of this total, about 260,000 tons of alumina will be exported. As a result of this expansion, Greek production of alumina and aluminum should reach record levels in 1971 and again in 1972. Preliminary figures showed 1970 production of alumina increased 9 percent over 1969 to 312,520 tons, and aluminum increased about 5 percent to 87,481 tons. Heavy domestic demand for aluminum in 1970 reduced the quantity exported; however, the expected rise in output in 1971 should improve the state of aluminum exports. Greece imported about 2,500 tons of aluminum in 1970.

Greek consumption of aluminum in 1970 increased 48 percent over 1969 to a record high of 29,000 tons. Heading the field of aluminum consumers were the electrical industry, the building industry, and, to a lesser extent, the packaging industry. Viohalco-Cables S.A. and Viohalco Aluminum, S.A. formed ELVAL Greek Aluminum Industry S.A. and announced plans to establish an $8 million factory at Levádhia to produce 35,000 tons of flat aluminum products annually.

Government negotiations with a private Greek investor to develop a major industrial complex including alumina-aluminum facilities were climaxed by signing an agreement and posting $7 million in performance bond deposits. The agreement called for building a 500,000-ton-annual-capacity alumina plant and a 160,000- to 350,000-ton-annual-capacity aluminum plant at Megara. Construction was to be completed 7 years from the effective date of the agreement.

Chromite and Nickel.—Eleusis Bauxite S.A. conducted intensive exploration of low-grade chromium-nickel lateritic ore deposits in Central Euboea. Following completion of topographic and geological surveys, the company began exploratory drilling operations. By mid-1970, seven drills had penetrated a total of 5,000 meters. Core samples indicated the Euboea ore deposits contained approximately 39 million tons of ore of a lower grade than those already developed at Larymna Vrsakia, where reserves of 38 million tons have been proven. The company was considering testing a hydrometallurgical process for treating the Euboea ores. Laboratory tests produced nickel sulfide grading 40-percent nickel.

An expansion program, to triple present nickel production capacity and install an electrolytic unit was planned at the Larymna nickel mining and smelting project of Mining and Metallurgical Company of Larymna (LARCO). In 1970 LARCO invested about $14.6 million for improvements at its Larymna plant, its existing underground mines at Agios Ioannia, Larymna, and its new open pit mines at Psachna, Evvia. Planned expansion of these facilities were expected to be completed between 1973 and 1974. The Greek nickel industry produced 8,642 tons of pure nickel as ferronickel in 1970, compared with 5,644 tons in 1969. In 1970 LARCO exports of ferronickel (7,210 tons nickel) to hard currency countries earned $45 million, or $13 million more than in 1969.

At yearend, negotiations were in progress for the establishment of another nickel refinery in Greece. The new refinery would have a capacity of 15,000 tons of nickel per year and use a chemical process developed in Greece and presently used in other European countries. Two or 3 years will be required to develop the mining and refining operations.

Copper.—Deposits containing 150,000 tons of 3 percent copper ore were proven at Stavros in the Chalkidiki peninsula. A zone of copper-bearing mineralization was also identified at Kirki; however, its quantity and grade were not determined.

Iron and Steel.—The Serifos iron mines suspended operations during the year because the quality of ore was unsatisfactory for use in the Halyvourgiki smelter. Preliminary surveys indicated iron ore reserves on the island Thasos at 8 million tons, with an additional 4 million tons probable.

The United States Steel Corp. made a feasibility study on projected expansion of the Hellenic Steel Co.'s mill at Thessaloniki. The information developed was for use in Greek-Japanese negotiations for expansion of the Thessaloniki mill. Initial talks were held in Japan in early 1970, and an agreement in principle was announced in January of that year. The agreement included the following: Establishment of a hot-rolling facility with a production capacity of 1.5 million tons per year; expansion of a cold-rolling mill; establishment of a steel mill with a capacity of 300,000 tons per year using electric arc furnaces; long-term supply of raw materials from Japanese firms; Japanese technical assistance in design, construction, and operation of new units; and the supply of equipment for the project. The British firm of L.H. Manderstam and Partners, Ltd., completed a feasibility report on the domestic steel industry for the Greek Government in 1970. The report covered a number of elements including optimum location of the new facility, with special consideration of Volos and Thessaloniki as priority sites. Although there was no official announcement on the conclusions of the report, it was expected that it would guide government policy regarding the iron and steel industry.

Uranium.—The Greek Institute of Geology and Subsoil Research announced the discovery of a uranium deposit in the Vathi District near Kilkis in Northern Greece. The deposit, located in a volcanic formation covering an area of about 50,000 square meters, was reported to average 100 grams of U_3O_8 per ton of ore. The results were based on 1,300 analyses of surface samples and three test drillings. The United Nations Development Program Council approved a program for prospecting uranium deposits in central and eastern Macedonia and in Thrace. Funds for conducting the work were to come jointly from the United Nations ($331,000) and the Greek Government ($226,000).

The capacity of the nuclear reactor operated by Democritus Nuclear Research Center to produce radioactive isotopes was being expanded. Democritus supplied 75 percent of the Greek demand for isotopes in 1970 and expected to supply 95 percent within 3 years.

NONMETALS

Asbestos.—An agreement to mine deposits and process asbestos at Zindanion, near Kozani, in northwestern Greece, was signed between the Greek Government and the U.S. Cerro Corporation. The agreement called for expanding present installations and beginning work on a new plant within 24 months. The plant will process 700,000 tons of asbestos-bearing ore, yielding 40,000 tons of asbestos fiber per year. The first phase of the enterprise, expected to be completed in early 1971, consisted of exploration, processing studies, and equipping an existing pilot plant. The second phase, expected to begin no later than January 1972, will be to establish a plant. The Zindanion asbestos deposit has reserves estimated at 50 million tons. It was the only known asbestos deposit in Greece in 1970.

Cement.—Greek cement production in 1970 was 4.9 million tons, compared with 4.8 million tons in 1969. Local cement consumption totaled 4,556,500 tons in 1970, compared with 4,257,000 tons in 1969. Cement exports in 1970 amounted to 371,165 tons, compared with 618,302 tons in 1969. The decline in exports was caused by increased local demand for cement. The industry announced several expansion plans aimed at increasing production to 8 million tons per year. The General Cement Co. S.A. announced expansion plans costing $17 million over a 3-year period beginning in 1970. The project included installation of a 2,500-ton-per-day-capacity rotary kiln at the Volos plant, expansion and modernization of the Drapetsona plant, and expansion and improvement of the firm's distribution centers at Thessaloniki, Rion, and Herakleion. In September 1970, a new 100-ton-per-hour-capacity cement grinding mill (supplied by F.L. Smidth of Denmark) was put into operation at the Olympos works in Volos, and a new 2,000-ton-per-day-capacity rotary kiln (supplied by Fives Fille Cail of France) was expected to go into production in the fall of 1971. At that time, Olympos works annual capacity will reach 2 million tons, and the firm's overall capacity will increase by 850,000 tons, to about 3 million tons. In November 1970 the company announced that it began production of white cement by its new patented method. The Titan Cement Co.'s planned $10.7 million expansion and modernization of its plant facilities at Elefsis and Thessaloniki were approved by the Greek Government. The program will increase total annual production capacity from 1.8 million tons to 2.3 million tons.

Fertilizers and Fertilizer Materials.—The Greek fertilizer industry continued expansion of existing plants and started construction of new plants in order to maintain self-sufficiency and to diversify fertilizer types. Nitrogenous Fertilizers Industry, S.A. awarded construction contracts for a 50,000-ton-per-year ammonium nitrate plant and an additional 40,000-ton-per-year nitric acid plant at Ptolemais.

Aghia Marina Chemical Corp. planned to start operating its fertilizer complex at Stylis in 1972. The complex will be composed of a 247,500-ton-per-year nitric acid plant, a 165,000-ton-per-year ammonium sulfate nitrate unit, a 115,500-ton-per-year ammonium nitrate unit, and a 594,000-ton-per-year complex fertilizer unit.

Phosphoric Fertilizers Industry Ltd.'s plant at Nea Karvali will produce complex fertilizers containing nitrogen, phosphous, and potassium in the following ratios: 8:8:8, 8:16:16, 12:12:12, 11:15:15, 12:12:17, and 15:15:15. The plant was designed to manufacture ammonium sulfate and single superphosphate fertilizers. As an alternative to current complex fertilizer production, 198,000 tons per year of granular ammonium sulfate and 50,000 tons per year of triple superphosphate were to be manufactured at the plant. These alternative fertilizers were to be manufactured without any change to the existing plant.

Magnesite.—During 1970, Greece produced 755,176 tons of crude magnesite, 57,338 tons of caustic calcined, and 219,366 tons of dead-burned magnesite; the respective figures for 1969 were 570,725 tons, 51,114 tons, and 168,518 tons. Exports of dead-burned magnesite in 1970 amounted to $18.9 million, compared with $12.7 million in 1969, $10.3 million in 1968, and $4.9 million in 1967. Known magnesite resources were estimated at 30 million tons.

The Société Financière de Grèce, S.A. (SFG), one of the major producers of raw and dead-burned magnesite, has extensive mining properties at Mantoudi, Evvia. In 1963, the firm began producing dead-burned magnesite at an annual capacity of 9,790 tons. Through a series of expansion programs and capital investments, it increased its annual capacity to 210,000 tons in 1970. When the new kilns are completed, sometime in 1972, total annual capacity will be about 320,000 tons of dead-burned magnesite. In June, a 100,000-ton-per-year-capacity magnesite ore benefication plant, which raised the capacity of Greece's ore benefication facilities to a total of 450,000 tons per year, was put in operation at Mantoudi. In September 1970, the firm obtained Government approval to invest $10.9 million in its Evvia mines to (a) expand, modernize, and complete installations of the magnesite mines at a cost of $5.9 million and (b) establish by 1975 a $5-million plant at Mantoudi to manufacture magnesite refractory bricks under foreign technical expertise (Didier Werke A.G. of Wiesbaden). Annual production of the plant, the first one to be established in Greece, will be 34,000 to 39,000 tons of refactory bricks. Macedonian Magnesite S.A., an affiliate of SFG, continued expansion of its facilities in the Ormylia area of Chalkidiki, where a magnesite dressing plant was under construction. The plant has a planned annual capacity of 120,000 tons. New loading facilities and a new rotary kiln for producing dead-burned magnesite were planned; the kiln will have an annual capacity of 40,000 tons. Investments were estimated at $3 million.

Eliniki Lefkolithi (Hellenic Magnesite), which operated magnesite mines at Yerakini, Chalkidiki, planned to complete a $2.8 million expansion program by 1972. Its new 45,000-ton-per-year-capacity rotary kiln was to go into production by mid-1971. This will increase the company's annual capacity to 65,000 tons of dead-burned magnesite.

In April 1970, the U.S. firm General Refractories took control of the General Mining Co. from the German concern F. Krupp. Under Krupp control, the company had produced raw and caustic calcined magnesite at Kalyvia, Chalkidiki, since 1965. General Refractories also controls the Magnomin firm, which operated magnesite mines at Vavdos, Chalkidiki, and produces 55,000 tons of dead-burned magnesite per year.

Mining, Trading, and Manufacturing Ltd. were planning production of dead-burned magnesite on Euboea in 1971. A 50,000-ton-per-year rotary kiln was under construction, and an ore dressing plant was planned.

Salt.—An agreement was reached for participation of the United Nations International Bank for Reconstruction and Development in the Nevros-Livanos Messolonghi salt-soda ash chemical complex. The funds were to help finance the first phase of the project to produce 600,000 tons of ammonium chloride and 60,000 tons of soda ash per year by 1972.

MINERAL FUELS

Lignite.—The Greek Public Power Corp. (PPC) and other small independent power producers have placed increased demands on the country's lignite industry by expanding the country's power network. Planned power projects (1970–74) included lignite-fired stations with a total capacity of 502 megawatts. Forecast total power output of 15,840 Gigawatt-hours (GWH) for 1974 will include 6,271 GWH (39.6 percent) from lignite-fired units. To date, lignite development has kept pace with the country's ambitious electrification program. Greece produced 7,858,000 tons of lignite in 1970, compared with 6,734,000 tons in 1969. The principal lignite fields and power stations were at Ptolemais, in northwestern Greece (opencast mines), Aliveri on Evvia (underground mines), and at Megalopolis, in the central Peloponnesus (opencast mines). At Aliveri, lignite mines supplied two 40,000 kilowatt units out of a total 380,000 kilowatt capacity thermal station (the remaining units were oil fired). Since beginning operations in 1951, half of the 20 million tons of lignite reserves at Aliveri have been mined. In Megalopolis, a new lignite-fired power station consisting of two 125,000 kilowatt units went into operation in November 1970. The station was to use 4.4 million tons of lignite per year. Development of the 360-million-ton opencast lignite field began in 1968 when a stock of 700,000 tons was created. At Ptolemais, a French contractor began construction of the fourth 300,000-kilowatt, lignite-fired unit in 1970. The unit was scheduled for operation at the end of 1972, along with the Kardia lignite mine. Annual output of lignite at the Kardia mine was planned for 5 million tons, eventually reaching 8 million tons.

Newly discovered lignite deposits in the Ptolemais and Megalopolis districts were proven to contain 840 million tons, with probable reserves estimated at 2 billion tons. About 4 billion cubic meters of peat were estimated at Philippi.

Petroleum.—Greek offshore petroleum exploration gathered momentum during 1970. Texaco completed the first deep well in Greek waters, about 45 miles southwest of Salonika, in the Gulf of Thermaikos. The Minister of Industry stated that some natural gas was located at a depth of 3,660 meters. A second evaluation well was being drilled. Texaco signed its second agreement in mid-1970 for exploration rights in a 1,000-square-kilometer area between Thasos Island and Lemnos Island, in the northern Aegean Sea. The company was to be granted oil drilling concessions on land and in the sea near the islands of Chios and Lesbos, in the east Aegean Sea. Estimated cost of this work is $3,350,000. An-Car Oil Co. (Boston, Mass.) was granted concessions in mid-1970 over a 5,000-square-kilometer area off the islands of Zante and Cephalonia and off the mainland of Kyllene. C.K. Petroleum Inc. (U.S.A.) reached agreement with the Greek Government for exploration rights in the north Ionian Sea around the islands of Corfu and Paxoi, and part of the northwest mainland in Epirus. The Greek Institute of Geology and Subsurface Research carried out exploratory work in southern Greece. The deepest well drilled by the Institute was 6,000 feet.

Although considerable effort was expended to discover oil in Greece, the results have been negligible. Greece imports all of the crude oil which it refines. The Government-owned refinery at Aspropyrgos (operated by Stavros Niarchos) and the Esso-Pappas refinery at Thessaloniki processed 5,010,000 tons of crude imported at a cost of $183.3 million in 1970. The country's current product requirements are well in excess of the refinerys' present capacity, thus indicating the country's need to expand its refinery capacity. A major step was taken in this direction when the Greek Government obtained signed agreements from two firms (Onassis and Niarchos) to construct and enlarge refinery capacities. The agreement with Onassis called for the construction of a large industrial complex at Megara on the Bay of Salamis. Nucleus of the complex will be a major refinery targeted for 1973. Its initial capacity will be 7.5 million tons per year, and there is the possibility of increasing this to 10 or 12 million tons later. The agreement with Niarchos was to enlarge the present refinery at Aspropyrgos near Athens from 1.8 million tons per year to 4.5 million tons within 2 to 7 years. The new schemes will raise Greek refinery capacity to 11 million tons per year by 1973 and 14.5 million or more by 1977. Tentative projects include a new 1.5-million-ton-per-year refinery to be built by Greek Naptha S.A. in the Piraeus area, and the planned expenditure of $3 million on refinery improvements by Esso-Pappas in the near future.

The Onassis-Niarchos projects both provide for development of lubricating oil plants. Onassis would be entitled to build a $20 million lubricating oil plant for export purposes, and Niarchos' investments would include a 100,000-ton-per-year lubricating oil plant.

The Mineral Industry of Hungary

By Joseph B. Huvos [1]

Hungary produced few minerals; only bauxite was important by world production standards in 1970, with about 4 percent of the world total. The production of mineral fuels, and iron and steel was important only for Hungary's domestic economy. Large imports were needed to satisfy demand for most mineral commodities except bauxite and low-rank coals.

Major events in 1970 included commissioning the expansion of the Almásfüzitö alumina plant; start of construction on a major nitrogen fertilizer project at Pétfürdö; commissioning the extension of a nitrogen fertilizer plant at the Tisza chemical combine; completion of a superphosphate production plant and a granulating plant at the Tisza chemical works at Szolnok and construction of a sulfuric acid plant at the same location; further increases in the share of oil and gas as a source of energy in the country; and construction of an ethylene plant at the Lenin City formerly called Tiszaszederkény Chemical Combine.

PRODUCTION

Production of coal, Hungary's most important mineral commodity, increased slightly; lignite accounted for the increase. Bituminous and brown coal output were practically unchanged. The production of bauxite, Hungary's most important export mineral, increased only slightly. Nitrogen fertilizer production continued to increase substantially. The increase in crude oil production was about 10 percent, and the increase in natural gas production was more important.

[1] Foreign mineral specialist, Division of Fossil Fuels.

Table 1.—Hungary: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum:			
Bauxite ---- thousand tons--	1,959	1,935	2,022
Alumina ---- do----	381	408	441
Metal including secondary	63,088	64,463	66,029
Copper:			
Mine output, metal content [e]	NA	1,000	1,000
Metal:			
Smelter, primary	NA	1,000	1,000
Refined including secondary	[r] 11,400	10,900	11,200
Gold [e] ---- troy ounces--	320	320	320
Iron and steel:			
Iron ore ---- thousand tons--	638	681	629
Pig iron and ferroalloys:			
Pig iron for steel ---- do----	1,625	1,735	1,798
Pig iron for foundries ---- do----	13	18	24
Ferroalloys ---- do----	18	14	9
Total ---- do----	1,656	1,767	1,831
Crude steel ---- do----	[r] 2,909	3,031	3,110
Steel semimanufactures rolled ---- do----	1,983	2,020	2,038

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS—Continued			
Lead:			
Mine output, metal content e	1,000	1,000	1,735
Metal refined, secondary e	1,000	1,000	720
Manganese ore [2] thousand tons	r 156	156	169
Silver e thousand troy ounces	6	6	6
Zinc:			
Mine output, metal content e	3,500	4,800	4,800
Smelter, secondary	NA	NA	740
NONMETALS			
Cement, hydraulic thousand tons	2,801	2,564	2,771
Clays:			
Bentonite do	r 60	57	106
Kaolin, crude and washed do	r 63	60	72
Fertilizer materials manufactured:			
Nitrogenous:			
Gross weight do	1,196	1,464	1,708
Nitrogen content do	245	300	350
Phosphatic:			
Gross weight do	846	917	900
Phosphorus pentoxide content do	r 156	170	167
Lime calcined do	733	691	652
Pyrite:			
Gross weight e	3,000	4,000	6,500
Sulfur content e	1,200	1,600	2,600
Stone:			
Dolomite thousand tons	637	629	697
Limestone do	5,670	5,241	e 5,500
Quartzite do	r 38	28	125
Sulfur:			
Elemental, byproduct	r 2,394	2,526	e 2,500
Sulfuric acid thousand tons	446	454	457
Talc	NA	NA	16,149
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	NA	NA	4,151
Coal:			
Bituminous thousand tons	4,242	4,133	4,151
Brown do	19,881	19,396	19,008
Lignite do	3,090	2,969	4,671
Total do	27,213	26,498	27,830
Coke:			
Coke oven do	500	512	657
Other bituminous coal coke do	703	704	509
Brown coal semicoke do	17	--	--
Total do	1,220	1,216	1,166
Fuel briquets do	1,238	1,310	1,463
Gas:			
Manufactured million cubic feet	20,235	20,694	NA
Natural, marketed do	r 94,890	114,242	122,506
Natural gas liquids:			
Natural gasoline thousand 42-gallon barrels	527	527	466
Liquefied petroleum gas do	NA	NA	854
Petroleum:			
Crude:			
As reported thousand tons	1,807	1,754	1,937
Converted thousand 42-gallon barrels	13,787	13,383	14,780
Refinery products:			
Gasoline including naphtha do	6,197	5,236	5,879
Kerosine do	31	8	4
Distillate fuel oil do	10,377	11,377	12,837
Residual fuel oil do	13,114	13,826	16,752
Lubricants do	979	1,134	1,166
Liquefied petroleum gas do	NA	NA	690
Asphalt and bitumen do	3,448	NA	2,838
Other do	NA	NA	1,992
Refinery fuel and losses do	NA	NA	2,324
Total do	NA	NA	44,482

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

[1] In addition to the commodities listed, gypsum and additional types of 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 containing less than 35 percent manganese.

TRADE

In 1969 the pattern of Hungary's foreign trade in mineral commodities did not change substantially. The country imported most of its mineral requirements, such as nonferrous base metals, iron ore, high-rank coal, coke, and crude oil. Bauxite, alumina, manganese ore, and various semimanufactured products were exported. Hungary's principal trading partners were the U.S.S.R. and other Communist countries, which provided most of the fuel, iron ore, and metals.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969 [2]
METALS			
Aluminum:			
Bauxite	[3] 665,355	[3] 656,111	Poland 96,544; West Germany 80,001; Austria 6,646.
Oxide and hydroxide	[3] 361,161	[3] 383,470	U.S.S.R. 169,200; Poland 140,150; Austria 30,863.
Metal and alloys:			
Scrap	5,707	9,404	Italy 5,146; West Germany 2,733.
Unwrought	[3] 47,529	[3] 41,050	Italy 6,026; France 5,094; Iceland 1,920.
Semimanufactures	[3] 4,711	[3] 4,581	Turkey 420; Italy 278; United Kingdom 236.
Chromium oxide and hydroxide	105	110	All to Yugoslavia.
Copper:			
Ore and concentrate	1,078	1,059	All to Poland.
Metal and alloys:			
Scrap	r 4,707	6,014	West Germany 4,722; Austria 1,013.
Unwrought and semimanufactures	1,214	1,522	West Germany 1,351; Poland 149.
Iron and steel:			
Scrap ... thousand tons	[4] 5	[4] 6	Mainly to West Germany.
Pig iron and ferroalloys ... do	[4] 67	[4] 18	Austria 12.
Steel, primary forms ... do	[4] 179	[4] 174	Turkey 75; Austria 27.
Semimanufactures ... do	[4] 519	[4] 700	West Germany 89; Italy 48; Poland 46; Yugoslavia 45; U.S.S.R. 40.
Lead:			
Ore and concentrate	3,043	4,236	Belgium-Luxembourg 3,099; West Germany 1,137.
Metal and alloys, all forms	1,060	4,515	Denmark 3,756; Italy 682.
Manganese ore and concentrate	5,852	13,380	West Germany 12,876; Italy 504.
Nickel and alloys, all forms	289	494	West Germany 401; Belgium-Luxembourg 40.
Platinum group and silver, waste and sweepings ... value, thousands	$881	$235	All to West Germany.
Tin including alloys ... long tons	--	151	Denmark 106; West Germany 45.
Titanium oxide	300	409	All to Turkey.
Zinc:			
Ore and concentrate	6,023	6,639	All to Poland.
Metal and alloys, all forms	--	199	All to Belgium-Luxembourg.
Other:			
Ash and residues containing unspecified nonferrous metals	9,594	10,071	West Germany 4,535; Italy 3,366.
Nonferrous metals not further described	1,059	881	Mainly to Poland.
NONMETALS			
Cement, hydraulic	[3] 212,963	[3] 144,449	Yugoslavia 130,546.
Clays and products:			
Crude, bentonite	r 20,735	24,226	Poland 2,850; Sweden 861.
Products:			
Refractory, fire brick	[3] 19,080	[3] 19,700	NA.
Nonrefractory	5,891	8,079	All to Yugoslavia.
Diamond, gem and industrial ... value, thousands	$40	--	
Diatomite and related materials	3,780	3,957	Italy 1,563; Sweden 1,471.
Fertilizer materials manufactured, all types	[3] 139,761	[3] 140,371	NA.
Pigments, mineral, natural, crude	--	35	All to Yugoslavia.
Sodium compounds n.e.s., caustic soda	2,611	2,400	All to Turkey.
Stone, sand and gravel:			
Dolomite ... value, thousands	$35	$29	NA.
Gravel and crushed rock	64,059	71,270	All to Yugoslavia.
Limestone	14,895	24,190	Do.
Quartz and quartzite	NA	3,500	Do.
Sand excluding metal bearing	14,031	16,576	Do.
Sulfur, elemental	--	826	All to Austria.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969 [2]
NONMETALS—Continued			
Other:			
Crude n.e.s.	5,141	7,579	All to West Germany.
Slag, dross and similar waste, not metal bearing	--	9,014	All to Austria.
MINERAL FUELS AND RELATED MATERIALS			
Argon gas	190	82	All to Poland.
Coal, brown	[3] 61,088	[3] 154,606	NA.
Coke from bituminous coal	[3] 180,270	[3] 180,117	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	2,057	2,177	Austria 2,166; Yugoslavia 11.
Refinery products: [5]			
Gasoline do	[3] 2,073	[3] 2,533	Austria 1,308.
Distillate fuel oil do	[3] 1,791	[3] 1,858	West Germany 839; Switzerland 466.
Residual fuel oil do	[3] 3,727	[3] 3,189	Austria 1,449.
Lubricants do	[3] 166	[3] 266	Yugoslavia 85; Austria 26.
Other:			
Mineral jelly and wax do	23	34	Italy 10; Austria 8; Switzerland 6.
Liquefied petroleum gas do	26	--	
Nonlubricating oils n.e.s. do	295	269	All to Austria.
Unspecified do	613	356	Austria 193; West Germany 95; Yugoslavia 68.
Crude chemicals from coal, oil or gas distillation	3,416	4,270	Yugoslavia 3,035; Italy 1,235.

[r] Revised. NA Not available.

[1] Compiled from official Hungarian trade returns (items indicated by footnote 3) and import data of selected trading partner countries (all items not specifically credited to other sources).

[2] All information on individual destinations are from import data or partner countries. In a number of instances, these figures total far less than officially recorded total exports. Destinations for remainder of quantity exported are not available.

[3] Official Hungarian export figure.

[4] Data from United Nations Economic Commission for Europe. Quarterly Bulletin of Steel Statistics for Europe. V. 22, No. 4, New York 1972, p. c11.

[5] In addition to information given on destinations by individual product, Poland reportedly received approximately 1,289,000 barrels of products and the U.S.S.R. received 199,000 barrels of products (distribution by product not reported).

Source: Official trade returns of Hungary, Poland, and the U.S.S.R., and 1968 and 1969 edition of Statistical Office of the United Nations. Supplement to the World Trade Annual. V.1 (East Europe). Walker and Company, New York, 1970 and 1971.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969 [2]
METALS			
Aluminum:			
Bauxite and concentrate	4,541	4,874	All from Yugoslavia.
Oxide and hydroxide	10,942	29,146	France 28,368; Yugoslavia 608.
Metal including alloys, all forms	[3] 72,116	[3] 66,500	U.S.S.R. 26,500; Yugoslavia 745; France 726.
Chromite	[r] 51,751	72,000	Turkey 66,000; U.S.S.R. 6,000.
Copper metal including alloys, all forms	[3] 18,239	[3] 19,165	U.S.S.R. 13,800; Belgium-Luxembourg 1,564; Italy 1,023.
Iron and steel:			
Iron ore thousand tons	[4] 2,830	[4] 2,914	U.S.S.R. 2,780.
Pig iron, ferroalloys, and similar materials do	[4] 235	[4] 245	U.S.S.R. 230; Spain 8; Austria 7.
Steel, primary forms do	[4] 408	[4] 299	NA.
Semimanufactures do	[4] 509	[4] 572	U.S.S.R. 459; Austria 44; Italy 38; West Germany 29.
Lead:			
Oxide	[3] 1,926	[3] 3,824	France 2,020; Austria 1,424.
Metal including alloys, all forms	12,977	[3] 13,833	U.S.S.R. 10,500; Denmark 99; United Kingdom 97.
Magnesium metal unwrought	302	301	All from U.S.S.R.
Manganese ore and concentrates	--	297	All from Netherlands.
Mercury 76-pound flasks	2,495	1,857	Spain 1,016; Italy 841.
Molybdenum including alloys, all forms	174	6	Austria 4; United Kingdom 2.
Nickel including alloys, all forms	122	147	United Kingdom 45; West Germany 30; France 28.
Platinum group including alloys value, thousands	$1,029	$342	West Germany $297; Switzerland $31.
Silver including alloys do	$947	$68	West Germany $54.
Tin including alloys long tons	[3] 1,263	[3] 1,389	Netherlands 515; Denmark 24.
Titanium oxides	2,496	1,726	Italy 1,620; West Germany 106.
Zinc:			
Oxide	387	1,207	Yugoslavia 987; France 220.
Metal, all forms	[3] 18,228	[3] 20,247	U.S.S.R. 7,900.
Other:			
Ores and concentrates of ferroalloying metals [5]	[3] 83,276	[3] 91,861	NA.
Metals including alloys:			
Metalloids	2	[6] 100	France 100.
Base metals n.e.s	82	80	Belgium-Luxembourg 49; United Kingdom 26.
NONMETALS			
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	417	287	Austria 158; West Germany 63.
Asbestos	[r] 14,077	14,695	U.S.S.R. 14,400; Canada 295.
Barite and witherite	4,090	18,762	Yugoslavia 17,542.
Borates, crude, natural	7.850	5,725	All from Turkey.
Cement, hydraulic thousand tons	[3] 509	[3] 620	U.S.S.R. 586.
Clays and products:			
Fire	[3] 68,149	[3] 91,377	NA.
Kaolin	[3] 12,497	[3] 14,238	NA.
Crude n.e.s	[3] 71,119	70,158	NA.
Products	2,504	12,433	Italy 4,770; Yugoslavia 3,977.
Diamond, gem and industrial value, thousands	$635	$83	Belgium-Luxembourg $34; United Kingdom $28.
Feldspar and fluorspar	2,862	6,444	Yugoslavia 4,545; Norway 1,440.
Fluorspar and cryolite	900	1,100	All from U.S.S.R.
Fertilizer materials:			
Crude phosphatic thousand tons	[3] 499	[3] 597	NA.
Manufactured:			
Nitrogenous do	[3] 503	[3] 512	NA.
Phosphatic do	[3] 147	[3] 147	NA.
Potassic do	[3] 387	[3] 457	NA.
Ammonia	--	1,834	Yugoslavia 1,017; Italy 817.
Graphite, natural	1,672	1,904	U.S.S.R. 1,700; Austria 204.
Magnesite, calcined	[3] 78,833	[3] 81,349	Austria 16,322; Turkey 1,000.
Mica, worked	12	16	Switzerland 14.
Pigments, mineral, iron oxides and hydroxides	2,826	1,035	West Germany 566; France 469.
Pyrite, gross weight thousand tons	[3] 148	[3] 167	All from U.S.S.R.
Precious and semiprecious stones, except diamond value, thousands	$109	$110	Switzerland $93.
Sand, industrial	[3] 53,748	[3] 32,417	NA.
Sodium compounds, caustic soda	17,716	51,063	West Germany 36,513; Italy 5,552.
Sulfur:			
Elemental	[3] 246,494	[3] 95,094	U.S.S.R. 70,700.
Sulfuric acid	[3] 44,812	61,623	U.S.S.R. 50,100.
Talc and natural steatite	1,940	1,695	All from Austria.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969 [2]
NONMETALS—Continued			
Other nonmetals n.e.s.:			
Crude:			
Meerschaum, amber, jet	--	65	All from Italy.
Other	918	490	All from West Germany.
Oxides and hydroxides of magnesium, strontium and barium	50	239	All from United Kingdom.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	[3] 6,268	[3] 5,776	U.S.S.R. 4,415; Italy 1,281; Yugoslavia 945.
Coal, anthracite and bituminous [7] thousand tons	[r] [3] 1,661	[3] 1,703	Poland 909; Czechoslovakia 576; U.S.S.R. 218.
Coal briquets [7] do	[3] 491	[3] 283	All from East Germany.
Coke, all types [7] do	[3] 1,661	[3] 1,173	U.S.S.R. 563;[3] Czechoslovakia 303; Poland 277.
Gas, natural million cubic feet	[r] [3] 7,063	[3] 7,063	NA.
Petroleum:			
Crude oil [8] thousand 42-gallon barrels	[3] 23,682	[3] 27,617	U.S.S.R. 26,836; United Arab Republic 781.
Refinery products:			
Gasoline do	[3] 617	[3] 851	NA.
Kerosine do	[3] 786	[3] 854	U.S.S.R. 826. [3]
Distillate fuel oil do	[3] 1,097	[3] 1,249	U.S.S.R. 1,144. [3]
Residual fuel oil do	[3] 2,218	[3] 2,399	U.S.S.R. 2,357. [3]
Lubricants do	[3] 67	[3] 65	NA.
Other do	20	8	Netherlands 4.
Crude chemicals from coal, petroleum or gas distillation	19,455	17,587	U.S.S.R. 16,600; Italy 542; West Germany 445.

[r] Revised. NA Not available.

[1] Compiled from official Hungarian trade returns (items indicated by footnote 3) and from export data of selected trading partner countries (all items not specifically credited to other sources).

[2] The bulk of the information on individual source countries are from export data or partner countries. In a number of instances, these figures total far less than officially recorded total imports. Origins for remainder of quantity imported are not available.

[3] Official Hungarian import figure.

[4] Data from United Nations Economic Commission for Europe. Quarterly Bulletin of Steel Statistics for Europe. V. 22, No. 4, New York, 1972, p. c11.

[5] Figures as presented in official Hungarian sources; may duplicate data on chromite and manganese ore from export statistics of trading partner countries presented elsewhere in this table.

[6] Partial figure, valued at US$33,000; an additional unreported quantity valued at $65,000 was imported, mainly from Belgium-Luxembourg.

[7] Data on source countries from United Nations Economic Commission for Europe. Annual Bulletin of Coal Statistics for Europe 1970. New York 1971, p. 80.

[8] Converted from metric tons reported in original source as follows: 1968—3,222,000 tons; 1969—3,763,777 tons.

Source: Except where otherwise noted, official trade returns of Hungary, Poland and U.S.S.R. and Statistical office of the United Nations. 1968 and 1969 editions of Supplement to the World Trade Annual. V. 1 (East Europe). Walker and Company, New York, 1970 and 1971.

COMMODITY REVIEW

METALS

Aluminum.—In 1970 Hungary maintained its position as a major European bauxite producer, with about 4 percent of world production. According to the 1971–75 plan, bauxite production will increase by the end of the plan period 50 percent, to about 3 million tons per year. For this purpose, the plan provides completion of the Rákhegy II, Iza II, and Halimba III bauxite mines.

Exploration for bauxite continued, and new deposits were found north of Nyirád. In the northern part of the Bakony mountains, deposits were found near Bakonyoszlop, Dudar, and Tés.

Detailed surveys showed deposits in the areas of Nyirád, Nagytárkány, Halimba, Iszkaszentgyörgy, Fenyöfö, and Darvastó.

Rehabilitation work was going on in some areas; open cast mines, when exhausted as in some parts of the Halimba basin, will be returned to grass or used for afforestation.

The Hungarian Government is planning to expand its bauxite-alumina production. According to plans, alumina production will increase to over 1 million tons per year by 1975.[2] This will leave virtually no bauxite available for export purposes. At

[2] Metal Bulletin (London). No. 5544, Oct. 27, 1970, p. 23.

Ajka, trial operations are expected to begin towards the end of 1971 at the new alumina plant. Plant capacity will be 240,000 tons per year.[3]

Capacity of the Almásfüzitö alumina plant was expanded in 1970 to 280,000 tons per year, at a cost of more than $30 million.[4]

There are plans for increasing present Hungarian aluminum smelter capacity in the next few years to about 90,000 tons per year.[5] Further increases are not planned because of high power costs. (See Minerals Yearbook, 1969, Hungary—Bauxite and Aluminum.)

Some alumina is being processed into ingots in the U.S.S.R. This raw aluminum is subsequently returned to Hungary for processing into semimanufactures. The aluminum demand of the Hungarian aluminum processing industry was 107,000 tons in 1970, and will be 166,000 tons in 1975.[6] According to Hungarian figures, the share of production going for export will rise from 42 percent in 1970 to 44 percent in 1975.

Aluminum industry expertise was exported to India by the Hungarian Aluminum Industry Planning Co. (ALUTERV). At Korba, in the state of Madhya Pradesh, ALUTERV experts are working on a 200,000-ton-per-year alumina plant, based on local bauxite. A similar contract for Hungarian cooperation has been signed for an aluminum combine project at Koyña, with annual production capacities of 100,000 tons of alumina and 50,000 tons of metal.

Other foreign design projects are a 250,000-ton-per-year alumina plant for Romania, a modernized alumina plant and semiplants in East Germany, and the expansion of an alumina plant for West Germany.[7]

Iron and Steel.—Ferrous metallurgy is the most important branch of the Hungarian metals industry. Sales for 1969, the last full year with available data, totaled about $833 million, as compared with only $163 million for all other nonferrous metals. During the past decade, ferrous production rose 58 percent, and aluminum more than doubled.

Shortage of ferrous raw materials contributed to higher costs in the Hungarian iron and steel industry. There was a marked trend to restructure production towards making quality products. There was a rapid increase in production of fine steel plate, cold-drawn steel wire (in particular high-tensile-strength wire), cold-rolled steel band, and welded steel tubes.

For the 1971–75 plan period, raw steel production, rolled goods, and steel tubes are slated to increase only by 30 percent.[8] There will be an acceleration in the output of alloyed products, fine-rolled products, and cold-rolled plates.

Two new steel rolling mills will be built at the Lenin steelworks at Diósgyör. East Germany will deliver the equipment for both plants in May 1971; the commissioning of the 200,000-ton-per-year, plant is planned for June 1972.

Other 5-year plan projects include a continuous casting plant, a fine-wire line, and an iron casting plant for the Ózd Metallurgical works.

The Sopron Iron Foundry was modernized in 1970; the expenditure was $10 million. Capacity was raised to 18,000 tons per year. The equipment was from East Germany, the United Kingdom, and Hungary.[9]

Nonferrous Base Metals.—Hungary's only domestic nonferrous base metal source is the Gyöngyösoroszi mine. Complex ore veins are mined by the room and pillar method. Heavy media preconcentration and selective flotation are used to prepare copper, lead, zinc, and pyrite concentrates. About 1 percent lead and 3 percent zinc are in the ore.[10]

Tin.—Hungary became a member of the International Tin Council in 1969. It consumed about 1,200 long tons of tin in that year. In 1968, 300 tons was used for 9,000 tons of tin plate, 400 tons of solder, and 300 tons of bronze and brass.[11]

Uranium.—Exploration for uranium in

[3] European Chemical News. Apr. 23, 1971, p. 14.

[4] Where necessary, values have been converted from Hungarian Forints (Fts) to U.S. dollars at the rate of FTs30=US$1.00.
Magyar Hirlap (Budapest). Aug. 2, 1970, p. 8a.

[5] Dobos, G. Present Situation, Development Trends of the Hugarian Aluminum Industry. AIME paper No. A69–4, the Metallurgical Society of AIME, New York, p. 6.

[6] American Metal Market. V. 77, No. 133, Dec. 8, 1970, p. 1.

[7] Népszabadság (Budapest). Timföldgyár (Alumina Plant). June 7, 1970, p. 9.

[8] American Metal Market. V. 18, No. 62, Mar. 31, 1971, p. 5.

[9] Figyelo (Budapest). Mar. 4, 1970, p. 21.

[10] Bányászati és Kohászati Lapok, (Budapest). Bányászat (Mining). V. 104, No. 1, 1971, p. 28.

[11] Tin International. July 1970, p. 193.

Hungary started in 1954, when the Mecsek mountain deposits were discovered. The ore is found in irregularly shaped, disconnected lenses, with an average thickness of 3 feet and an area of 2,000 to 4,000 square feet. At present, the depth of the workings is 3,100 feet. An ore beneficiation plant was built in 1963 and produces a concentrate containing 60- to 70-percent uranium oxide. Production figures have not been published.

NONMETALS

In 1970 Hungary was essentially self-sufficient in lime, clays, and bentonite. A number of nonmetallic minerals such as asbestos, cryolite, phosphate rock, salt, sulfur, and pyrites had to be imported to meet all, or virtually all, of the domestic needs.

Cement.—To ease the shortage in building materials, it was decided to raise Hungarian cement production from the present level of 2.77 million tons to 5 million tons by 1975.[12] Another measure to ease the shortage of building materials was the decision to raise imports from 900,000 tons to 1.2 million tons in 1971.[13]

Plans to speed completion of a new Hungarian 1-million-ton-per-year cement works have been announced in Budapest. The plant is under construction at Beremend near the Yugoslav border and is now expected to open in August 1972, 10 months ahead of schedule. It is being built at an investment cost of nearly $85 million and will use oil for fuel in both of its production lines.

Fertilizers.—Kellogg International Corp. has been awarded a contract for the design and engineering of a 1,000-ton-per-day ammonia plant to be built by Petrolkémia Beruházási Vállalat (Petrolber), the Hungarian contractors, for Pét Nitrogen Works at Pétfürdö, western Hungary.[14] All the engineering and design work covered by the Kellogg contract will be done in London. Lazard Frères & Co. is to provide the financial backing. A large proportion of the hardware will be purchased in the United Kingdom, although some of the equipment will be supplied by other West European manufacturers. Like the existing 550-ton-per-day ammonia plant at Pétfürdö, the Kellogg unit will operate on natural gas. The plant is scheduled to open in 1974.

Coppée-Rust S.A. of France is the subcontractor for a 200,000-ton-per-year urea plant, which will utilize the Stamicarbon N.V. process. An additional 430,000-ton-per-year nitric acid plant will be constructed by the U.S.S.R., and a 726,000-ton-per-year prilled complex fertilizer plant is to be built by Wellmann-Lord, Inc. and GEXA S.A. of France. The plant will be using the Norsk-Hydro process. The plant is scheduled to produce 363,000 to 396,000 tons per year of either prilled calcium ammonium nitrate, containing 25 percent nitrogren, or calcium nitrate, containing 15.5 percent nitrogen. GEXA has been appointed the managing contractor for the fertilizer units, which are due to become operational in 1974.

The complex fertilizer and calcium ammonium nitrate plants are reportedly already under construction.[15]

The Borsod Chemical Combine is planning to expand ammonia capacity at its Kazincbarcika plant by an equivalent of 54,120 tons of contained nitrogen per year. Current ammonia capacity of the plant is equivalent to 122,000 tons contained nitrogen per year. There are also plans to add plants for producing ammonium sulfate and urea to the Kazincbarcika complex. Urea capacity will be expanded by 80,000 to 100,000 tons per year, bringing total nitrogenous fertilizer capacity at this location to 450,000 tons per year.[16]

An extension of the existing 350,000-ton-per-year nitrogenous fertilizer plant at the Tisza chemical combine was opened, raising total plant output to 410,000 tons per year. Products of the plant are ammonium nitrate and urea. Feedstock used natural gas piped from Romania by the Kissármás (Kopşa-Mică) Tiszaszederkény pipeline.

A third superphosphate plant has been completed at the Tisza chemical works. Total capacity is 480,000 tons per year. Granulating capacity at this facility was doubled in 1970 with the addition of a second 240,000-ton-per-year granulating plant, which went on stream in December

[12] Népszabadság (Liberty of the people) (Budapest). Dec. 6, 1970, p. 1.
[13] Work cited in footnote 12.
[14] Petroleum Times. V. 74, No. 1897, June 19, 1970, p. 16.
[15] Nitrogen. No. 67, September–October 1970, p. 14.
[16] Nitrogen. No. 65, May–June 1970, p. 16.

1970. The additional plant makes it possible to granulate the entire output of the superphosphate plant.

Magnesite.—Experimental work continued at the pilot plant for synthetic magnesite at the Tiszavárkony site of the Magnesite Industrial Works of Budapest. The work is being done in preparation for the construction of a commercial plant of 50,000-ton-per-year capacity.

Sulfuric Acid.—A sulfuric acid plant of 200,000-ton-per-year capacity is being built at the Tisza chemical works. Most of the equipment is of Polish origin.

MINERAL FUELS

Hungary's reliance on imported mineral fuels, mainly from the U.S.S.R., increased during 1970. Although low-rank coal remained the principal source of energy in the country, natural gas and petroleum increased their share of the energy market, to about 48 percent in 1970.

Coal.—Output of brown coal decreased, but output of bituminous coal remained almost unchanged, in keeping with plans for concentration and improvement in the productivity of the mining industry. Lignite production increased by more than one-half because of increasing production at the open cast mine at Visonta near Gyöngyös. During the year, underground mining ceased in the Mátra region, and only two open cast mines were left in production, one at Ecséd and the other at Visonta. The Visonta mine produced 2.8 million tons of lignite in 1970 and will produce 7.5 million tons in 1975; however, the Ecséd mine will be closed down in 1973 because of increasing production costs.

New coal faces were readied at the Putnok coal mine in the Ózd coal basin, where Polish coal mining equipment is going to be used.

At Tatabánya, exploratory work was performed leading to the discovery of readily accessible coal reserves of 6 million tons.

The Felsönyárád mine located in the Borsod coal basin was to be closed down in April 1970.

A new mine was sunk at Lencse Hill in the Dorog coal field, where 30 million tons of high-grade coal was found, It is planned that exploitation of the deposit will occur over a period of 11 years.

In 1970 six long-wall coal-cutting machines were delivered to Hungary by the U.S.S.R., and delivery of 20 to 25 more machines is expected in the next 5 years.

Fletcher Sutcliffe Wild Ltd. of Harbury, Wakefield, Yorkshire, has installed its new 200-ton, four-leg support at the Oroszlány mine near Tatabánya. Between 800 and 1,000 tons per day of coal is now being produced from this coal face. According to official releases the present level of Hungarian coal mining, including open cast and underground mining, will have to be maintained for at least 25 to 30 years, or until the use of atomic energy becomes widespread.

The present coal shortage reportedly was caused by low estimates of the level of consumption. A delay in switching from steam to diesel engines at the railroads has resulted in 600,000- to 700,000-ton per-year increase in the use of coal.

Petroleum and Natural Gas.—Hungary's 5-year plan (1971–75) puts considerable emphasis on investment in oil and natural gas. Hungary's natural gas reserves are estimated at 3,000 billion cubic feet, which is approximately a 20 years supply. Oil reserves total only 1,045 million barrels, and the aim is to increase proven reserves by 20 percent in the next 5 years.

In 1970 about 60 exploratory wells were sunk east of the Danube, where drilling totaled 416,000 feet. In the future, the focus will shift west of the Danube, where the most promising unexplored areas lie. Exploratory drilling will average 940,000 feet per year over the next 5 years.

Production of crude oil will remain at the present level of just under 15.3 million barrels a year until sufficient proven reserves are found. Natural gas production will increase about 60 percent over the next 5 years, reaching about 194 billion cubic feet in 1975.

Over the next 5 years, most of Hungary's hydrocarbon deficit will be met by imports from the U.S.S.R. A second Soviet-Hungarian pipeline, Friendship No. 2, which will have a capacity of 75 million barrels per year, is to be completed in 1976. This project will cost about $30 million, of which $1.6 million is for imports of tubing and machinery from the West. Through this pipeline will come more than 70 percent of Hungary's oil needs.

Since Hungary will probably not be able to increase its imports from the U.S.S.R.

indefinitely, alternative sources must be considered in Africa and the Middle East, such as the cooperative agreement with Iraq. A pipeline from a Yugoslav port is under discussion, and Poland and Czechoslovakia may be interested in linking up.

A pipeline for natural gas will be built in the early seventies to bring 30 billion cubic feet of gas per year from the U.S.S.R.

About 600 miles of domestic pipeline will also be built in the next 5 years, including a main supply line from the oilfield at Algyö to Budapest.[17]

Oil refining capacity will be expanded. The Százhalombatta refinery, which has a capacity of 60,000 barrels per day, will be expanded to 120,000 barrels per day in 1972. A thermal powerplant, of 619 megawatts, will be expanded to 1,475 megawatts between 1973 and 1975. The Hungarian Government decided to build a new oil refinery at Lenin City, in northeast Hungary; capacity will be 120,000 barrels per day, with completion set for about 1976.

Hungary is expanding its petrochemical industry. A plant producing 250,000 tons of ethylene per year is being built at the chemical complex at Lenin City and is due to be started by 1975. Fifty percent of the ethylene produced will be sent by pipeline to the U.S.S.R.

[17] Foreign Trade. V. 1351, No. 4, February 1971, p. 28.

The Mineral Industry of India

By Harold A. Taylor, Jr. [1] and Charles W. Sweetwood [2]

According to most measures, the Mineral Industry of India stayed roughly at the same level in 1970 as in 1969. Value of crude mineral output in 1970 declined to $606 million,[3] down from $611 million in 1969; value of mineral, ore, and metal exports in 1970 was $416 million, compared with $378 million in 1969; and value of mineral, ore, metal, alloy, and crude petroleum imports in 1970 was $528 million, compared with $421 million in 1969.

Mining contributed only about 1.2 percent to India's gross national product (GNP) of $44.03 billion for the year ending March 31, 1971. Mineral processing is not included in the 1.2 percent and presumably makes a contribution several times that of mining.

Detailed mine employment data for 1970 are not yet available. Mine employment in 1970 was probably about the same as in 1968 and 1969. The Indian petroleum industry employed 59,409 people in 1970; of this number, 26,734 were in exploration and production, 20,793 in marketing, 10,694 in refining, and 1,188 in pipelining, research, and other related activities. While official 1970 data on strikes, lockouts, and go-slow tactics are not yet available, it appears that the situation was about the same in 1970 as in 1969.

The Geological Survey of India, aided by the Indian Bureau of Mines, continued its accelerated mineral exploration and evaluation program in 1970. Some results of this program appear in the Commodity Review section of this chapter. The Government of India, in collaboration with the French Bureau de Recherches Géologiques et Minières, approved an airborne survey, similar to the U.S. Agency for International Development (AID) sponsored "Operation Hardrock." This 38-month survey will involve airborne geophysical work, followup geological studies on the ground, and exploration drilling in areas of Rajasthan, Gujarat, Madhya Pradesh, and Mysore totaling 80,000 square kilometers.

The United Nations-aided Tamil Nadu airborne geophysical and photogeological survey, now in the ground followup stage, reported some further success. Near Tiruvannamalai, it found extensive magnetite-quartzite reserves, estimated at 400 million tons of 35 to 45 percent Fe. It also discovered favorable prospects that might produce vermiculite, ceramic and refractory-grade clays, and radioactive and rare-earth elements.

Exploration for petroleum in 1970 produced no outstanding finds. Primary emphasis in 1970 was on field development in the producing States of Assam and Gujarat. The well begun in Jammu remained unfinished, while the well near Aliabet Island was mildly encouraging.

The Government of India continued its heavy involvement in mineral production and trade. It is the Government that has made the major expenditures in the minerals field in recent years. As of March 31, 1970, the Government's total investment in all types of public sector projects was $5.7 billion, of which $1.9 billion was in steel, $0.63 billion was in minerals and metals, and $0.54 billion was in petroleum.

The joint venture concept has assumed a more important role in government thinking. There are a number of joint ventures already in existence, and more in the planning stage, both in petroleum and in mining. Joint ventures now existing include three lubricant plants half-owned by the Government (Indian Oil Corp.) and half-owned by foreign oil companies (ESSO, Mobil Oil Corp. (2)). In addition to a minor joint venture for oil exploration

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[3] Where necessary, values have been converted from Indian Rupees (Rs) to U.S. dollars at the rate of Rs1 = $0.133.

there are two joint venture oil refineries, one at Cochin, Kerala State (Government of India 52.4 percent, Phillips Petroleum Co. 26.4 percent, Duncan Brothers and Co. 2.0 percent, others 19.2 percent), and one at Madras, Tamil Nadu (Government of India 74.0 percent, American International Oil Co. 13.0 percent, National Iranian Oil Co. 13.0 percent). A joint venture between the Government of India's National Minerals Development Corp. (51 percent), Marcona Corp. of San Francisco (25 percent), and a group of Japanese firms including the Mitsui Corp. (24 percent) hopes to mine and beneficiate iron ore at Kudremukh, Mysore State, and export the concentrate to Japan. Other joint ventures involve the Government of India with a State government in an alumina plant; a State government with a domestic private corporation in gypsum and phosphate rock mines; and a State government with a foreign private corporation in an iron ore operation.

PRODUCTION

The following tabulation shows the slight overall decline in value of crude mineral output from 1969 to 1970 by commodity groups:

Commodity group	Value (million dollars)		
	1968	1969	1970
Metallic minerals:			
Ferrous	50.13	54.43	59.44
Nonferrous	15.02	19.05	18.89
Subtotal	65.15	73.48	78.33
Nonmetallic minerals	[1] 47.76	99.28	93.42
Mineral fuels:			
Bituminous coal	269.52	347.84	344.21
Lignite	10.45	10.63	9.71
Petroleum, crude [2]	63.15	75.00	76.26
Gas, natural [3]	3.63	4.38	4.06
Subtotal	346.75	437.85	434.24
Total	[r] 459.66	[r] 610.61	605.99

[r] Revised.
[1] Does not include pyrites and crude nonsalable china clay.
[2] Estimated, applying a value of $1.45 per barrel produced.
[3] Estimated, applying a value of $0.17 per thousand cubic feet produced.

All the individual commodities in the ferrous subgroup increased fairly equally in value from 1969 to 1970, although iron ore had a predominant influence because it comprised 79 to 80 percent of the total ferrous metal value in the above tabulation for both years. A large decline in the value of gold production partly counterbalanced by a rise in value of bauxite was a prominent factor leading to the small decline in the nonferrous subgroup value from 1969 to 1970. Gold accounted for 48 percent of the total nonferrous metal value in 1970 (52 percent in 1969), and copper ore for 26 percent of the nonferrous metal value in 1970 (26 percent in 1969). The decline in the total value of the nonmetallic minerals group resulted from declines in the value of most of the individual nonmetallic minerals led by the principal ones—limestone, crude nonsalable china clay, and salt. Limestone accounted for 29 percent of the nonmetallic mineral value in 1970 (compared with 28 percent in 1969), crude nonsalable china clay for 16 percent in 1970 (compared with 19 percent in 1969), and salt for 14 percent (compared with 15 percent in 1969). The decline in value of bituminous coal and lignite paralleled a decline in quantity produced. The rise in value of crude petroleum exactly parallels a rise in quantity produced because the assigned value of $1.45 per barrel remained fixed for all 3 years. A similar explanation applies for the decline in value of natural gas assigned a value of $0.17 per thousand cubic feet for all 3 years.

Table 1.—India: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum:			
Bauxite, gross weight ... thousand tons	936	1,085	1,360
Alumina, gross weight ... do	245	267	327
Metal, primary only	120,100	131,160	161,081
Antimony (regulus)	821	637	526
Beryllium, beryl, gross weight [e]	1,300	1,300	1,300
Cadmium	41	44	34
Chromium, chromite, gross weight	205,659	226,568	270,879
Copper:			
Mine output, metal content	9,272	10,317	10,262
Metal refined, primary only	9,286	9,751	9,311
Gold, smelter ... troy ounces	115,357	109,473	104,200
Iron and steel:			
Iron ore and concentrate ... thousand tons	27,433	29,564	30,780
Pig iron excluding blast furnace ferroalloys ... do	7,151	7,361	7,034
Ferroalloys:			
Ferrochrome	1,080	5,189	13,343
Ferromanganese	146,800	167,620	173,412
Ferrosilicon	20,500	27,228	27,590
Steel ingots (excluding castings) ... thousand tons	6,448	6,461	6,098
Steel semimanufactures:			
Angles, shapes, sections ... do	919	889	970
Bars and rods ... do	1,435	1,737	1,572
Plates and sheets:			
Uncoated ... do	664	601	593
Galvanized ... do	167	204	171
Tinplate ... do	91	88	116
Hoop, strip, skelp ... do	490	569	483
Rails and accessories ... do	530	494	498
Wire ... do	159	183	130
Special steels, form not specified ... do	33	301	286
Lead:			
Mine output, metal content	2,550	2,031	2,388
Metal, primary only	1,500	1,958	1,862
Manganese ore and concentrate ... thousand tons	1,602	1,485	1,651
Rare earth, monazite concentrates, gross weight [e]	2,600	2,600	2,600
Silver, smelter output ... thousand troy ounces	90	105	50
Titanium:			
Ilmenite concentrate, gross weight	58,725	51,445	79,000
Rutile concentrate, gross weight	2,686	2,496	2,500
Tungsten mine output, metal content	20	21	18
Zinc:			
Mine output, metal content	6,968	7,407	8,246
Metal	20,699	23,051	23,410
NONMETALS			
Abrasives, natural, n.e.s.:			
Corundum, natural	326	537	412
Garnet	1,983	1,637	986
Asbestos	9,065	9,738	9,834
Barite	51,718	51,795	71,923
Cement, hydraulic ... thousand tons	11,940	13,260	13,543
Chalk	48,915	51,384	46,904
Clays:			
Ball	8,353	4,931	8,372
Fire	418,706	509,526	509,271
Kaolin (china) [2]	505,961	555,838	538,425
Diamond:			
Gem ... carats	7,280	[e] 9,794	[e] 17,369
Industrial ... do	1,484	[e] 2,000	[e] 2,500
Total ... do	8,764	11,794	19,869
Feldspar	33,493	32,221	29,255
Fertilizer materials:			
Crude, phosphatic:			
Apatite	6,695	9,316	15,768
Phosphate rock	-------	69,175	149,544
Manufactured:			
Nitrogenous, nitrogen content [3]	434,088	[e] 520,000	NA
Phosphatic, P_2O_5 content [4]	182,592	[e] 190,000	NA
Fluorspar, all grades	1,184	1,880	4,647
Gem stones excluding diamond:			
Agate (including chalcedony pebbles)	630	503	739
Emerald:			
Crude ... thousand carats	23	99	112
Dressed ... do	79	NA	NA
Garnet ... kilograms	4,986	3,619	4,483
Sapphire ... do	145	NA	NA
Gypsum ... thousand tons	1,321	1,390	883

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
NONMETALS—Continued			
Kyanite and related materials:			
Kyanite	64,361	66,285	118,998
Sillimanite	4,651	3,946	4,562
Lime	283,984	304,938	461,672
Magnesite	253,073	295,508	348,962
Mica:			
Crude	17,667	17,626	15,300
Processed: [5]			
Blocks	1,731	1,789	1,630
Splittings	6,188	6,686	6,313
Condenser film	87	107	122
Other	14,186	18,474	24,876
Pigments, natural mineral, ocher	35,494	39,089	37,682
Quartz and silica — thousand tons	294	392	347
Salt, all types — do	5,044	6,380	5,588
Stone, sand and gravel:			
Calcite	13,292	17,249	16,307
Dolomite — thousand tons	1,259	1,275	1,135
Limestone — do	20,745	22,512	23,565
Slate	859	728	632
Sand, calcareous — thousand tons	822	891	e 900
Talc, and related materials:			
Pyrophyllite	10,286	10,912	13,725
Steatite (soapstone)	165,326	176,580	154,686
Vermiculite	2,348	3,981	727
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	e 25,000	e 25,000	36,287
Coal:			
Bituminous — thousand tons	70,814	75,411	72,408
Lignite — do	4,126	4,188	3,545
Coke:			
Coke oven and beehive — do	7,368	8,939	e 8,710
Gashouse — do	e 50	64	e 74
Other soft — do	2,985	4,126	4,000
Total — do	10,403	13,129	12,784
Gas, natural:			
Gross production e — million cubic feet	e 50,000	e 55,000	50,288
Marketable production — do	r 21,330	25,744	23,873
Petroleum:			
Crude oil — thousand 42-gallon barrels	43,552	51,726	52,596
Refinery products:			
Gasoline:			
Aviation — do	214	205	106
Other — do	13,959	13,855	13,880
Jet fuel — do	3,265	3,316	5,767
Kerosine — do	19,883	20,505	24,268
Distillate fuel oil — do	32,435	35,678	36,074
Residual fuel oil — do	25,616	21,087	20,841
Lubricants — do	468	584	3,083
Other — do	19,218	29,343	27,598
Refinery fuel and losses — do	5,388	6,794	6,882
Total — do	120,446	131,367	138,499

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

1 In addition to commodities listed, India also produces bromine, other clays (bentonite and fuller's earth), other varieties of gem stones (aquamarine, ruby, and spinel) uranium, and natural graphite, but production data are not available.

2 Data given are total crude production; includes directly salable crude as follows, in tons: 1968—156,001; 1969—181,420; 1970—201,795. 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: 1968—102,123; 1969—102,336; 1970—102,123.

3 Includes nitrogen content of nitrogen-phosphate fertilizers.

4 Includes phosphorus content of nitrogen-phosphate fertilizers.

5 Actual production data not available; figures given are exports but are believed to closely approximate actual output in most years.

TRADE

Exports of ores, minerals, and metals totaled \$416 million in 1970, \$38 million more than in the previous year; imports of ores, minerals, metals, and crude petroleum were worth \$528 million in 1970, \$107 million more than in the previous year. The exports of ores, minerals, and metals comprised about 21 percent of India's total 1970 earnings of \$2.03 billion from exports. Imports of ores, minerals, metals, and crude petroleum were about 25 percent of India's total expenditure of $2.13 billion for imports in 1970.

Iron ore was the most important export in 1970, accounting for 36.6 percent of the total value of ores, minerals, and metals exported. Iron and steel accounted for 19.1 percent of the total exports, diamond for 8.3 percent, and pig and cast iron for 7.6 percent. The most important import, iron and steel, accounted for 29.8 percent of the total value of ores, minerals, metals, and crude petroleum imports. Next in importance was crude petroleum with 23.8 percent, then copper and copper alloys with 16.0 percent, and diamond with 5.0 percent of the total value.

Data showing the identity of India's principal trading partners in the total mineral commodity trade were not available. Japan clearly received more of the exports than any other nation. The major sources of Indian mineral imports were Iran (petroleum), the United States, the Soviet Union, Japan, West Germany, and Zambia, but not necessarily in that order.

Table 2.—India: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1969	1970
METALS		
Aluminum:		
Bauxite	73,883	54,651
Metal including alloys, all forms	[1] r 21,226	[1] 10,775
Chromite	r 111,620	157,540
Copper metal including alloys, all forms	[1] r 3,512	[1] 4,456
Iron and steel:		
Iron ore and concentrate thousand tons	16,670	20,425
Pig iron and sponge iron do	521	484
Ferroalloys:		
Ferromanganese	r 99,920	95,347
Ferrosilicon	r 8,339	3,529
Other	11,158	7,905
Iron and steel scrap thousand tons	r 445	332
Steel ingots and semimanufactures do	732	707
Lead including alloys, all forms	[1] 12	[1] 32
Manganese ore and concentrate thousand tons	r 1,208	1,589
Silver, all forms thousand troy ounces	2,529	-------
Tin including alloys, all forms long tons	[1] 197	[1] 1,173
Titanium ore and concentrate (ilmenite)	r 74,005	64,858
Vanadium ore and concentrate	4,750	20
Zinc including alloys, all forms	[1] 21	[1] 68
NONMETALS		
Abrasives, natural, tripoli earth and emery	r 100	38
Asbestos	r 7	52
Barite	13,759	21,089
Bentonite	1,720	618
Cement	156,889	126,253
Chalk	r 8	7
Clays:		
Fire	49	10
Fuller's earth	90	102
Kaolin	157	207
Other	44	259
Feldspar	r 9,014	9,600
Graphite	153	-------
Gypsum	5	-------
Kyanite and related materials:		
Kyanite	46,256	68,024
Sillimanite	r 2,101	1,937
Lime	r 465	344
Magnesite	r 25,922	32,372
Mica, all grades	21,056	26,942
Mineral pigments	446	1,047
Salt thousand tons	290	196
Stone, sand and gravel:		
Building stone not further identified	r 7,564	10,179
Gravel	-------	1,983
Marble	124	108
Sand including natural quartz	2,796	6,602
Talc and related materials, steatite	25,405	18,998
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen	21,187	3,235
Coal and coke thousand tons	320	529
Petroleum refinery products:		
Gasoline and naphtha thousand 42-gallon barrels	5,691	3,138
Distillate fuel oil do	511	348
Residual fuel oil do	54	-------
Asphalt do	142	62
Total do	6,398	3,548

r Revised.

[1] Excludes scrap, if any, which is given subsequently as part of an aggregate of nonferrous metal scrap.

Table 3.—India: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1969	1970
METALS		
Aluminum metal, all forms	r 2,091	2,878
Antimony:		
Ore and concentrate	r 1,636	637
Metal, all forms	r 6	2
Arsenic sulfides	r 11	4
Copper metal and alloys, all forms	r 47,750	50,005
Iron and steel:		
Pig iron, sponge iron, and powder	455	201
Ferroalloys:		
Ferrochromium	r 321	1,133
Ferromanganese	r 96	-------
Ferromolybdenum	r 51	107
Ferrophosphorus	r 186	187
Ferrosilicon	29	77
Ferrotungsten	12	143
Other	r 84	115
Total	r 779	1,762
Steel ingots and semimanufactures	r 427,000	564,000
Lead:		
Ore and concentrate	r 81	101
Metal including alloys, all forms	r 30,125	39,571
Manganese ore	7,922	3,727
Nickel:		
Ore and concentrate	r 20	-------
Metal and alloys, all forms	r 2,483	2,492
Platinum ----troy ounces	r 4,405	4,340
Silver ----do	15,850	37,551
Tin metal and alloys, all forms ----long tons	r 2,717	2,406
Tungsten ore concentrate	r 172	287
Zinc:		
Ore and concentrate	29,998	47,001
Metal including alloys, all forms	r 30,866	73,947
NONMETALS		
Abrasives, natural, tripoli earth	r 2,071	2,163
Asbestos	r 33,609	39,693
Boron materials (borax)	1,700	6,359
Chalk	59	-------
Clays:		
Ball	1,903	451
Bentonite	10	5
Fire	23	4
Fuller's earth	r 117	26
Kaolin	r 3,040	1,295
Other	r 604	105
Diamond:		
Gem ----value, thousands	r $31,640	$26,579
Industrial ----thousand metric carats	r 185	205
Diatomaceous earth	1,531	59
Fertilizer materials, crude:		
Nitrogenous, sodium nitrate	r 3,975	2,700
Phosphate rock ----thousand tons	955	925
Fluorspar and cryolite:		
Cryolite	r 2,885	2,801
Fluorspar	r 13,045	11,733
Graphite	r 1,088	1,504
Gypsum and plaster	1	5
Magnesite	r 131	59
Mineral pigments:		
Red oxide	r 1,830	2,124
Other (earth colors)	r 16	680
Stone, sand and gravel:		
Alabaster	r 60	17
Building stone, not further specified	r 14	2
Gravel	7	44
Limestone	100	3
Marble	26	10
Sand, all types	r 218	247
Sulfur	427,388	558,513
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	r 511	1,137
Coal, anthracite	1,085	782
Coke	8,588	3,091
Petroleum:		
Crude oil ----thousand 42-gallon barrels	78,767	86,557

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity		1969	1970
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products:			
Aviation gasoline	thousand 42-gallon barrels	359	432
Kerosine and jet fuel	do	4,658	2,846
Residual fuel oil	do	816	2,494
Lubricants	do	2,590	2,290
Total	do	8,423	8,062

[r] Revised.

COMMODITY REVIEW

METALS

Aluminum.—India produced 1,359,641 tons of bauxite in 1970, compared with 1,084,899 tons in 1969, a 25-percent increase. Indian production of aluminum metal was more than enough to meet domestic needs; 1970 production was 161,081 tons. Exports totaled 10,775 tons while imports were a meager 2,878 tons.

Bauxite.—Most of the rise in bauxite production in 1970 compared with 1969 production met domestic needs. Exports of bauxite in 1970 were 54,651 tons while exports in 1969 were 73,883 tons. Bihar supplied 36 percent of the total 1970 bauxite output; Gujarat supplied 18 percent; Madhya Pradesh supplied 16 percent, with the remainder supplied by other States. The manufacturers of aluminum metal consumed about 966,000 tons of bauxite and 338,990 tons were used by other industries, such as the chemical, refractory, abrasives, cement, and steel industries.

Aluminum ingot.—The following tabulation shows the production and capacity of the individual aluminum plants:

Company, plant, and location of plant	Thousand metric tons		
	1970		1973
	Output	Capacity	Proposed capacity
Aluminium Corp. of India Ltd.:			
Asansol, West Bengal	8	9	12
Bharat Aluminium Co. Ltd.:			
Koyna, Maharashtra	---	---	50
Korba, Madhya Pradesh	---	---	100
Hindustan Aluminium Corp. Ltd.:			
Renukoot, Uttar Pradesh	78	80	120
Indian Aluminium Co. Ltd.:			
Alwaye, Kerala	62	16	16
Belgaum, Mysore		30	40
Hirakud, Orissa		20	20
Madras Aluminium Co. Ltd.:			
Mettur, Tamil Nadu	13	14	25
Total	161	169	383

Apparent consumption of aluminum was 153,184 tons in 1970, as compared with 123,554 tons in 1969. The bulk of India's consumption, as much as 50 percent, goes to the electrical industries.

The Governments of India and Gujarat State have under consideration a 200,000-metric-ton public sector export-oriented alumina plant and associated bauxite mines near Bhuj in Gujarat State. The Government of India also gave a Goan industrialist permission to build a 200,000-metric-ton-capacity alumina plant in Goa. The Aluminium Corp. of India, Ltd., received Indian Government permission to build a second aluminum plant with a 30,000-metric-ton capacity in Orissa. Bihar State officials are thinking of erecting an aluminum complex in cooperation with the private sector at Latehar.

Chromite.—Indian chromite output in 1970 continued its upward trend and reached 270,879 metric tons compared with 226,568 tons in 1969. The 1970 exports of 157,540 tons, valued at $4,289,269, went entirely to Japan. Total exports break out into 93,147 tons grading 48 to 56 percent Cr_2O_3, 31,830 tons grading 38 to 48 percent Cr_2O_3, and 32,563 tons grading below 38 percent Cr_2O_3. Ferrochrome production in 1970 rose to 13,343 tons, compared with 5,189 tons in 1969. Ferro-Alloy Corp. Ltd. supplied 56 percent of the total production. Ferrochrome exports in 1970 were 8,413 tons valued at $3,070,000; 72 percent of this tonnage was exported to Japan. The Orissa State Industrial Development Corporation is negotiating with Japanese interests for an expansion of their Jaipur Road ferrochrome plant to a 25,000-metric-ton-per-year total capacity.

Copper.—The demand for copper in India as estimated by the Planning Commission was 93,400 tons in 1970. India's only producer, the private sector Indian

Copper Corporation, produced only 9,311 tons at its 9,960-metric-ton-capacity Ghatsila refinery. Therefore, India remains heavily dependent on imports.

The Indian Copper Corporation is presently building a flash smelter at Ghatsila that will raise its total capacity to 16,500 tons by 1971. The public sector Hindustan Copper Ltd. signed a contract with Power-Gas Corp. of London for the design and building of a flash smelter using the Outokumpu Oy process at Khetri-Kolihan. The smelter will have a capacity of 31,000 tons of electrolytic copper and will reach full capacity by 1976–77. The total estimated cost of the Khetri-Kolihan project increased again and is now $124.8 million.

A number of other copper development projects were under way, but there has not been much significant progress on most of them. Further evaluation of a copper find at Malanjkhand, Madhya Pradesh, reveals that it may be a porphyry deposit. A preliminary reserve figure for it would be in the range of 210,000 to 900,000 tons of contained copper. If the higher end of the range is correct, this could be a significant increase to the all-India reserves of 3.5 million tons of contained copper. The Rakha Copper Project, which has the potential of being an important producer, has reportedly made progress by completing mine dewatering and rehabilitation and finishing the design of the concentrator plant. The Agnigundala Lead-Copper Project of Hindustan Copper, which has the potential of being an important producer of lead and a copper producer of lesser importance, has delineated reserves of 691,000 tons of contained lead and 117,000 tons of contained copper (included in the 3.5-million-ton all-India reserve figure). Hindustan Copper was reportedly doing some investigatory mining in the Bandalamottu block of Agnigundala.

Gold.—Problems with depletion caused Indian gold production to continue to decline in 1970. As in 1969, this decline resulted from a decrease in output by the large producer—Kolar Gold Mining Undertaking—from 377,853 metric tons containing 0.20 troy ounce of gold per ton in 1969 to 360,528 tons containing 0.17 troy ounce per ton in 1970; and from an increase in output by the small producer—Hutti Gold Mines Co.—from 109,495 tons containing 0.31 troy ounce per ton in 1969 to 160,918 tons containing 0.26 troy ounce per ton in 1970. Both producers seem to have operated at a financial loss.

Ore reserves dropped in 1970 to 4.2 million tons, averaging 0.27 troy ounce per metric ton.

The Government of India terminated a consulting engineering agreement with John Taylor and Sons of London—the modern operators and developers of the Kolar gold mines since their reopening in 1880.

Ilmenite, Rutile, and Monazite.—The two beneficiation plants of the Government-owned Indian Rare Earths, Ltd., were the only mineral sand producers in India in 1970. The plant at Manavalakurichi has a capacity of 40,500 tons of ilmenite, 3,600 tons of zircon, 3,000 tons of monazite, 1,500 tons of garnet, and 800 tons of rutile. The company hopes to complete the much-delayed new Chavara plant in 1971; it reactivated the old Chavara plant in 1970 to meet export demand. Indian Rare Earths, Ltd., hopes to have a 600-metric-ton-per-year capacity zirconium oxide plant on stream in August 1971. The new additions to the Travancore Titanium Products Ltd. titanium dioxide pigment plant that were scheduled to open in 1971 will not open until 1972.

Iron Ore.—While overall Indian iron ore production rose moderately in 1970, the growth occurred exclusively in the export category; the domestic use of iron ores decreased to 10.35 million tons from 11.63 million tons in 1969. Total value of iron ore exports was $152 million in 1970, an increase from $128 million in 1969. Average value of iron ore exports per ton was $7.44, a decrease from $7.66 in 1969. Table 4 shows iron ore exports by destination. While exports jumped in 1970, India still has not come near to realizing its potential as a supplier of iron ore, and its present status is even in danger. The bottleneck is caused mainly by lack of port facilities and an inadequate transportation system.

In 1970, 299 iron ore mines were in operation, all open pit, 11 of which were captive mines. About 30 of these mines produced over 100,000 tons of ore annually.

New mine development was mostly by the National Minerals Development Corporation in the public sector. Its Kiriburu mine, now producing 3.3 million tons of ore per year, is undergoing expansion towards its 1972 goal of 5.5 million tons of

Table 4.—India: Exports of iron ore
(Million metric tons)

Destination	1969	1970
Belgium	0.35	0.35
Czechoslovakia	.76	.72
Germany:		
East	.03	.04
West	.14	.11
Hungary	.18	.12
Japan	13.85	16.47
Poland	.39	.38
Romania	.68	1.54
Yugoslavia	.18	.20
Other	.11	.50
Total	16.67	20.43

ore per year. While Kiriburu now exports most of its ore, ultimately its total production will go to the Bokaro steel plant. The switchover should begin in 1972 and should last several years. The Bailadila deposits will take over the Kiriburu mine's export market by opening another deposit, thus expanding their annual output from 4.0 million tons to 10.0 million tons. The developers of the Kudremukh project have found that the project is economically feasible, but they still need government approval before construction can begin. A joint venture between Mysore State, Kaiser Engineering Corp., and Sumitomo Metal Mining Co. Ltd. started pilot plant and feasibility studies for a large-scale iron ore beneficiation plant processing low-grade greatly expand iron ore port capacity by ores in Mysore State.

The Government of India is planning to greatly expand iron ore port capacity by 1974. The projected capacities include 10.0 million tons at Visakhapatnam, 11.0 million tons at Mormugao, 5.0 million tons at Madras, 4.0 million tons at Paradip, and lesser capacities at other ports. If the Government succeeds in expanding port facilities and in solving related problems, perhaps the expected demand for 51 million tons of iron ore (31 million tons for export) by 1973–74 can be met.

Iron and Steel.—India's iron and steel industry produced less pig iron and steel ingot in 1970 than it did in 1969. However, it did have a larger output of most ferroalloys in 1970 than in 1969. In terms of value, India was a net importer of ferrous metals in 1970, since exports decreased while imports increased compared with those of 1969. Ferrous metal imports exceeded exports by $21.8 million in 1970, but in 1969 exports exceeded imports by $30.4 million.

Steel plant capacities have remained unchanged since 1968. Bhilai accounted for about 31 percent of steel ingot output, Tata Iron and Steel Co. (TISCO) produced 27 percent, Rourkela produced 18 percent, Durgapur produced 13 percent, and Indian Iron and Steel Co. (IISCO) produced 11 percent. The industry as a whole only used 70 percent of its capacity; Durgapur had the worst performance and utilized only about 40 percent of its capacity. Durgapur had severe labor trouble and some serious technical problems related to maintenance and misuse of plant equipment.

The net result of the above trends was a severe steel shortage in 1970. It was so bad that some major steel consumers had to close their plants for lack of steel. The Government of India has responded by permitting minor price increases for steel, partly banning steel exports and allowing large-scale imports, mostly from Japan. It has also encouraged electric furnace steelmaking in the private sector and is studying the feasibility of setting up mini-mills in various parts of the country. In spite of these stop-gap measures, the shortage is likely to last for at least several years.

In the future, large steel plant expansion planned and under construction may alleviate the situation. The Bokaro project continues to fall behind schedule, and March 1973 is the earliest date likely for even a partial startup. The Bhilai plant will have the technical barriers to full-capacity use removed, but this may necessitate expanding plant capacity to 4.2 million tons. Exactly when Bhilai will be operating at a level above its present 2.5-million-metric-ton capacity is uncertain, even though the expansion to 3.2 million tons should be completed in 1971. The Government of India has also announced plans for three more steel plants, all in southern India, with a combined capacity of 4.2 million tons. It will not complete these plants before the late 1970s.

Lead and Zinc.—Although India has over 100 known lead-zinc deposits, in 1970 only one mine, the Zawar mine of Hindustan Zinc, Ltd., near Udaipur, Rajasthan, was in operation. Imports provided most of the nation's needs for lead and zinc. Strong evidence suggests that there is enough ore in some of these undeveloped deposits, if developed, to make India self-sufficient in lead and zinc. The development of the Agnigundala lead-copper deposits (previously mentioned), if successful, should help to increase the supply of lead.

In the area near the Zawar mine, total proved and indicated ore reserves rose to 165 million tons in 1970. All the increase occurred near Dariba-Rajpura. Previous data indicates that the ore reserves contain from 0.5 to 2.5 percent Pb and from 3.5 to 7.0 percent Zn. The ore output in 1970 rose to 266,362 tons containing 0.7 percent Pb and 3.6 percent Zn, as compared with 203,136 tons in 1969. This ore yielded 3,880 tons of lead concentrates and 15,888 tons of zinc concentrates in 1970, compared with 3,300 tons of lead concentrates and 13,781 tons of zinc concentrates in 1969.

Ore imports in 1970 rose to 47,001 tons of zinc concentrates, up from 29,998 tons in 1969, and to 101 tons of lead ore and concentrates in 1970, up from 81 tons in 1969.

Imports of zinc metal and alloys in 1970 rose to 73,947 tons (almost all of it unwrought), compared with 30,866 tons in 1969. This increase in 1970 was not as significant as it appeared to be because the 1969 imports were unusually low; in 1969 India was using up an unexpected surplus of metal which appeared in 1968. India's demand for zinc metal was about 106,550 tons, leaving a supply-demand gap of about 9,000 tons. Almost 50 percent of the zinc consumed went into galvanizing.

By 1972 Hindustan Zinc will multiply production at its Zawar mine and concentrator by 3.75 times if construction proceeds according to plan. Some of this new capacity should be on stream by late 1971. Expansion of the company's Debari smelter is scheduled for completion in 1974. It is planned to run the smelter at full capacity by 1977, using only concentrates from the Zawar mine.

India's only lead smelter, owned by Hindustan Zinc at Tundoo, produced 1,862 tons of lead in 1970 while utilizing only 34 percent of capacity. A drop in output of Zawar lead concentrates and obsolescence of the plant caused this underutilization of the plant. The remainder of the national supply came from imports of 39,751 tons of lead metal, of which 214 tons was semimanufactured and the balance unwrought. This compares with 30,125 tons of lead metal imported in 1969. The lead supply-demand gap persisted in 1970; actual demand in 1970 was 73,197 tons. Domestic production, imports, and scrap (7,500 tons) met most of this demand, but left a gap of about 24,000 tons.

India's two zinc smelters ran at about 62 percent of capacity in 1970 while producing 23,410 tons of zinc. The Hindustan Zinc smelter at Debari produced 9,642 tons of zinc (capacity 18,000 tons per year). The Cominco Binani Zinc Ltd. smelter at Alwaye produced 13,768 tons of zinc (20,000 tons per year capacity). Poor utilization of smelter capacity resulted from the Zawar mine not supplying enough concentrates for the Debari smelter and from startup problems that hindered operation of the Alwaye smelter.

The Government of India approved a 1969 agreement between Hindustan Zinc and Centrozap of Poland to study the construction of a second public sector zinc smelter at Visakhapatnam. Proposed capacity is 30,000 tons of electrolytic grade zinc metal, plus 1,500 tons of zinc dust, 2,120 tons of lead metal, 66 tons of cadmium, and 45,540 tons of sulfuric acid annually. The smelter would use imported concentrates. Hindustan Zinc was also considering construction of a new smelter near Udaipur which would use the Imperial Smelting Furnace system of Britian. Thus, there are several proposed smelters which could help meet future Indian demand for zinc but not for lead.

India's demand for zinc metal should increase 10 percent annually from 1971 to 1980, while its demand for lead metal should increase 10 percent annually until 1973.

Manganese.—Production and exports of manganese ore in 1970 were higher than in 1969. While India continued to rank high among world manganese producers, other producing nations were challenging its position. The State of Orissa accounted for 30 percent of the nation's 1970 manganese production, followed by Mysore with 22 percent, and then other States with lesser amounts. India's manganese industry still faces the same problems that it has faced for a number of years, such as competition from new, efficient, more favorable located producers in other nations, and high transportation-infrastructure costs in India. Table 5 shows exports by type and destination. Domestic consumption increased slightly from 740,000 tons in 1969 to 748,600 tons in 1970. Of this amount,

Table 5.—India: Exports of manganese ore by type and destination

(Thousand metric tons)

Type and destination	1969	1970
Types:		
Ore, 48 percent manganese or higher	[1] 154	NA
Ore, 35 to 48 percent manganese	[1] 362	NA
Ore, ferruginous, below 35 percent manganese	[1] 690	NA
Peroxide and other processed oxides	[1] 2	NA
Total, ores and similar materials	[1] 1,208	NA
Destinations (all types):		
Belgium	67	32
Czechoslovakia	49	51
France	40	11
Italy	-----	17
Japan	845	1,230
Netherlands	29	96
Norway	45	-----
Romania	19	-----
Spain	19	72
United Kingdom	11	5
United States	60	68
Other	-----	10
Total	1,184	[2] 1,590

NA Not available.
[1] Data on exports by type for 1969 are from a compilation by the Indian Bureau of Mines and differ from that reported in official trade returns, which were used as source for 1969 destinations.
[2] Data may not add to totals shown because of independent rounding.

iron and steelmakers consumed 388,600 tons; 350,000 tons went into making ferromanganese; and battery producers used 10,000 tons.

Nickel.—The Geological Survey of India has discovered at Kansa in Orissa what may turn out to be that nation's first workable nickel deposit. The survey states that the indicated reserves are 10 million tons of nickeliferous laterite averaging 1 percent nickel. Although Chemical and Metallurgical Design Co. has completed a feasibility study on exploiting these deposits, it is not yet known whether the deposits will actually be exploited. The feasibility study proposes a plant more than large enough to supply all domestic needs for nickel.

Uranium.—The concentration plant of the Uranium Corp. of India, Ltd., at Jaduguda had an input rate approximating plant capacity in 1970. The company's mine at the same location now has 3.5 million tons of ore blocked out which probably averages about 0.076 percent equivalent U_3O_8.

NONMETALS

Cement.—The Government-owned Cement Corporation of India Ltd. again successfully kept a balance between supply and demand in 1970. Production in 1970 increased to 13.54 million tons while consumption rose to 13.41 million tons, in contrast to exports which continued to drop. Yearend stocks increased 250,000 tons with 240,000 tons in 1969. Installed cement plant capacity rose to 16.3 million tons in 1970, as planned. Demand, however, fell below the Planning Commission estimates of 13.9 million tons in 1970. Because the Planning Commission estimates that cement consumption will be 18.5 million tons in 1973, various plant expansions are continuing which should raise total plant capacity to 21.2 million tons in 1973. However, actual demand in 1973 may not be that high.

New building construction consumed over 50 percent of India's cement production. The industry used 18.78 million tons of limestone to make cement in 1970.

The 1970 cement exports went principally to Nepal (67,235 tons) and to Ceylon (29,315 tons).

Fluorspar.—India's production doubled in 1970 to 4,647 tons of mine-run fluorspar worth $500,000, up from 1,880 tons in 1969. Imports were down to 11,733 tons worth $1.3 million in 1970.

The fluorspar beneficiation plant of the State-owned Gujarat Mineral Development Corp. at Kadipani went on stream in May 1970. Its capacity is 20,000 tons of metallurgical-grade (80 to 85 percent CaF_2) and 20,000 tons of acid grade (97 percent CaF_2) fluorspar concentrates annually. Another State-owned fluorspar beneficiation plant, located at Mandokapal, Rajasthan, and belonging to the Industrial and Mineral Development Corp., should be ready to go on stream by the end of 1971. Its capacity is about 19,000 tons of acid grade concentrates annually. These plants have available reserves of 3.87 million tons contained CaF_2.

Gypsum.—Gypsum production in 1970 was much below 1969 because the principal producer began a phase-down of its operations in response to long-anticipated reductions in orders from its principal customer, Sindri Fertilizers and Chemicals, Ltd. (part of the Government-owned Fertilizer Corp. of India), and because unusually heavy monsoon rains forced the producers to close for almost 4 months. Since the plans of Sindri Fertilizers and Chemicals Ltd. to switch from gypsum to pyrite as a raw material for manufacture of ammonium sulfate were delayed until at least 1972, the company had to use 500,000 tons of gypsum in 1970 instead of the pyrite. Thus, gypsum was in short supply late in 1970 and its shortage in turn curtailed production at some cement plants and at plants of other consumers as well. With some of the mine pits still flooded and stripped of equipment, it may be difficult to return to the former level of gypsum production for some time.

Kyanite, Sillimanite, and Wollastonite.—While India has produced kyanite for over 45 years, it has yet to accurately assess its kyanite reserves. Reserves seem to be at least 1 million tons and may be as high as 10 million tons. The private sector Indian Copper Corp. has produced over 80 percent of India's output from the Lapsa Buru deposit in Bihar State. Bihar State accounted for 86 percent of total output in 1970 and Maharashtra for 14 percent. About 80 percent of Indian Copper Corp.'s production averaged above 62 percent Al_2O_3; 17 percent averaged between 60 and 62 percent Al_2O_3; and the remainder averaged below 60 percent. Domestic consumers used about 35,000 tons of kyanite in 1970 with 15,974 tons going into stocks, while consumers used about 21,000 tons of kyanite in 1969 with none going into stocks. Japan took 20 percent of India's kyanite exports by quantity, Italy took 18 percent, and the remainder mostly went to other European countries.

While sillimanite production has been decreasing in the last several years because the principal producer, Assam Sillimanite, Ltd., was having ore depletion problems, 1970 sillimanite production increased because the company was able to mine new leaseholdings. Assam State accounted for 66 percent of output, Tamil Nadu for 22 percent, and other States for the remainder. Japan received 60 percent of the exports, by quantity.

The large deposits of wollastonite found by the Jai Mining Syndicate near Udaipur, Rajasthan State, have probable reserves exceeding 200 million tons. A typical analysis of the wollastonite is 52 percent SiO_2, 47 percent CaO, with the remainder being iron and alumina impurities and loss on ignition.

Magnesite.—Magnesite output in 1970 again reached a new high of 348,962 tons valued at $1.1 million compared with 295,508 tons in 1969. Tamil Nadu produced 98 percent of the 1970 output. The refractory industry again accounted for most of domestic consumption. The domestic consumption in turn accounted for most of the output; exports were minor.

India's magnesite reserves total 70.3 million tons.

A new corporation, Belpahar Refractories Ltd., will begin to mine and calcine magnesite using a 35,000-metric-ton plant in the Almora District of Uttar Pradesh in 1971.

Mica.—Total processed mica production during 1970 exceeded production during 1969, thus enabling India to retain its role as a major world producer of mica. India consumed about 6,000 tons of mica domestically, mainly to make insulating brick. Total quantity of exports of mica in 1970 increased over exports in 1969. Table 6 shows the distribution of the quantity of exports by type. The value of 1970 mica exports was $22.1 million, slightly less than the $22.2 million recorded for 1969. The value of 1970 exports by type was block—$10.6 million; splittings—$6.5 million; film—$1.7 million; other—$3.3 million. The leading destinations for mica exports by value were U.S.S.R.—$6.2 million; Japan—$2.9 million; United States—$2.6 million; Poland—$1.7 million; the United Kingdom—$1.5 million; East Germany—$1.3 million; and Czechoslovakia—$1.0 million.

While the Government of India showed concern that the impact of synthetic mica and mica substitutes on the world mica market might destroy one of India's important foreign exchange-earning industries, there seems to be insufficient evidence to support this view. Although India has lost part of its traditional markets, it has gained some new markets. Specifically, India's production as measured by exports increased its share of world production of mica sheet, block, and splittings from 59 percent in 1960 to 72 percent in 1970, while the world production in 1970 declined to 66 percent of 1960 world production.

Table 6.—India: Mica exports by type

(Metric tons)

Type	1969	1970
Block	1,790	1,630
Film	107	123
Cut condenser film and plate	36	138
Cut sheet and strip	27	21
Washer and disc	103	119
Splittings	6,686	6,313
Scrap and waste	8,997	14,972
Powder	3,289	3,616
Micanite and builtup mica	21	10
Total	21,056	26,942

However, India's mica production as measured by exports of all grades showed a slight decline in its share of world mica production, from 18 percent in 1960 to 16 percent in 1970, while world production of all grades of mica in 1970 was 103 percent of the 1960 figure. Thus, competitors have only somewhat curtailed India's mica industry so far. There seems to be an adequate quantity and quality of reserves to keep the industry functioning for a long time, although the actual quantity available is not known.

Phosphate Rock.—The sole producer, the Jhamar Kotra Mine of the 50 percent government-owned Bikaner Gypsum Co., Ltd., produced 149,544 tons of phosphate rock worth $1.75 million in 1970 compared with 69,175 tons in 1969. India met most of its demand for phosphate rock in 1970 by importing 327,198 tons from the United States; 291,153 tons from the United Arab Republic; 197,581 tons from Morocco; 94,980 tons from Jordan; and 13,716 tons from Hungary.

The Bikaner Gypsum Co., Ltd., reached its 1,000-ton-per-day expansion target early in 1971 and will now try to double that early in 1972. The International Bank for Reconstruction and Development may give financial aid to the State of Rajasthan for the further development of the Jhamar Kotra Mine and for building a beneficiation plant as the result of successful pilot plant studies conducted by an AID phosphate beneficiation specialist and the staff of India's Bureau of Mines.

Sulfur and Pyrite.—The only producer of pyrite, the Pyrites and Chemicals Development Co., Ltd., which works the Amjhore-Ghogha deposits in Bihar, produced 26,400 tons of ore (quality unavailable) in 1970, as compared with 38,686 tons in 1969. The 1970 production was only 22 percent of the planned output. The ore contained 35 to 38 percent sulfur rather than the 40 percent sulfur expected on the basis of diamond drilling. Company officials announced that further development of the mine will be necessary before it can make its planned contribution to India's sulfur supply.

In addition to the above production, India's zinc smelters produced 47,250 tons of byproduct sulfuric acid in 1970 from zinc sulfide concentrates, compared with 49,500 tons in 1969. Smelter expansion should provide a production of 195,000 tons of sulfuric acid in 1974. Imports supplied most of India's needs for sulfur. Principal sources were Canada—305,841 tons; Poland—113,009 tons; and Iran—105,217 tons.

MINERAL FUELS

Coal.—Coal was again India's most important mineral commodity in terms of value, even though both value and quantity were a bit lower in 1970 than in 1969. The average value per ton was $4.75 in 1970 as compared with $4.61 in 1969.

Private collieries produced 75.7 percent of the total 1970 output, the Government-owned National Coal Development Corporation produced 19.2 percent; Singareni Collieries Co., Ltd., produced 5.1 percent. Of the total output, 16.50 million tons was coking coal in 1969 and in 1970. Of the total output, 76 percent came from underground mines and 24 percent came from open pit operations.

In 1970, 759 coal mines were operating, 33 mines less than the previous year.

India consumed 70.18 million tons of coal in 1970; 16.0 million tons of this was consumed by the Indian railways; 16.0 million tons by thermal powerplants; 14.5 million tons by the iron and steel industry; 3.0 million tons by coke ovens; and other industries consumed the remainder.

The coal industry had a difficult time in 1970. Production was down, a number of mine closures occurred, and pithead stocks reached an unprecedented high of 8.6 million tons by the end of 1970. This difficult time resulted from labor disturbances in the mines, at the railways, and at the consumers plants, plus problems with the coal price structure and a shortage of rail cars at peak shipping periods.

The Government of India's efforts to promote exports of coal, begun in 1968, began to show results in 1970. The likelihood of large increases in coal export still remains small, however, mostly because of inadequate port and railway facilities. Inadequate transportation facilities have also led the Ministry of Steel and Mines to consider importing coal for two planned steel plants which will be quite distant from the sources of domestic coking coal.

Lignite.—The Neyveli mine was the only lignite producer in 1970. Its urea fertilizer plant produced 97,300 tons of fertilizer, and its briquetting and carbonization plant produced about 150,000 tons of carbonized briquets.

Natural Gas.—Natural gas production in 1970 decreased compared with 1969 production. Natural gas reserves, as of January 1, 1970, were 2,092 billion cubic feet, a decrease of 145 billion cubic feet compared with the previous-year figure. The Oil and Natural Gas Commission (ONGC) agreed to construct a 15-mile pipeline in Gujarat.

Petroleum.—The Indian petroleum industry had a slower growth in 1970 than in the previous year. Production of crude increased by only 0.9 million barrels, to 52.6 million barrels in 1970. Production from Gujarat was 52 percent of the total and that from Assam was 48 percent. Crude oil imports, however, jumped to 86.6 million barrels, 7.8 million barrels above the 1969 figure. Refinery throughput was 138.5 million barrels, while refinery output (excluding plant fuel and losses) was 131.7 million barrels. Product exports dropped 2.9 million barrels to only 3.5 million barrels in 1970. Product imports dropped by 0.3 million barrels to 8.1 million barrels.

Exploration, Drilling and Crude Oil Production.—There were no major discoveries in 1970. Drilling of the deep well at Suruin (near Jammu), spudded-in as scheduled in March 1970, was only able to proceed until October when drilling difficulties (stuck rods) forced a temporary suspension of activity. India's first offshore well, near Aliabet Island, reached a depth of 4,859 feet and bottomed in Deccan Trap volcanics. While the well encountered barren Eocene sediments, three overlying Miocene horizons did produce a noncommercial flow of crude oil. This opened other possibilities in unexplored Miocene sediments in adjacent offshore areas and nearby Gujarat. The ONGC finally completed negotiations early in 1971 to commission Mitsubishi Heavy Industries, Ltd. to build India's first self-propelled jackup drill platform according to a design supplied by The Offshore Co. (Houston, Tex.) for delivery by December 1972. This drill platform will drill on the "Bombay High" structure. The Offshore Co. will be acting as consultant and contractor, both now and during the early phases of drilling.

The ONGC completed 90 wells (more than 554,000 feet drilled) during 1970; Oil India, Ltd., completed 14 wells (almost 157,000 feet); and Assam Oil Co., Ltd., completed 10 wells (almost 22,000 feet). At the end of 1970 in all of India there were about 1,050 producing oil wells, 95 gas wells, 140 holes under test, and 35 water injection holes in operation.

Refining.—The following tabulation shows refinery output in million barrels:

Refineries	1969	1970
Private:		
Digboi	3.7	3.5
Burmah-Shell	26.3	24.8
ESSO	17.2	16.7
Caltex	9.2	8.3
Subtotal [1]	56.5	53.3
Government-controlled:		
Gauhati	5.6	4.9
Barauni	14.3	15.9
Koyali	25.0	25.1
Cochin	17.6	18.4
Madras	5.6	14.1
Subtotal [1]	68.0	78.3
Total [1]	124.6	131.7

[1] Data may not add to totals shown because of independent rounding.

The refinery production of private corporations decreased because the Government reduced foreign exchange allocations between April and August. Shortages of Assamese crude oil lowered the output of the Government-owned Gauhati and Barauni refineries. In 1970, 62 percent of the refinery feed was imported.

The Government is making all the plans for refinery expansion and new refineries. It wants to expand the Koyali refinery from 60,000 to 170,000 barrels per day. Haldia is still scheduled for completion in 1973. The Government announced plans for a new refinery in Assam in 1975. The Government of Goa petitioned the Central Government for approval of a refinery in Goa.

Transportation.—Most petroleum products still moved by rail in 1970. The role of pipelines was unchanged, since the Kalol-Koyali pipeline in Gujarat was not completed on schedule. The pipeline reportedly has a capacity of 7.5 million barrels of crude oil annually.

Marketing.—The Government's Indian Oil Corp. raised its share of total product distribution in India to 52 percent in 1970, an increase of 3 percent compared with the previous year. Burmah-Shell and Esso both had a slight increase in volume while suffering a loss in their percentage of total sales. Caltex had a loss both in volume and in percentage.

The Mineral Industry of Indonesia

By E. Chin [1]

On April 1, 1970, Indonesia began the second year of its 5-year plan, Repelita. Under this program, increases in public and private investment, domestic production, and exports have indicated economic progress. Additionally, foreign investment and assistance have grown significantly. The Government remained committed to a generally free market system and the overall confidence in the economy within the business community improved. For the past 2 years, the Government has held inflation under 10 percent per year in spite of a rapid expansion of bank credit and money supply. Under the 5-year plan, priority is given to increasing the volume of production of existing plants and factories.

Since the implementation of the plan, there has been noticeable growth in production, financing, marketing, management, taxes, rates of duties, infrastructure and competition. Provisions of the Repelita call for increasing fertilizer and cement production since the domestic demand was rising sharply. If all investments in the cement industry were to be realized, cement production in Indonesia would reach 1.34 million tons annually by the end of the 5-year plan.

In 1970 the output of the textile industry increased markedly, partly by the increased output of existing plants and partly by the establishment of new enterprises. The chemical industries developed more favorably than in previous years. Production of glass, carbon dioxide, and oxygen increased. In March, a detergent plant in central Djakarta was commissioned. Petroleum production by the private companies and the state-owned oil company, Pertamina, was markedly increased. Between December 6, 1969, and the end of 1970, more than 35 production-sharing contracts were signed between Pertamina and foreign oil companies. Mine production rose at various rates for tin, nickel, and bauxite. Coal production declined.

Power generation was being increased due to the construction of 11 projects throughout the country, which were in varying stages of completion during 1970. The World Bank provided $16.8 million in credits for the reorganization of the state-owned electricity company and for the improvement of distribution.

[1] Chemist, Division of Nonferrous Metals.

PRODUCTION

Output of crude petroleum, by far the most important Indonesian mineral commodity, increased 15 percent in 1970. Mine output of tin increased 9 percent in 1970, to 18,761 metric tons. However, tin metal production decreased 13 percent in 1970, to 5,108 metric tons. In 1970, production of bauxite was 1,229,168 metric tons, an increase of 61 percent over the previous year's output.

Table 1.—Indonesia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970
METALS			
Aluminum, bauxite, gross weight	879,323	765,282	1,229,168
Gold [2] troy ounces	5,968	8,250	7,608
Lead	NA	NA	[e] 200
Manganese ore [e]	[r] 2,200	6,400	2,000
Nickel mine output, metal content [e] [3]	[r] 7,222	7,624	18,000
Silver thousand troy ounces	309	340	283
Tin:			
Mine output, metal content long tons	16,671	17,138	18,761
Metal do	[r] 3,558	5,900	5,108
NONMETALS			
Cement thousand tons	[r] 410	540	553
Clays, kaolin powder [e]	[r] 7,500	2,500	9,500
Diamond:			
Industrial [e] thousand carats	6	6	6
Gem [e] do	14	14	14
Total [e] do	20	20	20
Fertilizer materials, phosphate rock [e]	10,000	10,000	10,000
Iodine	NA	[e] 1,000	[e] 1,000
Salt, all types [e] thousand tons	80	180	180
Sulfur, elemental [e]	1,200	1,200	1,500
MINERAL FUELS AND RELATED MATERIALS			
Asphalt rock, bitumen content [e]	10,000	12,000	18,300
Coal thousand tons	176	191	172
Gas, natural:			
Gross production million cubic feet	[r] 116,025	[e] [r] 110,000	108,435
Marketed do	[e] [r] 24,067	[e] 30,161	27,649
Natural gasoline thousand 42-gallon barrels	260	NA	254
Petroleum:			
Crude do	[r] 219,913	271,003	311,550
Refinery products:			
Gasoline do	10,991	10,927	12,253
Kerosine and jet fuel do	14,317	15,943	15,780
Distillate fuel oil do	13,672	8,371	9,023
Residual fuel oil do	12,890	12,926	13,646
Lubricants (including grease) do	6	21	17
Other [4] do	16,082	24,446	29,888
Fuel and losses do	4,355	3,464	2,852
Total do	72,313	76,098	83,459

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

[1] In addition to the commodities listed, a variety of crude construction materials such as clays, stone, and sand and gravel 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 20,000 troy ounces per year.

[3] Includes a small amount of cobalt which is not recovered separately.

[4] Includes unfinished oils requiring further processing.

TRADE

Official Indonesian trade statistics for 1968-1969 were not available. The statistics given in tables 2 and 3 were based on data from trading partner countries.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum, bauxite	845,366	837,501	Japan 767,741; Italy 69,760.
Copper scrap	111	126	West Germany 66; Belgium-Luxembourg 60.
Iron and steel scrap	3,382	10,494	All to Japan.
Lead alloys unwrought	--	50	Do.
Manganese ore and concentrate	6,233	3,140	Do.
Nickel ore and concentrate	234,960	268,099	Do.
Tin:			
Ore and concentrate ------ long tons	4,852	62	Spain 42; Japan 20.
Metal alloys unwrought ------ do	5,833	7,250	West Germany 3,805; France 1,987.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined:			
Crude thousand 42-gallon barrels	125,184	169,129	Japan 105,326; Australia 32,067.
Partly refined ------ do	5,159	4,474	Japan 2,366; Australia 1,725.
Refinery products:			
Gasoline, motor ------ do	67	943	Japan 822; New Zealand 104.
White spirit, kerosine ------ do	--	38	All to New Zealand.
Distillate fuel oil ------ do	96	13	Do.
Residual fuel oil ------ do	14,068	20,282	Japan 18,641; Netherlands 1,641.
Mineral jelly and wax ------ do	124	110	Australia 39; West Germany 21; Netherlands 21.
Total ------ do	14,355	21,386	

[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 U.S.S.R., the United Kingdom, the United States, and Yugoslavia.

Source: For the U.S.S.R.: Official trade returns of that country; for all other countries: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 5 (The Far East), Walker and Company, New York 1970, pp. 445–449; 1969 Supplement to the World Trade Annual. V. 5 (The Far East), Walker and Company, New York 1971; pp. 316–320.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	--	35
Metal including alloys, all forms	5,557	4,760
Copper including alloys, all forms	554	1,345
Iron and steel:		
Scrap	260	--
Pig iron and cast-iron	4,708	515
Semimanufactures	156,928	223,595
Lead alloys unwrought	91	--
Manganese oxide	--	165
Nickel semimanufactures	6	--
Tin including alloys, all forms ... long tons	422	52
Titanium oxides	103	154
Zinc:		
Oxide	380	105
Metal including alloys	1,733	1,707
Other:		
Ash and residue containing nonferrous metals	--	237
Oxides, hydroxides and peroxides of metals n.e.s	59	39
NONMETALS		
Abrasives, natural, grinding and polishing wheels and stones	33	51
Barite	2,939	3,499
Caustic soda	12,710	15,404
Cement	157,015	339,166
Clays and products:		
Crude n.e.s	4,537	4,408
Products ... value, thousands	$462	$492
Fertilizer materials:		
Crude ... do	$1,060	$1,224
Manufactured:		
Nitrogenous	47,081	124,127
Phosphatic	111,370	41,692
Potassic	5,244	32,937
Mixed	50,143	130,406
Total	213,838	329,162
Gypsum and plasters	10,556	(2)
Limestone	1,963	2,341
Precious and semiprecious stones, n.e.s ... value	$71,000	$104,000
Sulfur:		
Elemental	5,015	4,596
Sulfuric acid	(3)	449
Other n.e.s.:		
Crude	--	1,846
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals n.e.s	1,620	2,849
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	1,097	677
Coal	335	10,000
Coke	3,406	6,755
Petroleum refinery products:		
Residual fuel oil ... thousand 42-gallon barrels	--	142
Lubricants ... value, thousands	$2,420	$3,118
Mineral jelly and wax ... thousand 42-gallon barrels	12	6
Other:		
Nonlubricating oils n.e.s ... do	5	10
White spirit, kerosine ... do	317	386
Bitumen and other residues ... do	354	735
Bitumen mixtures ... do	4	--

[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 U.S.S.R., the United Kingdom, the United States, and Yugoslavia.
[2] Quantity not reported, value $89,000.
[3] Quantity not reported, value $25,000.

Source: For U.S.S.R.: Official trade returns of that country; for all other countries: Statistical Office of the United Nations, 1968 Supplement to the World Trade Annual. V. 5 (The Far East), Walker and Company, New York 1970, pp. 450–460; 1969 Supplement to the World Trade Annual. V. 5 (The Far East), Walker and Company, New York 1971; pp. 321–328.

COMMODITY REVIEW

METALS

Aluminum.—P. T. Alcoa Minerals of Indonesia, a wholly owned subsidiary of the Aluminum Company of America (Alcoa), reported the discovery of bauxite deposits in West Kalimantan, Borneo. The discovery was made along a 300-kilometer belt from the Kapas River southeast to the Djelai River in southwest Kalimantan. P. T. Alcoa has been exploring in various locations in the Indonesian archipelago under a 1969 agreement between Alcoa and the Indonesian Government. From samples taken on Kalimantan the bauxite appears similar to the bauxite mined on the Indonesian island of Bintan. Alcoa indicated that exploratory work shows that bauxite reserves in Kalimantan are probably of adequate tonnage and grade to support an alumina plant. However, further studies will take a year or longer to determine the extent and quality of the bauxite.

With the annual production of bauxite at 1.2 million tons, the Indonesian Government increased the storage capacity at the port of Kidjang on the island of Bintan from 40,000 metric tons to 90,000 tons and raised the loading capacity of the port from 400 to 1,000 tons per hour. The Gulf of Kidjang is being dredged to enable ships of up to 30,000 tons to reach the port. In addition, the bauxite plant in the Tembling district has been expanded and equipped with better loading facilities.

Three Japanese aluminum companies—Nippon Light Metal Co., Ltd., Showa Denko Co., Ltd., and Sumitomo Chemical Co., Ltd.—are studying the feasibility of building an alumina plant on Bintan Island. Earlier in 1970, it was reported that the Indonesian Government hoped to build an alumina plant in Bintan with an annual production of 200,000 tons or more and to export the entire output to Japan.

To encourage the erection of an alumina reduction plant, the Indonesian Government has offered low-cost electricity from a planned hydroelectric powerplant to be built on the Asahan River in Sumatra. Four Japanese companies—Sumitomo Shoji Kaisha Ltd., Nippon Light Metal Co., Ltd., Showa Denko Co., Ltd., and Sumitomo Chemical Co., Ltd.—are studying the feasibility of constructing an aluminum smelter with an annual capacity of 200,000 tons in Sumatra. Kaiser Aluminum & Chemical Corp. also is planning to build an aluminum refinery in the same area and will presumably participate in the project through separate arrangements with the Indonesian Government.

Copper.—Freeport Indonesia, Inc., a subsidiary of Freeport Minerals Co., started the construction of roads and facilities at its Ertsberg copper deposit in West Irian. This prospect contains 33 million tons of proven ore, averaging 2.5 percent copper, and 0.025 ounce of gold, and 0.265 ounce of silver per ton. The proposed open pit mine in the Carstenz Mountains is expected to produce annually 250,000 tons of concentrate (containing 26 percent copper plus the precious metals) beginning early in 1973. The entire output of this project has been committed to Japanese and West German firms.

The Ertsberg project includes the building of a seaport, an airstrip, a mining town, and the construction of 90 kilometers of roads, in addition to the installation of mining equipment. The estimated cost for developing this ore body increased by $15 million to a total of $135 million. The additional cost was due to the problems encountered in building roads through the rain forest where rainfall may amount to 120 inches during the July–September period and to the construction of more reliable and efficient conveying and grinding equipment for the 7,500-ton-per-day flotation mill. The increased cost of $15 million is within the amount of additional loan and equity funds already committed to the project.

Gold and Silver.—All recorded gold and silver production was from the underground Tjikotok mine in southern Banten in Java. The Logas mine in Central Sumatra, a dredging operation, is in the trial-operation stage.

Iron and Steel.—At the request of the Indonesian Government, Nikko Engineering Co. of Japan is conducting a survey of iron sand deposits in a district 120 kilometers east of Chalachap.

The Japanese Kawasaki Steel Corp. announced it will build a steel plant in Surabaya, East Java, in a joint venture with the Indonesian firm, C. V. Gayantara. The venture, called P. T. Steel Pipe Industry of Indonesia, is scheduled to produce 18,000 tons per year of steel pipe.

Manganese.—Manganese ore production is small due to limited reserves and sporadic due to the seasonal character of mining. Presently, all mining is in Karangnunggal, West Java, and in some localities in Central and East Java. While a small amount of manganese is consumed by Indonesian battery manufacturers, the bulk of the production is exported mainly to Japan.

Mercury.—Ariadi Corp. of Djakarta, an Indonesian firm, was conducting a mercury exploration program in West Borneo.

Nickel.—Sulawesi Nickel Development Company (SUNIDECO), a joint concern established in Sulawesi by Nippon Mining Co. Ltd., Sumitomo Metal Mining Co., Pacific Nickel Mining Co., and Nippon Yakin Kogyo concluded a contract with P. N. Aneka Tambang (Aneka) to export 500,000 tons of nickel ore to Japan in 1970 and 600,000 tons in 1971. According to SUNIDECO, lower grade nickel ore in Sulawesi (containing 1.5 percent nickel) may total 65 million tons. SUNIDECO is conducting feasibility studies on expanding the production capacity of its ferronickel smelter which it is constructing at the Pomalaa area in Sulawesi. The original project was for a smelter having a 12,000-ton-per-year ferronickel capacity.

Tin.—The Netherlands firm, N. V. Cesco, signed a tin exploration agreement with the State tin enterprise, P. N. Timah, to explore an area of 33,000 square kilometers in the area of the Islands of Bangka and Belitung. Under terms of the agreement, the exploration includes a sonic survey, the first stage of which constitutes a geophysical sonic survey covering 6,000 line-kilometer traverses. The cost of the first stage is $200,000, of which the Indonesian Government will pay $71,000 and the balance will be financed by the Netherlands partner.

Approximately 170 tin mines were in operation in Indonesia, scattered through the Islands of Bangka, Belitung, Singkep, and Karimun and their surrounding offshore areas. Land and seagoing dredges accounted for more than 50 percent of the tin concentrate produced, the remainder is from hydraulic mining.

The world's largest sea going dredge, "Bangka I" is in operation in Indonesia. The state-owned dredge, Maras, sank at sea in mid-January, 1971.

The smelting plant in Montole, Bangka, with an annual capacity of 25,000 tons of tin, is conducting trial operations.

NONMETALS

Cement.—The main Indonesian producers of cement were P. T. Semen Gresik, P. N. Semen Padang, and P. N. Semen Tonasa with rated annual capacities of 375,000 tons, 120,000 tons, and 120,000 tons, respectively. As part of its overall 5-year development program, the Government expects production of cement in 1973 will reach 1.25 million tons to achieve self-sufficiency. Prospects for increased output of cement are considered good inasmuch as credits for expanding the capacity for cement production have been approved. Kaiser Cement and Gypsum Corp., Bank of America, International Finance Corp., and P. T. Semen Gresik are discussing the feasibility of establishing a cement factory at Tjibinong.

Fertilizer Materials.—The startup for the Indonesian Government's fertilizer facilities at Gresik was scheduled for the beginning of 1971. This complex includes a 220-ton-per-day ammonia unit, a sulfuric acid plant, and facilities for the manufacture of 45,000 tons per year of urea and 150,000 tons per year of ammonium sulfate.

The U.S. Agency for International Development (AID) granted a $20 million loan to Indonesia to help finance a $84.4 million fertilizer complex in South Sumatra. The proposed plant will have an annual capacity of 380,000 tons of urea and will include a gas conservation and transmission system utilizing indigenous natural gas. Additional financing for the fertilizer plant is to be provided by the International Development Association ($30 million), the Asian Development Bank ($10 million), and the Overseas Economic Cooperation Fund of Japan ($8 million). The $68 million total will finance foreign exchange costs of the project.

Pertamina is considering a cooperative venture with the Japanese nitrogen industry, represented by the Japan Ammonium Sulfate Industry Association, in the construction of an ammonia-urea complex. The plans call for a 163,000-ton-nitrogen-per-year ammonia unit and a 340,000-ton-per-year urea plant. Three sites are being considered, these being Djakarta, Surabaya, and Medan.

In cooperation with Pertamina, Universal Chemicals, Ltd. (based in the Bahamas), is to establish a complex comprising an ammonia unit (1,000 tons per day), a urea unit (258,000 tons nitrogen per year), and all necessary ancillary facilities. This complex is expected to involve an investment of $64 million but is not expected to come on stream before 1975.

MINERAL FUELS

Petroleum.—The annual output of Indonesian petroleum represents approximately 2 percent of the world total output but is more than half the oil produced in south, southeast, and east Asia, outside mainland China. Output from the 40-odd producing oilfields in Indonesia jumped to an alltime high of 312 million barrels in 1970.

The principal oilfields are in the eastern Sumatran plains, in northern Java and the surrounding seas, and in West Irian. The increase in total oil production during 1970 was due primarily to the increase in production in east-central Sumatra, particularly the Minas and Duri fields. A pipeline moves the oil north from these fields to Dumai, Indonesia's largest port in tonnage handled.

During 1970, Pertamina accepted contracts from eight companies interested in petroleum exploration and development.

Capitalization for the eight contracts totaled to a $78.05 million investment in exploration activities to be made over a period of 8 years. The contracts were for a duration period of 30 years, except for the award to Pixa Oil N. L. (Australia) which was for 25 years. The contracts awarded were briefly as follows:

Wendell Phillips was granted on February 4, 1970, 32,000 square kilometers, onshore and offshore, in northwest Irian. Also, Wendell Phillips is to build hospital and/or school buildings in West Irian, when its production share exceeds 75,000 barrels per day. On February 9, 1970, the California Asiatic Oil Co. and Texas Overseas Petroleum Co. was granted 72,000 square kilometers between Sulawesi and Java. Forty thousand square kilometers were awarded to Kondur S. A. on August 5, 1970, for an offshore area on the Rian Islands. Additionally, if Kondur's production share reaches 100,000 barrels per day, it is to build a refinery or petrochemical plant. On September 23, 1970, Trend Exploration Ltd. was granted 4,000 square kilometers onshore West Irian. Trend Exploration is required to invest in a refinery or petrochemical project if its production share exceeds 100,000 barrels per day. Indonesia Gulf Oil Corp. and Whitestone Indonesia, Inc., were both awarded contracts on October 19, 1970, for 29,000 square kilometers onshore and offshore in West Sulawesi and for 15,000 square kilometers in Bomberai, West Irian, respectively. If the production share exceeds 100,00 barrels per day, each company is required to invest in a refinery or a petrochemical project. On October 15, 1970, Pixa Oil N. L. was granted an exploration area of 1,550 square kilometers onshore East Kalimantan.

P. N. Pertamina is converting Merak Island in Djakarta Bay into a base to provide various services needed by oil company ships now operating in offshore oil exploration in Indonesia. The base is to be constructed by Toyo Menka (Japan) and Santa Fe International Oil (U.S.) in cooperation with Pertamina. The base will provide 100,000 square meters of storage space for oil pipes, drills, rigs, and chemicals and will serve additionally as a supply center for foodstuffs and water for the ships servicing oil-drilling operations. The two construction companies are also planning to build assembly plants for oil-drilling rigs, construction materials, and other heavy equipment.

The Mineral Industry of Iran

By David A. Carleton [1]

Iran's mineral industry, which is dominated by petroleum production, demonstrated significant gains again in 1970 that have been characteristic of the country's economy for nearly 2 decades. Because of the world's continuing demand for petroleum, there is every reason to believe that this growth will continue into the near future.

The value of mineral output in 1970 reached an estimated $2 billion,[2] more than 95 percent of which was from crude petroleum production. Accordingly, the mineral industry contributed about 22 percent to the nation's gross national product (GNP), estimated at $9 billion in 1970. During that year the petroleum sector accounted for 90 percent of Iran's foreign exchange earnings and provided $1.2 billion in government revenue.

During the Iranian year 1349 (March 21, 1970 to March 20, 1971) 80 percent of the oil revenues were allocated to the Government's economic development program (Plan Organization). Income from petroleum was escalated by the November 14, 1970, agreement between the Government and the foreign private concessionaires to increase posted prices and to elevate the tax rate from 50 to 55 percent of net profits. As a result of the completion of a natural gas pipeline to the U.S.S.R. near the end of 1970, revenues from natural gas are expected to contribute an additional $40 million annually.

The output of minerals other than petroleum and natural gas was valued at an estimated $68 million in the Iranian year 1349, up 10 percent from the previous year. Cement production contributed 70 percent to the total followed by lead-zinc, 12 percent; and chromite, 5 percent.

Mineral exploration (other than petroleum and natural gas) continued active during the year with several contracts signed and the Geological Survey of Iran mapping prospective regions. A contract valued at $5 million was awarded in 1970 to a Yugoslav government agency by the Iranian Government to conduct a detailed survey of the Kerman mineralized area in southwestern Iran. Another contract was awarded the French Atomic Energy Commission to explore for radio-active materials throughout Iran. Furthermore, a 3-year minerals exploration project financed by the Iranian Government ($1.4 million) and the United Nations ($0.6 million) is planned by the Geological Survey of Iran.

Developments in the nonpetroleum sector of the mineral industry were highlighted by plans to develop Iran's substantial copper reserves. Although plans are to bring the large Sar Cheshmeh deposit into production by 1974 at a rate of 30,000 tons of ore per day, financial arrangements were pending at yearend.

PRODUCTION

During 1970, the Iranian Bureau of Statistics, Ministry of Economy, published the results of a mineral production survey for the calendar year ending March 20, 1969, the first to be conducted since 1962. Based on this survey, certain extrapolations, and estimates based on exports, the value of nonpetroleum sector mineral production during the calendar year ending March 20, 1971, totaled $68 million.

Iran was the world's fourth largest crude oil producing country, following the United States, U.S.S.R. and Saudi Arabia. Production in 1970 averaged 3,828,650 barrels per day and was valued at about $2 billion.

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[1] Supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

[2] Where necessary, values have been converted from Iranian Rials (Rs) to U.S. dollars at the rate of Rs 1=US$0.0132.

Table 1.—Iran: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968 [2]	1969 [2]	1970 [2] p
METALS			
Chromite, gross weight e	90,000	140,000	120,000
Copper mine output, metal content	616	515	722
Iron ore, gross weight	1,057	1,650	1,858
Lead:			
Mine output, metal content	22,087	21,700	22,940
Smelter	r 183	e 180	e 180
Manganese ore, gross weight	r 25,000	35,000	e 36,000
Zinc mine output, metal content	r 53,952	e 53,200	e 57,700
NONMETALS			
Barite	r 53,319	58,619	60,219
Cement, hydraulic thousand tons	r 1,904	2,342	e 2,577
Clays, kaolin	31,750	33,660	e 35,000
Gypsum thousand tons	r 1,520	1,596	1,676
Lime e do	1,000	1,000	1,000
Magnesite	r 25,000	21,000	20,000
Mineral pigments, ochre	9,700	8,000	NA
Salt, rock	r 214,222	235,644	252,321
Sulfates, natural:			
Alum (aluminum-potassium sulfate)	4,100	4,182	4,213
Sodium sulfate (mineral not specified)	8,900	8,900	9,000
Sulfur:			
From ores (refined)	1,300	1,400	1,300
Elemental byproduct e	38,000	40,000	40,000
MINERAL FUELS AND RELATED MATERIALS			
Coal thousand tons	r 297	309	323
Coke do	r 44	52	54
Gas, natural:			
Gross production million cubic feet	802,490	892,583	1,094,194
Marketed production do	55,534	98,201	396,333
Petroleum:			
Crude (net) [3] thousand 42-gallon barrels	1,039,366	1,232,155	1,397,460
Refinery products:			
Gasoline:			
Aviation do	6,533	6,475	5,752
Motor do	15,818	16,998	18,718
Jet fuel do	12,617	13,428	12,743
Kerosine do	17,579	19,682	18,338
Distillate fuel oil do	27,390	29,831	33,160
Residual fuel oil do	72,939	76,842	84,127
Lubricants do	448	560	560
Other:			
Naphtha and solvents do	2,964	4,934	4,438
Asphalt do	1,654	2,243	2,165
Liquefied petroleum gas do	530	930	1,310
Other do	9,251	11,619	13,652
Refinery fuel and losses do	11,742	7,085	5,802
Total do	179,465	190,627	200,765

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

[1] In addition to the commodities listed, a variety of crude construction materials such as common clays, sand and gravel, and 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 reinjected into the fields.

TRADE

Iran promulgated a law bringing the Irano-Romanian economic trade agreement into force. The agreement provides for a $100 million credit to be extended to Iran by Romania at an annual interest rate of 2.5 percent which will be used for the purchase of Romanian industrial equipment and machinery. Iran is to repay 85 percent of its purchases in crude oil and 15 percent in other products.[3]

In July an Iranian-Hungarian economic commission signed a protocol which envisaged increased trade between the countries. Under the agreement Iran will repay two credits totaling $50 million for purchases of Hungarian goods over a 12-year period. Hungary will purchase Iranian goods with the repaid sums, including 200,000 tons of sulfur.

[3] Middle East Economic Survey. V. 13, No. 27, May 1, 1970, p. 6.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite	--	1,500	All to Spain.
Metal including all forms	10	19	Afghanistan 16; Iraq 3.
Chromite, 48 percent Cr_2O_3	62,128	145,300	Netherlands 43,450; France 29,450; Czechoslovakia 21,200.
Copper ore and concentrate	--	3,000	All to Japan.
Iron and steel:			
Scrap	25,883	14,646	Mainland China 9,550; Japan 5,000.
Semimanufactures	359	3,403	Malagasy Republic 2,616; Kuwait 508.
Lead ore and concentrate	36,177	66,637	U.S.S.R. 52,277; United Kingdom 8,520.
Manganese ore and concentrate	32,800	950	Italy 750; Belgium 200.
Tin ore and concentrate ..... long tons	--	57	All to U.S.S.R.
Zinc ore and concentrate	51,112	53,233	Japan 20,320; U.S.S.R. 13,126; Belgium 5,787.
Other:			
Ore and concentrate	132	1,075	Kuwait 900.
Ash and residues containing nonferrous metals.	--	40	All to Belgium.
NONMETALS			
Barite, natural	10,090	4,212	Dubai 3,645.
Cement	r 42,903	34,352	Kuwait 21,362; Oman 12,903.
Chalk	352	193	Dubai 184.
Clays, crude n.e.s.:			
Bentonite	12,284	3,942	Ethiopia 2,450; Oman 1,105.
Fuller's earth	21	12	Oman 9.
Other	747	658	Oman 613.
Fertilizer materials:			
Nitrogenous	7	3	All to Kuwait.
Phosphatic	1	12	Do.
Gypsum	1,942	843	Kuwait 650.
Lime	1,901	2,517	Kuwait 863; Oman 700.
Pigments:			
Ochre	4,139	8,467	France 3,700; United Kingdom 2,408; India 1,808.
Other earth colors	--	1	All to Kuwait.
Precious and semiprecious stones:			
Turquoise ..... grams	182,835	292,843	India 163,000; United States 71,871.
Other ..... do	90,000	--	
Pumice	2	2	All to Dubai.
Salt	4,720	2,719	Oman 1,839; Kuwait 577.
Stone:			
Dimension:			
Alabaster	10	148	All to Japan.
Marble	9,160	12,108	Italy 8,900; Kuwait 994.
Other	r 5,016	13,530	Italy 7,596; Japan 1,879; Kuwait 1,820.
Crushed	48,709	27,833	Kuwait 20,260; Oman 5,503.
Sulfur	(2)	5,000	All to Republic of South Africa.
Other nonmetals n.e.s	10	6	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Coal	288	114	Kuwait 64; Iraq 45.
Petroleum: [3]			
Crude oil ..... thousand 42-gallon barrels	r 876,152	991,797	Asia 611,296; Europe 287,981; Africa 51,980; Americas 31,691; Australasia 8,849.
Refinery products:			
Gasoline, aviation ..... do	r 6,514	9,631	Asia 5,607; Africa 1,949; Europe 944; Australasia 667; Americas 464.
Gasoline, motor ..... do	r 17,080	16,067	Africa 679; Asia 634; Europe 280; Australasia 196; Americas 102.
Jet fuel ..... do	10,497	9,540	Asia 4,756; Africa 2,345; Europe 1,522; Australasia 753; Americas 164.
Kerosine ..... do	6,169	5,702	Africa 2,601; Asia 2,014; Europe 737; Australasia 272; Americas 77.
Distillate fuel oil ..... do	11,751	12,715	Asia 5,607; Africa 5,502; Europe 1,440; Australasia 88; Americas 78.
Residual fuel oil ..... do	73,475	65,573	Asia 41,087; Europe 14,354; Africa 6,260; Australasia 2,199; Americas 1,672.
Lubricants ..... do	1	10,277	Asia 10,277.
Other:			
White spirit ..... do	541	--	
Solvents ..... do	r 154	272	Asia 101; Australia 89; Africa 82.
Asphalt ..... do	415	613	Africa 348; Asia 250; Europe 15.
Unspecified ..... do	350	4	Europe 3; Africa 1.
Total ..... do	126,947	130,394	
Mineral tar and other coal, petroleum, or gas derived crude chemicals.	--	8,674	Egypt 4,745; Oman 2,662.

r Revised.
[1] Data are for Iranian calendar years beginning March 21 of the year indicated.
[2] Less than ½ unit.
[3] Destinations of shipments reported by continent only, detail by countries not available.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide	183	316
Metal including alloys:		
Scrap	812	1,525
Unwrought	4,970	7,592
Semimanufactures	3,526	4,521
Antimony including alloys	108	115
Arsenic oxide and acid	79	36
Cadmium including alloys ......kilograms	765	1,853
Chromium:		
Oxide	16	40
Metal including alloys	2	--
Cobalt including alloys ......kilograms	328	589
Copper including alloys:		
Scrap	42	56
Unwrought	3,120	83
Semimanufactures	6,687	9,058
Gold:		
Including scrap and waste ......troy ounces	16,300	97,481
Rolled, drawn, sheets and bars ......do	17,233	193
Iron and steel:		
Ore	--	1
Metal including alloys:		
Cast iron	25,507	23,741
Ferroalloys	812	1,312
Scrap	6,030	3,843
Unwrought	8,633	43,247
Semimanufactures ......thousand tons	1,358	1,109
Lead:		
Oxide	r 1,673	1,436
Metal including alloys:		
Scrap	3	1
Unwrought	3,570	4,487
Semimanufactures	r 43	62
Magnesium including alloys	2	(2)
Manganese oxide	648	800
Mercury ......76-pound flasks	1,276	261
Nickel including alloys:		
Scrap	(2)	3
Unwrought	28	7
Semimanufactures	123	55
Platinum including scrap, waste and ash ......troy ounces	482	675
Silver including scrap, waste and ash ......do	r 60,475	152,362
Tin:		
Oxide ......long tons	(2)	8
Metal including alloys:		
Unwrought ......do	225	331
Semimanufactures ......do	r 427	413
Titanium oxide	1,254	1,241
Tungsten including alloys	2	2
Zinc:		
Oxide	550	606
Metal including alloys:		
Scrap	122	6
Unwrought	3,313	2,456
Semimanufactures	r 230	128
Other:		
Ores n.e.s	NA	666
Ash and residue containing nonferrous metals	NA	150
NONMETALS		
Abrasives:		
Emery	34	54
Grinding and polishing wheels and stones	r 986	1,084
Asbestos	5,914	6,707
Barite	196	204
Bromine ......kilograms	--	62
Cement	51,132	22,837
Chalk	114	356
Clays, crude n.e.s.:		
Bentonite	9,490	948
Fire clay	578	1,021
Kaolin	1,056	675
Pozzolana and similar earths for cement manufacture	47	65
Other	800	3,649
Diatomite	NA	659

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Fertilizer materials manufactured:		
Nitrogenous	20,480	15,342
Phosphatic	28,715	61,471
Potassic	r 300	3,000
Mixed and unspecified	r 44,360	47,941
Graphite	415	670
Gypsum	378	354
Iodine kilograms	200	500
Lime	142	373
Magnesite	227	37
Mica, all forms	253	13
Pigments, mineral:		
Iron (including processed)	578	489
Other	127	9
Precious and semiprecious stones:		
Turquoise grams	--	12,000
Other do	4,256	35,597
Manufactured do	1,000	2,090
Salt	46	75
Stone, sand and gravel:		
Dimension stone:		
Slate	2	--
Other	79	180
Stone, crushed	148	474
Sand and gravel	493	1,090
Quartz	104	259
Sulfur:		
Elemental	r 700	545
Sulfuric acid	40	803
Talc	NA	333
Other n.e.s.:		
Meerschaum, amber, jet	183	365
Oxides and hydroxides:		
Magnesium	125	216
Barium	10	148
Other	NA	1,297
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	2	15
Coal	2,965	7,241
Peat including peat briquets	25	(2)
Petroleum refinery products:		
Gasoline, aviation 42-gallon barrels	7	4
Gasoline, motor do	1	17
Kerosine do	--	9
Distillate fuel oil do	46	1,686
Lubricants do	47,148	54,075
Other:		
Bitumen do	140,022	42,801
Other do	21,951	14,810
Total do	209,175	113,402
Mineral tar and other coal, petroleum, or gas derived crude chemicals	788	2,328

r Revised.
NA Not available.
[1] Data are for Iranian calendar years beginning March 21 of the year indicated.
[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—Construction of the $50 million aluminum smelter at Araq in Western Iran continued during the year with some 1,000 workers and technicians employed. Construction of a short single-line railway spur from the plant site to the Trans-Iranian Railway began during the year. The line will be used to carry imported bauxite from Bandar Shahpur to Araq. The Government of Iran holds 70 percent interest in the smelter; Reynolds International, Inc., 20 percent; and the Government of Pakistan, 10 percent. From the total rated capacity of 45,000 metric tons per year, Iran will get 15,000 tons, Pakistan 10,000 tons, with the balance to be sold on the international market.[4]

Bauxites of both the Permo-Triassic and Cretaceous systems continue to be found;

[4] Metal Bulletin. No. 5604, June 4, 1971, p. 23.

however, no deposit or group of deposits contain sufficient tonnages to warrant the development of a wholly indigenous aluminum industry.[5]

Copper.—On January 4, 1971, the Iranian Government formally approved plans for the $330 million open-pit development of the Sar Cheshmeh deposit by a joint venture owned 30 percent by Iranian Selection Trust, Ltd. (IST) and 70 percent by the Kerman Mining Co., a holding of the Rezai family. IST which is owned 60 percent by Selection Trust, Ltd., and 40 percent by Consolidated African Selection Trust, Ltd., was required in 1970 to present to its Iranian partners a program for developing the ore body and a plan for raising the necessary financing. At yearend 1970, IST submitted a program to its partners which provides for blister copper production to begin in 1974 and to be maintained at annual rate of at least 105,000 tons during the first 10 to 14 years. Presumably, production at this rate will be adequate to finance the operation and to supply 25,000 tons of blister per year to a refinery the Government wishes to have built in Iran. Ore production from the large open pit will probably be at a daily rate of 30,000 tons. The reserves at Sar Cheshmeh to a depth of 500 feet are estimated at 350 million tons of 1.2 percent sulfide copper which can be mined with a low stripping ratio. In addition, there are 20 million tons of higher grade oxide copper. An additional 450 million tons of reserves occur between 500 and 800 feet in depth.

With the escalation of the size of the project and its financial requirements, it appears that the profit-sharing arrangements are in doubt. An agreement between the partners regarding financing arrangements was set for conclusion on April 30, 1971. It is most likely that West European countries, especially West Germany, will be the principal customers. Reportedly, banks in West Germany, Belgium, France, the Republic of South Africa, and the United States (Export-Import Bank) would participate in the financing.

Iron and Steel.—Construction of Iran's first integrated steel plant near Isfahan continued under the guidance of a large team of Soviet specialists. Trial production operations were successfully conducted in April 1971. Reportedly, the 1.5-million-ton-per-year plant should be completed by 1972, and have an initial operating capacity of 600,000 tons per year. The ore bodies, of which there are several, are of the intrusive magnetite type and occur near Bafq in central Iran, a distance of 250 miles from Isfahan. The coal will come about 400 miles from north of Kerman and all rail connections are well underway.[6]

Imports of Japanese heavy plates to the Ahwaz Pipe Mills have steadily declined since 1968 following the termination of a 6,000- to 8,000 ton-per-year pipe supply contract between Iran and the U.S.S.R. Fabricated round pieces, however, were in strong demand and were supplied by West Germany and the United Kingdom. Iran imported 180,000 tons of sheets during the calendar year ending March 20, 1969, an increase of 60 percent over the previous fiscal year. Particularly strong demand in recent years has come from the automobile industry for cold-rolled steel.

Imports of galvanized sheets have registered an annual growth rate of almost 10 percent over the past few years. During 1969 Iran demand totaled about 40,000 tons, of which 12,000 tons were produced domestically. Since there were plans to set up two new galvanizing plants in Iran, the country could become self-sufficient in supplying this product.[7]

Early in 1971 a Japanese steel company expressed an interest in establishing a steel project at Bandar Abbas in southern Iran, in collaboration with private Iranian sources. This resulted from the announced discovery of two large iron ore deposits at Sange Zagh and Goli Gohwar, south of Kerman, with reserves of 250 million and 300 million tons, respectively. The ore type and grade were not reported.[8]

Lead-Zinc.—The production of lead and zinc concentrates showed a modest increase during the year. The plant at Khusk near Bafq, owned by Iranian, French, and British interests, is now producing at capacity. Output is 50,400 tons of 60-percent lead-zinc sulfide concentrates from an ore having a metal content of 26 percent. Following a geophysical examination the Lakan deposit near Khomein (about 150

[5] Mining Annual Review. June, 1971, p. 375.
[6] Mining Annual Review. June 1971, p. 375.
[7] Metal Bulletin. No. 5545, Oct. 30, 1970, p. 30.
[8] Mining Journal. V. 276, No. 7068, Feb. 5, 1971, p. 103.

miles southwest of Tehran) is now being prepared for production after being closed since 1959. Prior to the closing, the Lakan operation was owned 49 percent by Société Minière et Métallurgique de Peñarroya. S.A.; 5 percent by the Government of Iran; and 46 percent by citizens in the Khomein area. In 1959 this open cast operation produced 11,000 tons of 65 percent lead ore and the flotation mill was operated at a rate of about 315 tons per day.

Production from the large Anguran deposit, which yields a heavily oxided ore, increased in 1970. Stripping of overburden is now approaching 1 million tons per year and in 1970 about 50,000 tons of concentrates were shipped. The mine is open only from May through October because of the high altitude of the mine (about 9,700 feet) and the severe winters. This lead-zinc operation is owned by the Iranian firm Société Industrielle et Minière Iranienne (Simiran) and is located near Zanjan in northwestern Iran.

The Ravandje lead-barite mine and mill yielded 8,000 tons of 62 percent lead concentrate and 2,000 tons of barite. Two of the three ore bodies are being worked—one by opencast method and the other by sublevel caving.[9] The third ore body was being prepared as an underground mine and is believed to have been opened for production during mid-1970. During the Iranian year 1348 (March 21, 1969 to March 20, 1970) production amounted to 9,137 tons of 60 percent lead. The operating company, Sogemiran, S.A., is owned 45 percent by Société Général des Minérais, S.A., and 55 percent by Iranian interests.[10]

Uranium.—After 2 years of effort, a joint Iranian-French uranium prospecting team has discovered interesting uranium mineralization in several parts of Iran. The most important areas are in the Elborz Mountains north of Tehran near the town of Shemshak and in the Meyghon hills south of Rasht. A discovery in the Anarak area on the edge of the Dasht-i Kavir has also aroused interest. Work is now underway to determine the grade and tonnage of the ore. A 1969 agreement between the Iranian Ministry of Economy and the French atomic energy agency, Commissariat à l'Énergie Atomique, provides for mutual collaboration in Iran uranium prospecting.

NONMETALS

Sulfur.—The Iranian Industrial Renovation Organization (IIRO) and the Tenneco Oil Co., a U.S. firm, which concluded an agreement in 1969, have announced that they will explore for sulfur in three areas in southeastern Iran in the region of Bandar Abbas, Bandar Lengeh, and Qeshm Island covering a total of 247 square miles. Although IIRO has a 55-percent interest in the venture and Tenneco 45 percent, all exploration costs are to be borne by Tenneco. The agreement provides for a 4-year exploration period, at the end of which Tenneco must submit a comprehensive report confirming or denying the presence of commercial deposits in the areas concerned. Preliminary surveys are reported to have indicated the presence of substantial sulfur deposits.[11]

MINERAL FUELS

Natural Gas.—Natural gas is produced, processed, transported, and/or marketed in Iran by the following companies: Iranian Oil Operating Companies (Consortium); National Iranian Oil Co., (NIOC); the Iran Gas Trunkline (IGAT); and four other companies that flared their entire production of 79 billion cubic feet in 1970.

Consortium.—The high-pressure gas supplied to the Abadan refinery from the Marun oilfield increased to an average of 93 million cubic feet per day. In addition deliveries from Gach Saran oilfield to the Shiraz area for industrial use averaged 22 million cubic feet per day.

Five gas wells in the Masjid-i-Suleiman oilfield supplied an average of 78 million cubic feet per day of natural gas rich in hydrogen sulfide to NIOC for processing by the Shahpur Petrochemical Co. Plant at Bandar Shahpur.

Three natural gas processing plants were completed at Agha Jari and one at Marun for separating natural gas liquids (a propane-butane-pentane mix) from methane. The Agha Jari natural gas liquids plants processed an average of 365 million cubic feet per day in 1970 and recovered 4.52 million barrels of liquids. The plant at Marun processed 426 million cubic feet per day following its completion in February

[9] Mining Annual Review. June 1971, p. 375.
[10] Union Miniere. Annual Report. 1970.
[11] Middle East Economic Survey. V. 13, No. 44, Aug. 28, 1970.

1970 and yielded 3.75 million barrels of liquids. The raw natural gas liquids from all four plants were piped to the 58,000-barrel-per-day fractionation plant at Bandar Mah Shahr for separation. In total the Consortium produced 1,012 billion cubic feet of gas in 1970, of which 396 billion cubic feet were utilized and 616 cubic feet were flared.[12]

NIOC.—The NIOC produced 2.9 billion cubic feet of gas from its Naft-e Shah oilfield, of which 0.8 billion cubic feet was utilized and 2.1 billion cubic feet was flared. In 1970 about 1.6 million cubic feet of natural gas was produced from Sarajeh gasfield and used to test the IGAT line. Several proposals for the construction of a liquefied natural gas complex in Iran have been presented by foreign firms to NIOC and were under consideration at yearend.

IGAT.—On October 1, 1970, IGAT went into operation and the first natural gas was delivered to the U.S.S.R. This was the first natural gas export from a Near East country. On the following December 17, an explosion at the Bid Boland processing plant ruptured a large-diameter pipe and ignited the gas. By the end of 1970, despite the slowdown caused by the accident, monthly exports to the U.S.S.R. had reached 13,131 million cubic feet. In addition, 112,000 tons of natural gas liquids (about 13.2 million barrels) were delivered to the local gas distribution companies. Preliminary steps have been taken to build the natural gas supply and distribution systems in Tehran, Isfahan, and Ahwaz. These towns will be supplied by IGAT feeder lines.[13]

Petroleum.—Once again, increases in Iranian petroleum production in 1970 reached record levels, with every prospect for greater increases in 1971. The Consortium was again the major oil producing and refining company in Iran, accounting for 91 and 81 percent, respectively, of the country's total crude oil production and refining. Although the Government company, NIOC is a major refining and marketing firm, its crude oil production accounts for less than 1 percent of the country's total. Companies that have joint ownership of petroleum production with NIOC are Iran Pan-American Oil Co. (IPAC); Société Irano- Italiènne des Pétroles (SIRIP); Lavan Petroleum Co. (LAPCO); and Iranian Marine International Oil Co. (IMINOCO). Companies that have contractual agreements with NICO are Société Française des Pétroles d'Iran (SOFIRAN); European Group Co. (EGOCO); and Continental Oil Co (CONOCO).

Consortium.—Five exploration wells were drilled in 1970 including a discovery well. Three development wells were deepened to investigate new horizons in producing fields. The exploration wells completed had a total depth of 40,511 feet and at yearend three wells were drilling with 19,469 feet completed. The successful exploration well, Karun 1, is located north of Masjid-i-Suleiman; however, preliminary indications show the reservoir to be small and the commercial prospects doubtful. The total depth of the well was 15,750 feet and the reservoir was in the prolific Asmari formation. One of the development wells deepened, Kupal 3, reached a depth of 14,700 feet and found commercial oil in the Bangestan formation.

During 1970, 19 development wells were drilled (excluding workover and deepened wells), having a combined depth of 197,893 feet; at yearend an additional five development wells with a combined footage of 50,702 were being drilled. About three-fourths of the development wells were producers.

The Consortium's net production (excluding reinjected oils) averaged 3,496,145 barrels per day in 1970 which is an increase of 388,114 barrels per day or 12.5 percent over the previous year. Agha Jari, the country's major oilfield for many years recorded a substantial (5 percent) decline in 1970 and fell to second position after Gach Saran. The following tabulation gives production for 1969 and 1970 in barrels per day for the major Consortium oilfields: Par-e Siah, a small field east of Masjid-i-Suleiman field, was the only new field brought into production by the Consortium in 1970. On October 24, 1970, Con-

	1969	1970
Gach Saran	724,375	841,600
Agha Jari	860,674	819,441
Marun	587,178	739,150
Bibi Hakimeh	368,819	435,526
Ahwaz	239,751	259,600
Others	327,234	400,828
Total	3,108,031	3,496,145

[12] Iranian Oil Operating Companies. Annual Review. 1970.
[13] Iran Oil Journal. No. 150, March 1971, pp. 17–18.

sortium production, for the first time exceeded 4 million barrels per day.

New records for crude oil export were set in 1970 at Kharg Island, the world's largest single crude oil export terminal. During the year the trading companies of the Consortium exported an average of 2,983,752 barrels per day, of which 49,241 barrels per day were to the account of NIOC's Eastern European customers. A total of 2,052 tankers called at Kharg Island for loading crude oil compared with 2,111 in 1969. This drop reflects an increase in the average size of tankers calling at the terminal, which was 77,000 deadweight tons in 1970 compared with 66,000 tons in 1969. The largest tanker loaded 250,000 tons of crude oil. Special dredging operations were necessary to permit the handling of tankers of this capacity.

Major facilities completed during the year were two 1 million barrel crude oil storage tanks at Kharg, bringing the total to 13,180,000 barrels. A total of 292,000 barrels per day of additional production unit capacity was constructed, the principal unit of which was a 200,000-barrel-per-day plant at Gach Saran.

The Abadan refinery, one of the world's largest, processed an average of 421,473 barrels per day in 1970, up slightly from 1969. Products produced in 1970 are shown below in percentages of total output of 396,606 barrels per day:

	Percent by volume
Aviation gasoline	4.2
Motor gasoline	9.0
Jet fuel	8.4
Kerosine	9.6
Distillate fuel oil	17.5
Residual fuel oil	44.1
Other	7.2
Total	100.0

Increased crude oil exports by Consortium members, coupled with the increase in the posted price and an additional tax of 5 percent on net income, both with effect from November 14, 1970, resulted in Consortium payments to the Government of Iran rising to a record $1,048 million. An additional $48 million was invested in Iran for capital improvements, making a total amount of foreign exchange available to Iran in 1970 from Consortium operations at $1,096 million.

NIOC.—The Government oil company performed exploration activities over large areas of Iran including some in the Consortium Agreement Area. The work involved 3 party-months and an area of 18,300 square-kilometers. Areas and geologic structures favorable for the accumulation and generation of hydrocarbons were found in three general regions: Kermanshah; Central Kopeh Dagh; and Western Kopeh Dagh. Exploration well drilling totaled 16,778 feet and development drilling totaled 750 feet. All five of the exploration wells were abandoned. The lone development well, Khangiran No. 4 in the Khangiran gasfield discovered in 1969, was being drilled at yearend 1970. An abandoned well in the Sarakhs area (northeastern Iran) produced some oil but was abandoned because of the low permeability of the reservoir rock and the thin pay section.

Production from NIOC's Naft-e Shah field averaged 10,234 barrels per day in 1970, while output from Alborz field near Tehran averaged 350 barrels per day. Production from the latter field, as well as an average of 685 barrels per day of gas condensate from NIOC's nearby Sarajeh gas field is now piped to a junction on the Ahwaz-Tehran crude oil line.

Rebuilding and renovation of the Kermanshah refinery was completed during 1970. Installed were a catalytic reformer (platformer) and a Merox treatment plant to remove sulfur from gasolines. Throughput capacity of the plant was increased from 8,000 barrels per day to 15,000 barrels per day. Furthermore, NIOC assisted in the construction of a 58,000-barrel-per-day refinery in the Republic of South Africa and began the construction of a 46,000 barrel per day refinery at Shiraz. The three NIOC refineries in operation during 1970 processed an average of 101,358 barrels per day, 89 percent of which was run at the Tehran refinery. Production at the latter plant increased 20 percent over the previous year.

Petroleum sales by NIOC, Iran's sole distributor, totaled 65.4 million barrels, an increase of 9.2 percent compared with those of 1969. More than one-half of this was provided by the Tehran refinery; most of the remainder came from the Abadan refinery of the Consortium.

Although speculation persisted regarding the construction of a 42-inch pipeline from Ahwaz through Turkey to a terminal near

Iskenderun, completion of the project remained doubtful.

IPAC.—One development well was completed successfully in Darius during 1970; no exploration drilling or geological-geophysical work was accomplished. The IPAC agreement area was reduced to 242 square miles by the relinquishment of 2,613 square miles during the year. Crude oil production fell a substantial 11 percent to an average of 92,566 barrels per day. Production was restrained in 1970 pending a long-term tax and price dispute with NIOC; however, encouraging progress toward settling the dispute was made. Darius was the principal oilfield in the area, accounting for 88 percent of the total. Cyrus oilfield accounted for the remainder.

With the settlement of the Iran-Saudi Arabia offshore Persian Gulf median line boundary, drilling of the Fereidoon/Marjan oilfield, which straddles the boundary, is planned for 1971. Production in 1972 in the Fereidoon (Iranian) section is to reach 100,000 barrels per day, to be increased to 300,000 barrels per day at a later date. Esfandiar oilfield, just north of Fereidoon straddles the disputed offshore boundary between Iran and the former Kuwait-Saudi Arabia Neutral Zone. Production and development await settlement of the dispute.

SIRIP.—Production by SIRIP increased 20 percent in 1970 to an average of 31,947 barrels per day. Drilling totaled 79,774 feet, of which one-third was exploration drilling and two-thirds, development drilling. In the offshore area, three development wells were completed at Hendijan field and two at Nowruz field. The former joined Bahregansar field as an oil producer in 1970 and is expected to be joined by Nowruz scheduled to come on-stream in early 1971. During the year, SIRIP completed and/or worked on several major projects for producing, transporting, storing, and loading crude oil from the three fields. A new offshore buoy mooring can accommodate tankers up to 250,000 deadweight tons. Most of the offshore acreage was relinquished, leaving only three small blocks totaling 135 square miles.

Onshore SIRIP tested a 2,021 barrel-per-day well at Shorum near the previous Kuh-e Rig find in the Zagros Mountains. Another well was being drilled at yearend and two more were planned. The company is awaiting the results of these three wells before declaring the field commercial.

LAPCO.—In 1970, LAPCO continued as the major offshore producer in Iran with production of 142,455 barrels per day. This was an increase of 19 percent above 1969 production, which indicates that the company has overcome its marketing difficulties. LAPCO suspended drilling activities during 1970 while it reviewed the problem of salt water penetration into the productive zone. Six of the company's 16 wells were shut in because of the salt water problem.

IMINOCO.—Production from IMINOCO's Rostam oilfield was elevated more than threefold as the field completed its first full year of operation. Output averaged 55,309 barrels per day in 1970. At yearend production rates were exceeding 100,000 barrels per day. Development of Rakhsh field, a 1969 discovery, continued during the year with the setting of a drilling platform over the discovery well. Production from this field is expected in 1971 at a rate of 50,000 barrels per day. An exploration well, Alpha-1 found oil shows at a site 16 miles northwest of Rakhsh but was abondoned. The company drilled twelve development wells for a total footage of 107,301 feet. Eleven of these wells were completed as producers.

SOFIRAN.—This company, which is owned by the French Government company, Entreprise de Recherches et d'Activités Pétrolières (ERAP), is the operator for its own concession area in the Dasht-e Kavir as well as for the EGOCO (formerly Association de Recherches et d'Exploration des Pétroles d'Iran (AREPI)) concession and the Farsi Petroleum Co. (FPC) holdings. SOFIRAN drilled a total of 32,052 feet of exploratory hole and abandoned three wildcats, two of which were in the Dasht-e Kavir area. In the EGOCO area of southern Iran 3 party-months of seismic surveys covered the Halegen and Kangan areas near the Persian Gulf coastline. In addition geologic and air magnetic surveys were undertaken and drilling of the Namak structure is planned for 1971.

In the offshore FPC area 25 percent of the concession was relinquished; there was no drilling activity.

CONOCO.—CONOCO exploration activity in its onshore concession north of Bandar Abbas quickened considerably during 1970. Field geologic work totaled 6 party-months, whereas, 3 party-months of seismic reflection survey were completed. Seismic surveys will continue in anticipation of drilling in 1971.

Other Companies.—Persian Gulf Petroleum Co. (PEGUPCO) and Iran Offshore Petroleum Co. remained essentially inactive, conducting only the minimum amount of geophysical work to fulfill contractual requirements.[14]

Petrochemicals.—In November 1970, Iran's largest petrochemical plant, the Shahpur Petrochemical Co. complex at Bandar Shahpur was completed. The plant processes sour gas from Masjid-i-Suleiman oilfield and imported phosphate rock. Daily production capacity of the plant, in metric tons, is as follows:

Sulfur	1,500
Ammonia	1,000
Urea	500
Sulfuric acid	1,320
Phosphoric acid	480
Diammonium phosphate	300
Triple superphosphate	430

The plant's total annual output will amount to about 120,000 tons. Total investment, including expenditures in administration and housing, amounted to $232 million, of which $18 million was spent on the drilling of five gas wells. Sour gas from Masjid-i-Suleiman oilfield is piped 108 miles to Bandar Shahpur via a 20-inch line. Fresh water for the complex is transmitted from the Karun River through a 50-mile, 40-inch pipeline. The water supply project for Bandar Shahpur and the surrounding region was implemented by National Petrochemical Co. (NPC) as a Plan Organization project costing $14 million. The complex employs 1,200 persons.

Efforts during the year by NPC, a subsidiary of NIOC, to develop petrochemical installations and to find foreign markets for products from the petrochemical complexes were very successful. Long-term agreements were signed with India and other countries for the sale of products from the Bandar Shahpur complex. Studies were made with a view to expanding the Abadan petrochemical complex. In addition, a unit is being installed at the Shiraz fertilizer plant for the production of sodium carbonate. The project for the production of aromatic products and olefins (two petrochemical feedstocks) is being prepared.

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[14] American Association of Petroleum Geologist Bulletin. V. 50, No. 8, August 1971, pp. 1604–1610.
World Petroleum Report. 1971. V. 17, pp. 65–66.

The Mineral Industry of Iraq

By David A. Carleton [1]

The petroleum industry, which is Iraq's only highly developed mineral industry, continued to expand but at a rate somewhat less than that of other major Middle East petroleum-producing countries. Iraq also produces other minerals including cement, gypsum, lime, and salt, but little data on these commodities have been reported in recent years. A major project nearing completion at yearend was a petrochemical complex at Basrah. The large Mishraq sulfur deposit was under development, and an important cement plant project was announced during the year.

In 1970 crude oil production averaged 1,566,685 barrels per day, an increase of 2.6 percent over that of 1969. Total Middle East crude oil production increased 12.2 percent during 1970. Iraq's share of Middle East crude oil production continued to decline, accounting for only 11.1 percent of the 1970 total, compared with 12.2 percent in 1969 and 18.4 percent in 1960. Crude oil reserves at the end of 1970 amounted to about 35.5 billion barrels or 6 percent of the free world total.

Similar to other major Middle East petroleum-producing countries, the petroleum industry dominates Iraq's economy. Crude oil produced in 1970 was valued at an equivalent of US $900 million based on realized prices and represented about one-third of the country's gross national product (GNP). During the year, the Government of Iraq received $512.6 million in oil payments, which represented more than 90 percent of the country's foreign exchange earnings and accounted for about half of government revenues.

Because of agreements reached between the Iraqi Government and officials of the Iraq Petroleum Companies (IPC group), average payments to the Government were increased from $0.905 per barrel in 1969, to $0.949 in 1970. Average payments in 1971 should exceed $1.20 per barrel. The IPC group is composed of Iraq Petroleum Co., Ltd. (IPC); Mosul Petroleum Co., Ltd. (MPC); and Basrah Petroleum Co., Ltd. (BPC).

The long strained relations between the Iraqi Government and the IPC group were eased somewhat after IPC raised the posted price for Iraqi crude oil at the east Mediterranean ports of Baniyas, Syria, and Tripoli, Lebanon, by $0.20 per barrel effective from September 1, 1970. In addition, the IPC group announced that they would pay the Government, effective from January 1, 1971 an extra $0.06 per barrel on exports from the east Mediterranean ports and $0.07 per barrel for exports from the Persian Gulf ports. These additional payments compensate for the lack of a full royalty expensing agreement between the companies and the Government. Apparently, the various relatively minor disputes concerning the application of the royalty expensing formula have not been resolved. Furthermore, the companies announced that they would increase production in 1971 by 16.5 million tons per year (about 330,000 barrels per day). Major unresolved issues between the Government and the companies include Iraq's claim to extra payments back to January 1964 in lieu of a royalty expensing agreement and IPC's claim to rights on acreage confiscated under Law 80 of 1961, which left IPC, *inter alia*, only the southern part of the Rumaila oilfield.

By concluding a crude oil barter agreement with Bulgaria, Ceylon, and Hungary in 1970, Iraq now has crude oil-for-goods arrangements with eight countries, including the U.S.S.R., Czechoslovakia, East Germany, Spain, and Italy.

In early 1970, the Government signed a treaty with the Kurds ending a Kurdish rebellion that had continued for many years and caused damage to IPC and MPC installation on various occasions.

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PRODUCTION

Crude oil production in 1970 totaled 571.8 million barrels, including about 2.7 million barrels from the Government's small oilfield of Naft Khaneh. Based on estimated f.o.b. prices, oil production was valued at about $900 million in 1970. Marketed natural gas production declined 12 percent during the year to 27.7 billion cubic feet because of operational problems with the Government's new sulfur recovery plant.

Other mineral commodities produced include cement, an impure sandy gypsum, and salt. The latest data available lists cement production in 1967 at 1,262,000 tons, of which 115,000 tons was classified as salt resistant. Production from Iraq's five plants, estimated at 1,400,000 tons in 1970, was valued at $3 million.[2]

Table 1.—Iraq: Production of mineral commodities

Commodity [1]	1968	1969	1970 [p]
Cement [e] ... thousand metric tons	1,400	1,400	1,400
Gas, natural:			
Gross production [e] ... million cubic feet	194,000	196,000	200,000
Marketable production ... do	27,293	31,617	27,720
Petroleum:			
Crude ... thousand 42-gallon barrels	[r] 548,705	[2 r] 557,093	[2] 571,840
Refinery products:			
Gasoline ... do	[e] 3,199	3,272	[e] 3,414
Jet fuel ... do	[e] 470	651	[e] 679
Kerosine ... do	[e] 4,492	4,174	[e] 4,356
Distillate fuel oil ... do	[e] 5,691	5,701	[e] 5,950
Residual fuel oil ... do	[e] 8,161	9,669	[e] 10,089
Lubricants ... do	[e] 188	246	[e] 256
Other ... do	[e r] 612	855	[e] 891
Refinery fuel and losses ... do	[e r] 1,080	[e] 1,236	[e] 1,290
Total ... do	[e r] 23,893	[e] 25,804	[e] 26,925
Salt ... thousand metric tons	43	50	[e] 50

[e] Estimate. [p] Preliminary. [r] Revised.
[1] In addition to the commodities listed, "juss," an impure sandy gypsum, lime, as well as a variety of crude construction materials (clays, stone, and sand and gravel) are produced, but available information is inadequate to make reliable estimates of output levels.
[2] Includes an estimate for production from the Government-owned Naft Khaneh field.

TRADE

The most recent official Iraqi foreign trade data available covers 1969. Crude oil is the major export, accounting for 99.8 percent of the value of mineral exports. In 1969 based on estimated f.o.b. prices, crude petroleum exports from Mediterranean ports and Khor al-Amaya on the Persian Gulf were valued at an equivalent of US$860 million. The value of other mineral product exports, most of which were cement and refined petroleum products, totaled $1.5 million.

Mineral imports into Iraq totaled $5.5 million, of which, iron and steel commodities accounted for 73 percent of the total. Imports of nitrogenous fertilizers showed the greatest growth, increasing 27 percent over that of 1968.

[2] Where necessary, values have been converted from Iraqi Dinars (ID) to U.S. dollars at the rate of ID 1=US$0.357.

Table 2.—Iraq: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum waste and scrap	--	25
Copper including alloys:		
Scrap	1,081	1,525
Unwrought	102	--
Iron and steel:		
Waste and scrap	19,866	11,995
Semimanufactures	46	4
Lead waste and scrap	NA	775
NONMETALS		
Cement	413,324	294,662
Clay products	62	85
Gypsum and plasters	--	295
Stone, sand and gravel	--	10,620
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	524,800	527,571
Refinery products:		
Gasoline do	3	16
Kerosine do	16	174
Distillate fuel oil do	916	150
Residual fuel oil do	84	1,396
Lubricants do	--	4
Naphtha do	128	770
Other do	305	32
Total do	1,452	2,542

NA Not available.

Source: Annual Foreign Trade Statistics, Central Statistical Organization, Ministry of Planning, Republic of Iraq, Baghdad, 1968 and 1969, 336 pp.

Table 3.—Iraq: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys	r 3,979	2,935
Arsenic, trioxide	NA	13
Copper including alloys	r 1,539	1,889
Iron and steel including semimanufactures	r 271,965	218,053
Lead including alloys	r 62	80
Magnesium including alloys	34	4
Nickel	12	--
Tin including alloys ... long tons	79	178
Zinc including alloys	r 128	169
Other	9	8
NONMETALS		
Abrasives, emery, etc	181	273
Asbestos, crude	r 1,184	2,772
Cement	r 16,122	14,945
Chalk	1,228	1,427
Clays and products (including all refractory brick):		
Crude	447	3,894
Products	791	2,338
Fertilizer materials manufactured:		
Nitrogenous	r 40,064	50,901
Phosphatic	1,507	--
Potassic	--	50
Other	r 72	40
Ammonia	298	195
Flint	13	401
Gypsum and plasters	9	28
Lime	122	295
Mica	12	23
Salt	14	439
Stone, sand and gravel	3,552	3,795
Sulfur, elemental	r 2,933	321
Talc, steatite	939	609
Other	19	101
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	NA	13
Carbon black	18	34
Coal and briquets	537	95
Coke and semicoke	1,016	993
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	(1)	--
Lubricants	21	--
Mineral jelly and wax	5	3
Other	3	(1)
Mineral tar and other coal, petroleum, or gas derived crude chemicals	274	11

r Revised. NA Not available.
[1] Less than ½ unit.
Source: Annual Foreign Trade Statistics, Central Statistical Organization, Ministry of Planning, Republic of Iraq, Baghdad, 1968 and 1969, 336 pp.

COMMODITY REVIEW

NONMETALS

Cement.—On August 4, 1970, the Iraqi Government and the Kuwait Fund for Arab Economic Development signed an agreement whereby Kuwait will loan Iraq an equivalent of US$14,640,000 to finance the expansion of the Samawah cement plant. The project involves the construction of a clinker production plant at Samawah that will increase production capacity of existing facilities by 500,000 tons annually. It also involves the construction of a 350,000-ton-per-year clinker-grinding plant at Umm Qasr and facilities to export clinker and cement from Umm Qasr. The project, which is expected to be completed by April 1973, will increase the country's foreign exchange earning and have a favorable impact on the GNP.

Fertilizer Materials.—The chemical fertilizer plant under construction at Abu al-Khusaib, near Basrah, was scheduled to start production during early 1971. The plant will have an annual capacity to produce 66,000 tons of ammonia, 140,000 tons of ammonium sulfate, 110,000 tons of sulfuric acid, and 56,000 tons of urea. Raw materials will be associated natural gas from the nearby (35 miles) Rumaila oilfield and sulfur from the distant (about 500 miles) Kirkuk sulfur recovery plant. Contracts have been concluded to export 25,000 tons of fertilizers to mainland

China; India has expressed an interest in purchasing 200,000 tons of ammonium sulfate and 100,000 tons of urea. The plant was being built by the Japanese firm Mitsubishi Heavy Industries Co. at a cost equivalent to US$31 million.

The Iraqi-Polish protocol signed on August 3, 1970, which formalized Poland's assistance in Iraqi sulfur development, also calls for assistance in phosphate development. Iraq requested that its phosphates be included in the barter arrangements between the two countries, which currently involve only crude oil on Iraq's part.

Sulfur.—Development of the Mishraq sulfur deposit in northern Iraq continued during the year. The original 1969 agreement between Iraq National Minerals Co., an Iraqi public corporation, and Centrozap, a Polish organization, called for an initial capacity of 250,000 tons per year by 1973, which would eventually be raised to 1 million tons per year. Plans were altered in early 1970 to accelerate construction so that production could begin in August 1971 at a rate of 350,000 tons per year This early startup was not met as several unforeseen difficulties, including the discovery of unexpected high concentrations of bitumen in the ore, were uncovered. As a result, technicians from Poland made further investigations of ore characteristics and production techniques to overcome the difficulties. Plans call for the transport of both solid and liquid sulfur from the plant to the Persian Gulf port of Umm Qasr. Under the terms of the contract, Poland will supply the technical personnel and equipment necessary to put the mine in operation and will also undertake a study of sulfur market trends on behalf of the two parties in order to advise Iraq on international marketing conditions. Iraq, in return, will provide Poland with crude oil and fertilizer materials.

The Government's sulfur recovery plant at Kirkuk, which began operations several years ago, has experienced technical difficulties in obtaining full production. At yearend, after considerable repairs and adjustments, most of the problems were solved and it was anticipated that full production would be reached during 1971. As of mid-1970, the Government of Iraq did not have adequate transportation to dispose of the 450 tons per day of sulfur, when the plant is in full operation. Some of the production will be transported more than 500 miles to the natural gas-based fertilizer plant near Basrah.

MINERAL FUELS

Natural Gas.—Iraq and Turkey have abandoned their plans for a natural gas pipeline from Rumaila oilfield to Istanbul, because of Iraq's failure to obtain U.S.S.R. financing and a dispute over the border price. They appear to have replaced this project with plans for a shorter, 250-mile line from Kirkuk to Batman in southeast Turkey. Initial throughput would be 100 million cubic feet per day and its cost would be about $50 million.

Petroleum.—The IPC group conducted no exploration during the year. Drilling was limited to five wells in the Kirkuk field by IPC. They included two producers, two observation wells, and one water-injection well. Two wells were reconditioned by BPC in the Rumaila field and two wells in the Butmah field were deepened for exploration purposes by MPC. In the Ain Zalah field one MPC well was deepened and converted into a water-injection well and another was reconditioned.

Iraq National Oil Co., (INOC) and drilling contractors for INOC drilled five wells during 1970, three of which were completed as producing wells (two in Buzurgan field and the other in North Rumaila field). The remaining two were drilling at yearend 1970; one in Buzurgan and the other at a new location northwest of Buzurgan.

The total footage of all wells drilled in Iraq in 1970 was about 47,000 feet. The producing well completed in North Rumaila was drilled by the Hungarian organization Chemocomplex under a 1969 contract which calls for the drilling of four wells in the North Rumaila field for INOC. According to an INOC statement, the well, based on an 8-hour test, has the potential to produce 13,200 barrels per day from the Middle Cretaceous Series and 56,000 barrels per day from the Lower Cretaceous Series. At yearend, Chemocomplex was ready to drill its second well, North Rumaila No. 3. The other North Rumaila well (North Rumaila No. 2). is being drilled by INOC with equipment supplied by the Soviet organization Machinexport under a contract signed in July 1969. The Buzurgan wells were drilled for

INOC by a subsidiary of the French Government agency, Entreprise de Recherches et d'Activités Pétrolières (ERAP). The 1969 Buzurgan discovery well tested at 3,000 barrels per day. ERAP has estimated Buzurgan reserves at 3.5 billion barrels. This will be the first commercial oilfield found by INOC.

Table 4.—Summary of operations of the IPC group

	1969	1970
Crude oil production by field: thousand 42-gallon barrels		
Kirkuk	394,075	407,721
Rumaila do	97,794	100,046
Zubair do	26,798	28,162
Bai Hassan do	21,792	20,386
Ain Zalah do	7,955	7,589
Jambur do	4,480	3,366
Butmah do	1,461	1,833
Total do	554,355	569,103
Daily average 42-gallon barrels per day	1,518,781	1,559,186
Crude oil exports:[1] million 42-gallon barrels		
Europe	433.5	424.0
Middle East do	17.7	41.8
Western Hemisphere do	30.0	31.9
Africa do	22.6	23.2
Far East and Australia do	19.1	11.8
Unaccounted for do	4.7	7.7
Total do	527.6	540.4
Via Syrian border[2] do	402.1	414.2
Via Persian Gulf[2] do	122.7	127.8
Shipments to—[1] thousand 42-gallon barrels		
Iraqi refineries	23,468	24,225
Syrian and Lebanese refineries do	17,729	18,150
Export terminals:		
Baniras, Syria do	223,546	226,058
Tripoli, Lebanon do	158,995	169,995
Khor Al-Amaya, Iraq do	122,684	127,785
Total export terminals do	505,225	523,838
Marketed natural gas: million cubic feet		
Petroleum companies	20,816	22,736
Iraqi Government do	10,801	4,984
Total do	31,617	27,720
Percent of total production	e 16	e 14
Footage drilled	23,408	17,912
Number of wells at yearend:		
Oil	111	106
Gas	2	1
Shut-in	39	44
Abandoned and observation	321	323
Water injection	11	14
Total	484	488
Water injected million 42-gallon barrels	409.3	485.0
Payments to the Iraqi Government: million US$		
IPC	374.6	401.3
MPC do	8.4	8.6
BPC do	[3] 105.0	102.7
Total do	488.0	512.6
Payments to Governments of Syria and Lebanon do	NA	63.8

e Estimate. NA Not available.

[1] Converted from long tons at a rate of 7.5 U.S. barrels per long ton.

[2] As reported.

[3] Includes US$9 million for settlement of port fees.

Source: Review for 1969, and 1970, Iraq, Basrah, and Mosul Petroleum Companies.

During December 1970, INOC's first seismic team completed a survey of the Ratawi area about 12 miles west of the North Rumaila field. ERAP exploration included 3 party-months of seismic survey in the swamps of southern Iraq. By February 4, 1971, 50 percent of ERAP's 4,170-square-mile agreement area in southern Iraq must be relinquished.

During the year, INOC officials announced their 5-year development program. Major items of the program were: second-stage development of the North Rumaila field; exploration and development of the Ratawi, Nahr Umr, Luhais, and Rachi structures in southern Iraq; extensive seismic surveys of promising areas throughout the country; a pipeline link to the Mediterranean coast; and establishment of a national oil tanker fleet.

The Soviet organization Technoexport, planned to start work in early 1971 on the laying of a 28-inch, 91-mile pipeline from North Rumaila field to the port of Fao, as part of a $33.6 million oilfield and terminal development contract signed with INOC in August 1970. At yearend 1970, all 20,000 tons of pipe needed for the line had been purchased from France and unloaded at Basrah.[3]

The Goverment during 1970 called for international bids for the exploration of a 6,900-square-mile section in southern Iraq, an area originally covered by the BPC concession. IPC group officials claim the area still belongs to BPC and that it will take legal steps against other companies that might "trespass on its rights." Proven reserves in the IPC group operating areas are estimated at 32 billion barrels of oil and 18.5 trillion cubic feet of natural gas. The country ranks seventh in the world and fourth in the Middle East in crude oil reserves.

Kirkuk oilfield continued as the country's major source of crude oil, accounting for 72 percent of the total, followed by Rumaila field, with 18 percent of the total. The Kirkuk field is continuing to increase its share of the total (up from 65 percent in 1965) by expanding field development and increasing pipeline capacity to the Mediterranean ports. Three new electrically driven pumps were installed at pump stations in Syria; pumps at stations in Iraq were replaced with larger equipment. Output at Rumaila field which has increased only slightly since 1965, when it accounted for 23 percent of the total, has been inhibited for technical and economic reasons. INOC's only field, Naft Khaneh produced an estimated 7,500 barrels per day in 1970.

Included in the October 1970 INOC–IPC group agreement was IPC's commitment to raise production from its northern fields by an additional 90,000 barrels per day. Because the pipelines that carry this production to the Mediterranean were operating at full capacity, the commitment was not expected to be fulfilled until 1972, when additional pumping equipment will be installed. However, BPC's programed production boost from the southern fields from about 320,000 barrels per day to 420,000 barrels per day by the end of 1970, and to 560,000 barrels per day by 1971, can be fully handled by the existing export facilities at Khor al-Amaya.

During the year, 1,505 tankers were loaded at Mediterranean and Persian Gulf ports with Iraqi crude oil, averaging 46,408 tons per shipment, an increase from 43,828 tons in 1969. This increase reflects the use of larger vessels at Mediterranean ports.

On September 3, 1970, BPC relinquished four loading piers at the Fao terminal near the mouth of the Shatt al Arab to the Iraqi Port Administration, particularly for the export of North Rumaila crude and eventually for Buzurgan crude. Exports were expected to start in early 1972. Since Fao can only accommodate tankers up to about 30,000 deadweight tons, the Fao operation is a temporary measure until a new facility capable of handling larger tankers can be made available. Iraqi officials want a terminal similar to BPC's existing Khor al-Amaya facility. It would have a 500,000-barrel-per-day capacity and be capable of handling 150,000-deadweight-ton tankers. Financing the projected terminal was under discussion between INOC and ERAP.[4]

Iraq's Oil Planning and Construction Administration at yearend 1970 was preparing to announce a tender for the construction of a 30,000-barrel-per-day oil refinery at Mosul. The plant will supply product requirements for northern Iraq with the possibility of exporting surplus products to nearby Syria and Turkey.[5]

[3] Middle East Economic Survey. V. 14, No. 6, Dec. 4, 1970, p. 7.
[4] Middle East Economic Survey. V. 14, No. 9, Dec. 25, 1970, p. 4.
[5] Middle East Economic Survey. V. 14, No. 2, Nov. 6, 1970, p. 8.

The Mineral Industry of Ireland

By J. M. West [1]

Minerals assumed an expanding role in the Irish economy as output values continued to grow. Offshore drilling for oil began in 1970, but it is too soon yet to evaluate results. Several reportedly dry holes were drilled. A number of companies were pursuing exploration for minerals on land after being granted prospecting licenses by the Irish Government. A relatively rich zinc-lead discovery was confirmed by Tara Exploration and Development Co., Ltd., northwest of Dublin, and early exploitation was expected. A plant for producing zinc oxide went into operation at the Tynagh mine, and a magnesia-from-seawater plant went into operation on the southeast coast of Ireland. Mine production of copper rose, and further increases were expected with the reopening of the Avoca mine late in the year. A 6-month bank strike ending in November caused marketing and financial problems throughout the Irish economy and hampered the minerals producing industry. Other detrimental influences were rising wages, labor unrest, and a serious rate of inflation. Growth in the real gross national product (GNP) was estimated at only about 2 percent during 1970. The balance of trade at yearend showed an approximate $0.5 billion [2] deficit, to which crude petroleum was a significant contributor.

PRODUCTION

Output of most of Ireland's mineral products were higher in 1970 except for cement, anthracite, and peat. Cement production was limited by a strike, anthracite output continued a downtrend, and peat mining was affected by the weather. Byproduct mercury recovery at the Gortdrum copper mine went through its first full year, and output was about 1,300 76-pound flasks. Petroleum refinery output was up from that of 1969.

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[1] Physical scientist, Division of Nonferrous Metals.

[2] Where necessary, values have been converted from the Ireland pounds to U.S. dollars at the rate of £1=US $2.40.

Table 1.—Ireland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Copper mine output, metal content	6,667	6,170	8,332
Lead mine output, metal content	62,200	58,700	59,300
Iron and steel, crude steel ... thousand tons	68	81	82
Mercury ... 76-pound flasks	--	420	1,304
Silver mine output, metal content ... thousand troy ounces	1,913	1,866	2,171
Zinc mine output, metal content	r 50,528	97,480	96,500
NONMETALS			
Barite	r 135,216	160,505	221,000
Cement, hydraulic ... thousand tons	1,352	1,273	860
Fertilizer materials manufactured (P_2O_5 content of superphosphates) ... do	95	NA	NA
Gypsum ... do	262	290	e 300
Lime ... do	63	53	59
Sand and gravel [2] ... do	3,717	4,352	4,779
Stone, limestone [2] ... do	5,064	5,387	5,488
Other [3] ... do	2,720	3,201	2,766
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite ... do	r 108	90	79
Bituminous ... do	r 59	63	75
Coke, gashouse including breeze ... do	54	36	e 36
Gas manufactured ... million cubic feet	6,533	NA	NA
Peat:			
Agricultural use ... thousand tons	41	54	53
Fuel use:			
Briquets ... do	250	314	319
Sod peat [4] ... do	2,248	2,188	2,028
Milled peat [5] ... do	2,521	3,927	2,881
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	4,113	4,344	4,260
Jet fuel ... do	685	616	488
Distillate fuel oil ... do	4,662	4,692	4,768
Residual fuel oil ... do	6,181	6,307	8,449
Other ... do	759	910	1,035
Refinery fuel and losses ... do	713	750	718
Total ... do	17,113	17,619	19,718

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

1 In addition to commodities listed, substantial quantities of stone, sand and gravel are produced by local authorities for purposes such as maintenance of roads, but statistics on output are not reported and available information is inadequate to make reliable estimates of output levels.

2 Excludes materials produced by local authorities (see footnote 1).

3 Figures given as reported in source; includes granite, marble, silica rock, sand, calcspar, fire clay, and shale and clays for cement, but apparently excludes those quantities of these materials specified in footnote 1.

4 Includes production by farmers and by Bord Na Móna.

5 Includes milled peat used in production of peat briquets listed previously in this table.

TRADE

Available information indicated that exports of mineral products continued to rise in 1970, but that imports in terms of value, rose even more, particularly imports of crude petroleum, which advanced sharply. There was a decline in the export of cement owing to a strike in the cement industry. Barite exports rose sharply in 1970. The bulk of Irish mineral exports continued to go to the United Kingdom.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys:		
Scrap	624	607
Unwrought and semimanufactures	r 1,790	4,708
Copper:		
Ore and concentrate	11,223	18,451
Metal including alloys:		
Scrap	4,095	4,258
Unwrought and semimanufactures	1,902	1,681
Iron and steel:		
Scrap	26,953	11,361
Steel, primary	226	NA
Semimanufactures	r 14,296	14,548
Lead:		
Ore and concentrate	156,437	148,308
Metal including alloys:		
Scrap	323	211
Unwrought and semimanufactures	1,529	NA
Zinc ore and concentrate	85,448	193,548
NONMETALS		
Barite and witherite	142,252	156,435
Cement thousand tons	292	102
Clays, refractory (including nonclay bricks)	38,188	37,422
Fertilizer materials manufactured	244	NA
Gypsum and plasters thousand tons	r 109	100
Stone, sand and gravel:		
Gravel and crushed rock do	326	359
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke including briquets	r 18,354	18,397
Gas, hydrocarbon	11,376	15,221
Peat including briquets and litter	62,516	82,551
Petroleum refinery products:		
Gasoline (including natural) thousand 42-gallon barrels	76	75
Distillate fuel oil do	r 847	877
Residual fuel oil do	r 1,453	831

r Revised. NA Not available.
[1] Excludes reexports.

Table 3.—Ireland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys:		
Unwrought	8,428	8,335
Semimanufactures	5,758	6,294
Copper including alloys:		
Unwrought	183	185
Semimanufactures	8,396	8,590
Iron and steel:		
Pig iron, ferroalloys, and similar materials	r 22,791	22,665
Steel, primary forms	4,159	6,937
Semimanufactures:		
Bars, rods, angles, shapes, and sections	86,780	102,831
Universals, plates, and sheets	78,875	96,663
Hoop and strip	7,437	11,527
Rails and accessories	4,979	6,376
Wire	6,580	22,622
Tubes, pipes, and fittings	37,848	41,507
Castings and forgings, rough	NA	555
Lead:		
Oxides	1,817	1,586
Metals including alloys, all forms	1,148	1,281
Nickel including alloys, all forms	449	449
Platinum-group and silver including alloys:		
Platinum-group value, thousands	$147	$190
Silver, all forms do	$373	$371
Tin including alloys, all forms long tons	33	100
Titanium oxide	2,639	3,265
Zinc:		
Oxides	748	686
Metal including alloys:		
Unwrought	4,504	4,579
Semimanufactures	668	866
Other ore and concentrate	18,464	20,686

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS		
Asbestos	4,018	6,545
Cement thousand tons	213	1,526
Clays and products (including refractory bricks):		
Crude n.e.s	r 12,016	14,802
Products:		
Refractory (including nonclay bricks)	11,630	14,799
Nonrefractory	6,326	7,558
Fertilizer materials:		
Crude:		
Nitrogenous thousand tons	1	1
Phosphatic do	425	339
Manufactured:		
Nitrogenous do	46	12
Phosphatic:		
Thomas slag do	147	153
Other do	6	17
Potassic do	233	193
Other including mixed do	115	67
Ammonia	31,990	39,092
Lime	3,916	4,441
Pyrite (gross weight)	1,102	1,256
Salt thousand tons	50	51
Sodium and potassium compounds n.e.s	5,164	6,233
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	3,131	5,022
Worked	393	363
Gravel and crushed rock	12,826	50,793
Sand excluding metal bearing	38,576	41,543
Sulfur:		
Elemental	104,140	108,525
Sulfuric acid including oleum	28,936	12,587
Other nonmetals n.e.s	12,664	10,974
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	3,163	17,188
Coal and coke including briquets thousand tons	1,245	1,167
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	17,128	16,996
Refinery products: [1]		
Gasoline do	r 498	580
Jet fuel do	1,240	1,736
Kerosine, white spirit, and special boiling point liquids do	690	576
Distillate fuel oil do	477	918
Residual fuel oil do	5,301	7,706
Liquefied petroleum gases do	220	290
Lubricants do	266	266
Bitumen do	412	24
Other do	1,360	2,390

r Revised. NA Not available.

[1] Source: Organization for Economic Cooperation and Development (OECD; Paris). Oil Statistics, Supply and Disposal. 1968 and 1969.

COMMODITY REVIEW

METALS

Copper, Lead, Zinc, Mercury, and Silver.—Avoca Mines, Ltd., a subsidiary of Avoca Mines (Canada) Ltd., reactivated the Avoca copper mine, County Wicklow, near the Irish east coast, in late 1970 and began shipping copper concentrates in December. The initial milling rate was about 2,000 tons of ore per day supplied from development work. Mill-heads averaged 0.75 percent copper, and a 20-percent copper concentrate was produced. Reserves of indicated ore were estimated at 7 million tons, grading 1 to 1.5 percent copper. Concentrates were initially destined for Spain for treatment; a pyrite byproduct was to be sold for its sulfur to a fertilizer manufacturer at Arklow, Ireland.

Tara Exploration and Development Co., Ltd., explored a zinc-lead deposit at Navan in County Meath, about 30 miles northwest of Dublin, and announced a major discovery.[3] Reserves were estimated at well over 5 million tons of ore with combined zinc-lead content exceeding 10 percent.

[3] O'Brian, M. V., and D. M. Romer. Tara's Zinc-Lead Discovery at Navan, Republic of Ireland. Canadian Min. J., v. 92, No. 4, April 1971, pp. 81–82.

Geochemical surveys played an important part in the discovery and investigation of the deposit. Smelter Corp. of Ireland, Ltd., 30-percent-owned by Tara Exploration and Development, was reported considering the purchase of a tidewater site at Little Island, in the Cork harbor, where an electrolytic zinc refinery is to be built. A lead-zinc refinery using the Imperial Smelting process was also considered for the Cork area. Mogul of Ireland, Ltd., continued production of lead and zinc at its Silvermines underground property, where combined metal content totaled 13.7 percent. Syngenore Exploration, Ltd., a subsidiary of Noranda Mines Ltd. (Canada), with a 19 percent share held by Barymin Exploration, Ltd., encountered lead-zinc values totaling 10.7 percent at its prospect near Mullingar, County West Meath.

Northgate Exploration, Ltd. (Canada), leading Irish base metal producer, through its wholly owned subsidiaries, Irish Base Metals, Ltd., and Gortdrum Mines (Ireland) Ltd., the latter acquired in full in August 1970, contributed much to Ireland's overall production during the year. Irish Base Metals planned to mine and mill about 667,400 tons of ore in 1971 at its Tynagh mine, compared with 697,643 tons in 1970. Improved treatment was expected to provide a 10-percent increase in concentrate output to about 160,000 tons in 1971.[4] Products were smelted abroad, but some concentrates were high in arsenic and antimony content and required special sales negotiations which delayed processing.

At the Tynagh mine, primarily an open pit, an $8.5 million development program for underground extraction was underway, with full-scale production scheduled to start in 1973. Tynagh produced 53,400 tons of lead, 19,800 tons of zinc, 2,800 tons of copper, and 1.75 million ounces of silver contained in concentrates in 1970. The Gortdrum mine produced 4,550 tons of copper and 0.4 million ounces of silver in concentrates during 1970; also, 10,331 tons of concentrates were treated in the Gortdrum mercury extraction plant yielding 1,304 76-pound flasks of mercury. A total of 1,610 76-pound flasks of mercury were reported sold during the year. Notwithstanding, recovery costs including plant depreciation were reported to considerably exceed the value of the mercury. Extraction was necessary, however, before the remaining base metals concentrate would be accepted by a smelter. Mining and milling costs for ores treated by the concentrator at Gortdrum amounted to about $6 per ton in 1970. Reserves available to open pit mining were estimated at 1.49 million tons averaging 1.4 percent copper and about 1 ounce per ton silver. Exploration continued on a 56-square-mile block of prospecting licenses in the Gortdrum area centered on the State Mining Lease and extending east and west into Counties Tipperary and Limerick. Cerro Corp. (U.S.) joined with a Canadian firm to explore the Allihies mine in County Cork, where copper ore reserves estimated at 2 million tons were reported. Several other sites were to be investigated in Counties Cork and Clare. American Smelting and Refining Co. (U.S.) was reportedly examining lead and zinc deposits in County Mayo.

Iron and Steel.—Most of Ireland's steel requirements were met by imports as in previous years. Crude steel was produced from scrap and imported pig iron by Irish Steel Holdings, Ltd., at Cork Harbor on the southeast coast. Imported castings and shapes were rolled, and sheet was galvanized in respective sections of the plant. Irish steel consumption was approximately 300,000 tons of ingot equivalent in 1970.

NONMETALS

Barite.—Barite output and exports rose by about one-third in 1970. The product, in lump and finely ground forms, was shipped mostly to the United States where it was used principally in oil well muds. Most of the barite came from the Ballynoe deposit of Magcobar (Ireland) Ltd., a subsidiary of Dresser Industries, Inc., in County Tipperary.

Cement.—Cement production, including manufacture of cement clinker for export, dropped sharply as a result of an almost 5-month strike in the early part of the year. Output was down about one-third compared with that of 1969. Greater imports of cement were necessary to supply the needs of the construction industry. Based on full production during the balance of the year, Irish cement capacity was estimated at about 1.5 million tons per year. Plants were operated by Cement Ltd. at Drogheda and Limerick.

[4] Northgate Exploration, Ltd. Annual Report 1970, 32 pp.

Diamond.—One of the world's largest industrial diamond manufacturing plants was opened in May at the Shannon Industrial Estate by Ultra-High-Pressure Units (Ireland) Ltd. Equipment initially installed included three 10,000-ton presses with provisions for six more units at a later time. Synthetic diamond abrasive-type grits were to be produced for diamond saws and abrasives.

Lithium.—Results of a limited diamond drilling project by Northgate Exploration Ltd. in County Carlow, where a part of a series of pegmatite dikes was explored, indicated reserves in excess of 2 million tons of lithium-bearing material. Further work was delayed pending market studies and metallurgical tests.

Magnesia.—Startup of seawater magnesia producing facilities was reported at Ballynacourty Point, Dungarvan, County Waterford, by the Quigley Magnesite Division of Pfizer Inc. (U.S.). In addition to seawater, the plant used dolomitic lime manufactured from County Kilkenny limestone as a source of magnesia. To provide this lime, a 170,000-ton-per-year quarry was opened in September. Dead-burned magnesite was to be the plant's principal product. Capacity was expected to exceed 75,000 tons of magnesia per year.

MINERAL FUELS

Nearly two-thirds of Ireland's energy supply was from imported mineral fuels in 1970, domestically mined peat and coal providing most of the balance. Hydroelectric plants supplied about 5 percent of the total energy needs. Growth in demand for electricity was estimated at a rate of 10 to 11 percent per year, with the required future capacity forecast at 3,000 megawatts by 1980. Because of rapid expansion, construction of a medium-size nuclear generating plant was under consideration.

Coal, Coke, and Peat.—Production of anthracite declined in 1970, as did production of sod and milled peat. Poorer weather conditions and labor problems were presumably responsible for the decline in peat output. Production of briquetes from peat increased slightly. Significant quantities of briquetes and agricultural peat continued to be exported. Coal and coke were imported, including gas coal from Poland.

Petroleum.—Marathon Petroleum (Ireland) Ltd. named Global Oil Co. as contractor for its offshore drilling in Irish territorial waters, which began about mid-year. The firm held three blocks for offshore exploration, one off the south coast Counties of Wexford, Waterford, Cork, and Kerry, another off Clare and Galway on the west coast, and the third off the north Mayo coast, Sligo and South Donegal. The south coast block was to be explored first.

Of a total of 19.43 million 42-gallon barrels of crude petroleum imported in 1970, 32 percent was from Kuwait, 31 percent from Saudi Arabia, 24 percent from Iran, and the balance from Iraq, the Netherlands, and the Federation of South Arabia. Partly refined petroleum totaling 0.63 million barrels was imported from the United Kingdom, the Netherlands, Trinidad and Tobago, France, and Italy. Estimated consumption of refined products, as reported by a principal Irish distributor, was 26.79 million barrels, including bunker fuels. Consumption excluding bunkering of foreign aircraft is shown in the following table, in thousand metric tons:

Product	1969	1970
Gasolines	576	609
Aviation fuels	99	73
Kerosine	70	104
Gas/diesel oil	664	745
Residual fuel oil	1,624	2,040
Other	147	198
Total	3,180	3,769

Source: Organization for Economic Cooperation and Development (OECD; Paris). Provisional Oil Statistics by Quarters (4th Quarter 1970), 1970.

The Mineral Industry of Israel

By Donald E. Eilertsen [1]

Israel's mineral industry output fluctuated somewhat in 1970; projects underway were being rushed for completion to assure greater outputs. The country's gross national product (GNP) rose sharply to $5.34 billion in 1970, compared with $4.53 billion in 1969, an increase of 18 percent, and for the first time exceeded $5 billion.[2 3] Important mineral industry developments in 1970 included: Government approval to construct a new $13 million magnesium plant; an increase in potash capacity; the completion of a rail link between phosphate rock mines and the seaport of Ashdod; construction of a new ammonia facility at Haifa; and the start of a new bentonite milling industry. Oil was discovered southeast of Arad; offshore drilling for oil in the Mediterranean began; and the 42-inch Eilat-Ashkelon oil pipeline came into operation and transported 11 million tons of crude oil in 1970.

An ion-exchange resin, called Srafion NMRR, was developed by Technion Israel Institute of Technology to selectively collect precious metals over a wide range of acid concentrations. The precious metals are separated from the resin by roasting or eluting with a complex agent. The resin is undergoing tests by various laboratories and mining companies in the United States, the Republic of South Africa, Canada, and the United Kingdom.[4]

[1] Physical scientist, Division of Nonmetallic Minerals.
[2] U.S. Embassy, Tel Aviv. State Department Airgram A-53, Feb. 11, 1971, p. 4.
[3] Where necessary, values have been converted from Israeli pounds (I£) to U.S. dollars at the rate of I£3.5=US$1.00.
[4] Mining World. V. 7, No. 2, February 1971, p. 48.

PRODUCTION

Some sectors of the mineral industry showed gains in output in 1970, while others showed losses or stability. There were increases in outputs of cement copper (2.9 percent), cement (7 percent), flint clays (greatly increased), beneficiated phosphate rock (1.3 percent), and potash (K_2O equivalent 59.3 percent).

Commodities which showed declines in outputs were bromine and bromine compounds (15.3 percent), gypsum (1.4 percent), natural gas (2.5 percent), crude petroleum (21.3 percent), and refinery products (4 percent).

Output of iron and steel, lime, sulfur, and peat were of the same magnitude as in 1969.

Table 1.—Israel: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Copper, cement, 70 to 80 percent Cu, gross weight metric tons	10,282	10,683	10,988
Iron and steel, crude steel [e]	100	120	120
NONMETALS			
Bromine:			
Elemental metric tons	9,376	10,550	[2] 8,000
Compounds do	NA	3,626	[2] 4,000
Cement, hydraulic	1,106	1,308	1,400
Clays, flint	[r] 20	15	100
Fertilizer materials:			
Crude:			
Phosphate, beneficiated	777	987	1,000
Potash:			
Gross weight	[e] 600	548	866
Potassium oxide (K_2O) equivalent	[e] 366	332	529
Manufactured:			
Nitrogenous [e]	95	100	NA
Phosphatic (superphosphate)	142	150	[e] 165
Potassic	2	2	[e] 4
Gypsum	[e] 70	71	70
Lime [e]	80	130	130
Salt, marketed (mainly marine)	65	67	[e] 66
Sulfur	6	[e] 8	[e] 8
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural million cubic feet	5,015	4,873	4,752
Peat [e]	20	20	20
Petroleum:			
Crude [3] thousand 42-gallon barrels	831	719	566
Refinery products:			
Gasoline do	[e] 5,848	[e] 6,279	4,072
Kerosine and jet fuel do	[e] 5,085	[e] 5,460	4,263
Distillate fuel oil do	[e] 7,701	[e] 8,268	7,288
Residual fuel oil do	[e] 11,987	[e] 12,870	16,737
Other do	[e] 2,978	[e] 3,588	2,947
Refinery fuel and losses do	[e] 2,724	[e] 2,536	[e] 2,118
Total do	[r] [e] 36,323	[e] 39,001	[e] 37,425

[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 construction materials such as dimension stone, crushed rock, sand and gravel are produced, but information available is inadequate to make reliable estimates of output levels.
[2] Sales.
[3] Does not include Israeli production from occupied Sinai Peninsula oilfields.

TRADE

Exports of mineral commodities in 1969, excluding crude oil and refinery products, totaled $304.6 million compared with $273.3 million in 1968. Some of the large-value exports in 1969 were diamonds, $253.5 million; copper concentrate (cement copper), $15.9 million; phosphate rock, $7.5 million; manufactured fertilizer materials, $14.5 million; semimanufactured iron and steel tubes, pipes, and fittings, $2.0 million; and bromine and bromine products, $1.8 million.

Imports of mineral commodities, excluding crude oil and refinery products, totaled $353 million in 1969 compared with $301 million in 1968. Some of the import values, by categories, in 1969 were as follows: Diamonds, $217.6 million; aluminum, $10.5 million; copper, $15.2 million; iron and steel metal, $1.3 million; iron and steel semimanufactures, $85.7 million; silver, $1.7 million; asbestos, $1.9 million; and sulfur, $4.1 million.

Values were not available on the exports and imports of crude petroleum and refinery products.

Table 2.—Israel: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum metal including alloys, all forms	r 2,429	2,831	West Germany 666; Netherlands 352; Uganda 312.
Copper:			
Concentrate (cement copper)	r 15,099	16,755	Spain 8,948; Greece 2,728; Hungary 2,260.
Metal including alloys, all forms	r 3,082	4,137	Spain 1,613; Belgium 943; West Germany 483.
Iron and steel:			
Metal:			
Scrap	r 2,026	1,981	Netherlands 843; West Germany 739; Greece 238.
Ferroalloys	10	---	
Semimanufactures:			
Tubes, pipes, and fittings	6,580	5,427	Romania 2,908; United States 987; Cyprus 320.
Other	3,216	94	United States 38; Cyprus 13; Kenya 9.
Lead metal including alloys, all forms	r 314	663	United Kingdom 280; Belgium 261; Netherlands 116.
Magnesium metal including alloys, all forms	3	13	Netherlands 7; United Kingdom 5.
Nickel metal including alloys, all forms	r 85	61	Switzerland 19; United States 18; United Kingdom 11.
Silver:			
Metal including alloys troy ounces	---	1,286	All to United States.
Waste and sweepings do	83,624	---	
Tin metal including alloys, all forms long tons	1	---	
Zinc metal including alloys, all forms	r 110	446	Belgium 204; Republic of South Africa 164; Netherlands 77.
Other base metals including alloys, all forms	159	---	
NONMETALS			
Bromine and products	r 3,730	5,168	United Kingdom 2,078; Netherlands 1,202; West Germany 464.
Cement and clinker	174,394	98,315	Ivory Coast 33,725; Italy 24,020; Brazil 12,000.
Clays and clay products:			
Crude, n.e.s	r 6,217	5,059	West Germany 2,455; Netherlands 2,147; Greece 360.
Products, refractory	r 4,844	5,242	Greece 4,592; Ethiopia 282; West Germany 268.
Diamonds, gem, not set or strung thousand carats	r 1,713	1,775	United States 676; Hong Kong 236; West Germany 211.
Fertilizer materials:			
Crude:			
Phosphatic	r 647,347	791,329	Romania 266,289; Italy 114,321; France 84,502.
Other	1,808	1,452	All to Cyprus.
Manufactured:			
Nitrogenous	---	102	All to Australia.
Phosphatic	r 14,212	49,714	Netherlands 17,467; Hungary 14,083; Spain 7,249.
Other, including mixed	567,082	579,037	France 183,294; Japan 85,654; Brazil 60,890.
Gypsum and plasters	r 28	---	
Lime	---	60	All to Tanzania.
Precious and semiprecious stone, except diamond value, thousands	r $416	$638	Switzerland $259; United Kingdom $160; West Germany $71.
Salt and brines	r 336	793	Malaysia 482; Kenya 216; Uganda 95.
Sodium and potassium compounds, n.e.s	r 1,717	322	All to Turkey.
Stone:			
Dimension:			
Crude and partly worked	78	78	Netherlands 29; Republic of South Africa 27; Madagascar 11.
Worked	1	2	All to United States.
Dolomite, chiefly refractory grade	---	4	All to Italy.
Sulfur:			
Elemental, all forms	r 945	1,273	Mainly to Romania.
Sulfuric acid	80	---	
Other nonmetals n.e.s., building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s	4,115	10,878	Ghana 3,071; Mauritius 1,330; Kenya 764.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	335	35	All to Cyprus.
Carbon black and gas carbon	r 8,080	8,243	United States 2,793; Austria 1,980; United Kingdom 680.
Hydrogen, helium, and rare gases	3	4	All to Iran.
Petroleum:			
Crude and partly refined e thousand 42-gallon barrels	11,779	16,750	NA.
Refinery products: e			
Gasoline (including natural) do	2,225	2,420	NA.
Kerosine and jet fuel do	1,875	2,019	NA.
Distillate fuel oil do	1,200	2,763	NA.
Residual fuel oil do	---	1,555	NA.
Other do	130	862	NA.
Total do	5,430	9,619	NA.

e Estimate. r Revised. NA Not available.

Table 3.—Israel: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	r 798	100
Oxide and hydroxide	r 577	643
Metal including alloys, all forms	r 14,167	14,895
Arsenic trioxides, pentoxide, and acids	3	-----
Chromium oxide and hydroxide	61	41
Copper:		
Matte	8	42
Metal including alloys, all forms	r 12,623	11,655
Gold metal, unworked or partly worked troy ounces	r 8,038	6,719
Iron and steel:		
Metal:		
Scrap	-----	147
Pig iron including cast iron	16,867	13,989
Sponge iron, powder, and shot	302	375
Spiegeleisen	100	250
Ferroalloys	931	1,333
Steel, primary forms	185	199
Semimanufactures:		
Bars, rods, angles, shapes, sections	200,202	216,206
Universal plates and sheets	322,478	276,173
Hoop and strip	8,814	9,244
Rails and accessories	4,520	547
Wire	7,018	8,176
Tubes, pipes, and fittings	11,474	28,134
Castings and forgings, rough	1,489	1,987
Ingots and semimanufactures, high carbon and alloys	19,565	20,031
Lead:		
Oxides	r 735	779
Metal including alloys, all forms	r 2,638	2,266
Magnesium metal including alloys, all forms	r 148	133
Manganese oxide	r 465	385
Mercury 76-pound flasks	232	174
Molybdenum metal including alloys, all forms	1	4
Nickel metal including alloys, all forms	r 173	215
Platinum-group metals including alloys, all forms troy ounces	r 1,897	45,397
Silver metal including alloys do	r 582,153	997,122
Tin:		
Oxides long tons	1	2
Metal including alloys, all forms do	r 197	180
Titanium oxide	r 2,162	2,407
Tungsten metal including alloys, all forms	1	1
Zinc:		
Oxide	r 528	728
Metal including alloys, all forms	r 4,603	6,476
Other:		
Ore and slag	r 799	375
Ash and residue containing nonferrous metals	-----	2,268
Oxides, hydroxides, and peroxides of metals, n.e.s	259	205
Base metals including alloys, all forms	r 103	65

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS		
Abrasives, n.e.s.:		
Pumice, emery, natural corundum, etc	r 104	157
Corundum, artificial	r 294	294
Asbestos	r 8,333	8,586
Barite and witherite	r 755	4,107
Boron materials, oxide and acid	319	246
Cement	r 11,337	34,627
Chalk	126	109
Clays and clay products (including refractory brick):		
Crude kyanite, andalusite, etc	r 29,258	30,977
Products:		
Refractory (including nonclay bricks)	r 1,710	2,214
Nonrefractory ... thousand square meters	r 119	226
Cryolite and chiolite	r 20	39
Diamonds:		
Gem not set or strung ... thousand carats	r 3,877	4,304
Industrial ... do	r 1,240	1,366
Diatomite and other	r 543	777
Feldspar and fluorspar	r 2,589	2,102
Fertilizer materials, manufactured:		
Nitrogenous	r 8,106	7,476
Other including mixed	r 446	155
Graphite, natural	r 13	42
Gypsum and plasters	r 138	137
Magnesite	r 1,514	1,517
Mica, all forms	r 123	136
Pigments, minerals including iron oxides	r 407	424
Precious and semiprecious stone, except diamond ... thousand carats	567	52
Sodium and potassium compounds, n.e.s	r 1,035	1,120
Stone, sand and gravel:		
Dimension stone, crude and partly worked:		
Calcareous	r 81	537
Slate	-----	183
Other	17	32
Dolomite, chiefly refractory grade	122	59
Gravel and crushed rock	r 2,625	3,142
Quartz and quartzite	r 974	514
Sand excluding metal bearing	275	193
Sulfur:		
Elemental, all forms	r 70,065	58,105
Sulfuric acid	r 35,604	38,640
Talc, steatite, soapstone, and pyrophyllite	r 2,210	1,884
Other nonmetals, n.e.s.:		
Crude	137	71
Slag, dross, and similar waste, not metal bearing	872	2,643
Oxides and hydroxides of magnesium, strontium, and barium	37	48
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s	193	139
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	r 39	150
Carbon black and gas carbon	5,492	3,005
Coal and coke, including briquets	8,548	9,577
Peat including peat briquets and litter	338	366
Petroleum:		
Crude and partly refined e ... thousand 42-gallon barrels	[1] 50,700	[1] 40,535
Refinery products: e		
Gasoline (including natural) ... do	112	140
Residual fuel oil ... do	2,664	3,330
Lubricants ... do	160	156
Other ... do	r 69	106
Total ... do	r 3,005	3,732
Mineral tar and other coal, petroleum, or gas derived crude chemicals	620	1,057

e Estimate. r Revised.

[1] Includes estimated receipts from Israeli-occupied Sinai Peninsula oilfields.

COMMODITY REVIEW

METALS

Copper.—A comprehensive report on Timna Copper Mines Ltd., was published.[5] Timna's copper operations are located 18 miles north of Eilat and, in general, consist of open pit mines, an underground

[5] Mining World. How Timna Copper Mines Increased Output and Raised Worker Efficiency. V. 7, No. 1, January 1971, pp. 36–41.

mine (Timna I), a processing plant, and sulfuric acid facilities. Most ore for processing is obtained from open pits and Timna I. Recently, an extension of the ore body was discovered, which added 10 million tons of ore containing 1.8 percent copper to the known reserves. This prompted the company to start another mine, Timna II, adjacent to Timna I. At yearend 1969, the new shaft, 5.5 meters in diameter, was down to the first level elevation, Timna II is scheduled for operation in 1973.

The existing beneficiation plant can process 3,400 tons of ore daily. The ore is crushed to minus 15-millimeter size and slurried with water, 1 to 1 ratio, for ball milling in closed circuit with spiral classifiers. The slurry is then leached, in pachua-type leaching towers, with sulfuric acid, 60 to 80 kilograms of acid per ton of ore. The pregnant solution from thickeners is pumped to precipitation launders for reduction by scrap iron to cement copper containing 70 to 80 percent copper. This is dried and shipped to copper smelters in Europe. The company is studying the feasibility of converting cement copper to copper in Israel and also the feasibility of using domestic hydrochloric acid instead of sulfuric acid derived from imported sulfur.

Magnesium.—The Government approved construction of a $13 million magnesium oxide plant in Arad, near the Dead Sea. The new plant will utilize byproduct magnesium chloride from Dead Sea Works Ltd. (DSW) and reportedly produce 46,000 tons of magnesia and 82,000 tons of hydrochloric acid annually. The plant is scheduled to begin operation in 2 years.[6]

NONMETALS

Clays.—Israel is a small consumer of bentonite, which is used largely in foundries. To import this mineral from the United States (Wyoming) is costly. An Israeli chemical engineer recently developed a secret process to beneficiate low-grade bentonite clays from Cyprus and make a product equal to that from Wyoming. Two research organizations tested samples of the product and found them to be suitable for pelletizing, oil and water drilling, and foundries. Sil-ka Ltd., a small importer of bentonite from Cyprus for animal feeds, secured rights to use the process and began building a plant at Nahariya scheduled for operation late in 1971. The initial capacity will be 20,000 tons of product annually, but will be gradually increased to 100,000 tons. The firm recently changed its name to Sil-ka International Ltd. and is assessing the market for their product in western Europe. Ore for the plant will be imported from the Berdy Mining Co. operation in the Troulli Mountains, Cyprus. This firm has a reserve of 10 million tons of bentonite.[7]

Diamonds.—Israel is a very large importer of rough diamonds, and in 1969 was the world's second largest exporter of polished diamonds—well over the $200 million level and ranking next to Belgium. Diamond cutting and polishing requires no water, little power, low fixed assets, small work space, and plenty of skill. Israel depends on the diamond syndicate for much of its supply of stones. Tel Aviv has the world's largest diamond exchange, a 28-story building that houses 1,000 Israeli dealers, and buyers from 50 foreign countries. They gather in small groups to inspect and bargain for $60 million in stones daily. A man's word is his best asset on the trading floor; there is no time to inspect each stone in the packets of 50 to 100. Dealers seal each transaction with a handshake and the Hebrew words "mazal ve bracha," meaning "luck and blessing."[8]

Fertilizer Materials.—DSW has capacity to produce 1 million tons of potassium chloride annually from three plants at Sodom. Plant A, built in 1953 and subsequently expanded, has a capacity of 200,000 tons. Plant B, brought on stream in 1964, has a capacity of 400,000 tons. Plant C, in operation since October 1969, has a capacity of 400,000 tons. An additional 200,000 tons of capacity can easily be added with little investment. The processes used at the three plants to produce potassium chloride are similar. Water from the Dead Sea is partially evaporated to remove sodium chloride, and then further evaporated to yield a carnallite slurry. This, in turn, is filtered to remove brine. Water is added to the remaining crystal residue, and the mixture is filtered to remove magnesium chloride, The filtrate, containing a mixture of potassium chloride

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[6] U.S. Embassy, Tel Aviv. State Department Airgram A-236, July 18, 1970, p. 4.
[7] Industrial Minerals (London). New Process Up-Grades Cyprus Bentonite. No. 39, December 1970, pp. 37, 39.
[8] Time. Israel, the Kindest Cut of All. V. 96, No. 7, Aug. 17, 1970, p. 62.

and some sodium chloride, is processed further to produce potassium chloride in Plant A by flotation and in Plants B and C by thermal dissolution. The potassium chloride product is then washed to remove sodium chloride impurities, filtered, dried, and conveyed to storage for shipment.[9]

American Israel Phosphate Corp. (AIPC) planned to invest $14.3 million in a phosphate mining and beneficiation project at Ein Yahav in the Negev. The plant will be able to produce 600,000 tons of product containing 32 percent P_2O_5 and 250,000 tons of product containing 35 percent P_2O_5 annually.[10] AIPC signed a contract with the Israeli Government for the project and had until March 31, 1971, to complete the plant design and then 1½ years longer to finish construction.

The $40 million, 165,000-ton-per-year phosphoric acid plant of Arad Chemical Industries, Ltd., was scheduled to come on stream in 1970. The company also was considering a joint venture with Madera Corp. of the United States, for producing a number of phosphatic fertilizers and chemicals, mostly for export.

The long-awaited rail link between the Mediterranean port of Ashdod and the phosphate mines at Oron was completed in March, thus permitting rock to be transported by rail directly to domestic consumers or to a terminal at Ashdod where all ore exported to Europe is dispatched. The 25-kilometer railroad connection cost $24 million. Previously, ore destined for Europe had to be trucked 25 kilometers to the railhead at Dimonah and then transported 115 kilometers farther by rail to Ashdod. Rock exported to Africa, Australia, and the Far East, however, has to be trucked 210 kilometers to the port of Eilat on the Red Sea, for shipment.[11]

The new ammonia facility of Chemicals & Phosphates Ltd. (C & P) at Haifa is scheduled to come on stream in 1971. The plant will have a capacity of 67,900 tons of nitrogen equivalent annually, and one-third of the ammonia will be exported. The new plant will use the process developed by Imperial Chemical Industries Ltd. The existing plant, having an annual capacity of 26,000 tons of nitrogen equivalent, will be phased out.[12]

The World Bank approved a $20 million loan to Israel in support of an agricultural credit program which totals $50 million for agricultural improvements extending over 3 years. The loan will be used to increase the production and export of high-value crops such as flowers, subtropical fruits, and off-season vegetables. This may well involve larger use of fertilizers.[13]

MINERAL FUELS

Petroleum.—At yearend 1969, 13 firms or groups held petroleum rights on 2,948,914 acres (including 800,000 acres on the Mediterranean Continental Shelf) compared with 3,332,286 acres at yearend 1968. The total footage drilled for oil in 1969 was 18,509 feet compared with 74,207 feet in 1968. No commercial discoveries of oil were made in 1969 as a result of drilling four new holes and deepening one old hole.[14]

Belco Petroleum Corp.'s first of six offshore exploratory wells in the Mediterranean showed indications of oil but no reservoir capable of producing commercial quantities. The hole yielded valuable geologic information and was abandoned at a depth of 13,500 feet. The work was being done by the drill ship *Typhoon*.[15] The second hole, drilled at another location, was abandoned at a depth of 14,600 feet. It indicated the existence of a nearby reef of Jurassic age that might warrant further testing. The *Typhoon* then moved 30 miles away to drill the third hole.[16] A later report showed that the fifth hole was abandoned at 8,700 feet after showing no commercial quantities of oil and that drilling began on the sixth hole.[17]

Lapidot Oil Co. announced the discovery of oil in 1970 at the Gurim 3 drilling field, southeast of Arad near the Dead Sea.

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[9] Phosphorous and Potassium. Dead Sea Works Now Among World's Largest Potash Producers. No. 46, March–April 1970, pp. 45–47.

[10] Mining World. V. 6, No. 1, January 1970, p. 50.

[11] Phosphorous and Potassium. Ashdod-Oron Rail Link Completed. No. 48, July–August 1970, p. 52.

[12] Nitrogen. No. 67, September–October 1970, p. 16.

[13] International Bank for Reconstruction and Development. Press Release 70/58, Oct. 14, 1970, 2 pp.

[14] American Association of Petroleum Geologists Bulletin. Petroleum Exploration Activities in Israel During 1969. V. 54, No. 8, August 1970, pp. 1548–1550.

[15] Petroleum Intelligence Weekly. V. 9, No. 16, Apr. 20, 1970, p. 8.

[16] Petroleum Intelligence Weekly. V. 9, No. 40, Oct. 5, 1970, p. 7.

[17] Petroleum Intelligence Weekly. V. 9, No. 14, Apr. 5, 1971, p. 8.

The oil was found in limestone strata at a depth of 1,550 meters. Tests are being made to determine the quality of oil and size of the new field. The company owns the Haletz-Kokhav-Bror fields in the Negev which produced 115,370 tons of crude oil during fiscal year 1968–69.[18]

Israel's new 42-inch Eilat-Ashkelon oil-transit pipeline extending 163 miles from Eilat on the Gulf of Aqaba to Ashkelon on the Mediterranean Sea went into operation early in the year. The pipeline is designed to eventually carry 1.2 million barrels of crude oil per day. Currently, it can carry five different types of crude oil in batched sequence.[19] The pipeline transported 11 million tons of crude oil in 1970. The original target of 14 million tons of oil was not met owing to technical obstacles and shortages of tankers.[20] A second loading berth for tankers was put into operation at Ashkelon, and four more are to be added.[21]

Plans by Haifa Refineries, Ltd., and Israel Petrochemical Enterprises for constucting a new 50,000-barrel-per-day refinery, costing about $40 million, at Ashdod were in the final stages. The plant, Israel's second, will have an ultimate capacity of 100,000 barrels per day and will come on stream in 1973.[22]

The demand for petroleum products, including bunkers, in Israel and occupied territories substantially increased in 1969 over that of 1968. Consumption (in thousand barrels) in 1969 amounted to 30,229 barrels, and was as follows: Gasoline 3,859; kerosine 3,441; distillate fuel oil 5,505; residual fuel oil 14,645; liquefied petroleum gas 1,322; bitumen 764; and other 693. According to Israel Petroleum Institute, sales by the three marketing companies (Paz Oil Corp. Ltd., Delek Israel Fuel Corp. Ltd., and Sonol Israel Oil Co. Ltd.) totaled $177 million in 1969 compared with $161 million in 1968.[23]

According to the Minister of Finance, Israel is earning about $15 million annually from refining oil for foreign customers. The Eilat-Ashkelon oil pipeline is also earning substantial foreign currency.[24]

Israel was reportedly extracting about 90,000 barrels of crude oil daily from the occupied Egyptian Sinai fields and shipping it to Eilat for transporting through the trans-Israel pipeline.[25]

A new 8-inch 35-kilometer-long pipeline was laid to carry oil from the old 16-inch Eilat-Haifa oil line to the Oron Phosphates plant in Negev. The plant will use crude oil for fuel instead of natural gas previously supplied from the nearby Zohar fields.[26]

The Triassic Saharonim Formation and the Dolomite Member of the Mohilla Formation in southern Israel were studied petrographically to obtain details on deposition for use in oil exploration.[27] Considerable knowledge about the Paleozoic Formation in southern Israel was obtained from drilling operations and from detailed studies of sandstone outcrops. The first two of a series of five reports describing the Paleozoic Formation of Israel and adjacent countries were published in 1969.[28]

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[18] U.S. Embassy, Tel Aviv. State Department Airgram A–226, June 15, 1970, p. 5.
[19] Petroleum Intelligence Weekly. V. 9, No. 8, Feb. 23, 1970, p. 5.
[20] U.S. Embassy, Tel Aviv. State Department Airgram A–90, Mar. 17, 1971, p. 5.
[21] Oil and Gas Journal. V. 68, No. 35, Aug. 31, 1970, p. 23.
[22] Oil and Gas Journal. V. 69, No. 13, Mar. 29, 1971, p. 97.
[23] Petroleum Press Service. V. 37, No. 4, April 1970, pp. 126–127.
[24] Petroleum Intelligence Weekly. V. 9, No. 45, Nov. 9, 1970, p. 7.
[25] Petroleum Intelligence Weekly. V. 9, No. 39, Sept. 28, 1970, p. 8.
[26] U.S. Embassy, Tel Aviv. State Department Airgram A–442, Nov. 20, 1970, p. 3.
[27] Druckman, Yehezkeel. The Petrography and Environment of Deposition of the Triassic Saharonim Formation and the Dolomite Member of the Mohilla Formation in Makhtesh Ramon, Central Negev (Southern Israel). Geol. Survey Bull. 49, 1969, 47 pp.
[28] Weissbrod, Tuvia, and Maurice Hamaoui. The Paleozoic of Israel and Adjacent Countries. Part 1, The Subsurface Paleozoic Stratigraphy of Southern Israel. Geol. Survey Bull. 47, 1969, 35 pp.
Weissbrod, Tuvia. The Paleozoic of Israel and Adjacent Countries. Part 2, The Paleozoic Outcrops in Southwestern Sinai and Their Correlation With Those of Southern Israel. Geol. Survey Bull. 48, 1969, 33 pp.

The Mineral Industry of Italy

By Andrew Kuklis [1]

Italy achieved a satisfactory rate of economic growth in 1970 by arresting inflationary developments and by maintaining external accounts near equilibrium. The gross national product (GNP) totaled an estimated $71.2 billion, an increase of about 6 percent over that of 1969. The elements of production most responsible for its rise were industrial and services, both having advanced over 7 percent. The industrial sector benefited from a high level of demand for machine products by the engineering industry, and construction-related products for building purposes, especially during the first half of 1970. However, the iron and steel industry failed to meet the rising demand of domestic markets and net imports of steel reached record levels. Moreover, the chemical industry, an important and consistent growth leader in the Italian economy, showed signs of weakness. Other industries, such as textiles and food canning, continued to decline in output and employment as a consequence of inadequate planning and/or modernization. The domestic mining industry continued to play a relatively small role in Italy's growing industrial economy.

In 1970, Italy imported various products valued at nearly $15 billion; or $2.5 billion more than in 1969. The increase in imports reflects a growing imbalance between domestic demand and production. The imbalance appeared to be of a short-term nature in the case of motor vehicles and iron and steel products, but there was no prospect for improvement in the agricultural sector. Italy had a surplus of about $2.4 billion in manufactured products and a deficit of $1.5 billion in agricultural products.

Despite shipment of products to other countries valued at $13.2 billion, Italian exports did not reach anticipated dollar levels. The relatively low growth rate in exports was not caused by a weakening in the Nation's competitive position but rather to dislocation of domestic production processes due largely to labor disputes.

After a decline in industrial output of about 10 percent in the last quarter of 1969, labor relations continued to be under strain in various industries. Throughout the economy, the rise in productivity was checked by shortening of the workweek and by reduced overtime. However, businessmen, eager to expand and modernize plants, were often discouraged because of difficulty in financing new projects, principally because of high interest rates and capital outflows.

[1] Mining engineer, Division of Ferrous Metals.

PRODUCTION

The general index of production for the mining industry in 1970 increased by 2 percent compared with that of 1969. In metal mining, all metallic minerals declined except bauxite and antimony. Lower production was reported for some commodities in the mineral fuel sector. The production of asbestos, rock salt, talc, pyrite, graphite, and construction minerals rose and accounted for the small increase in the general index. The total value of 1970 mineral output was estimated at approximately $528.0 million.

Performance of the mining industry is indicated by the following tabulation:

Sector	Index (1966 = 100)	
	1969	1970
Metallic minerals	104.4	106.1
Nonmetallic minerals	r 109.6	115.3
Marble, building stone	137.3	142.1
Solid fuels	127.1	127.2
Petroleum and natural gas	125.3	126.9
Total mining	122.0	124.5

r Revised.

Table 1.—Italy: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite	216,197	216,464	224,703
Alumina	r 293,824	291,979	313,300
Metal:			
Primary	142,348	141,559	146,476
Secondary	102,000	128,000	154,000
Antimony mine output, metal content	r 1,268	1,284	1,299
Cadmium smelter output	250	422	425
Copper:			
Mine output, metal content	2,304	2,270	2,110
Precipitate, metal content	3,300	2,400	2,000
Metal, secondary only	18,000	16,500	13,700
Iron and steel:			
Iron ore and concentrate [1] thousand tons	738	763	757
Roasted pyrite do	862	NA	NA
Pig iron do	7,826	7,795	8,332
Ferroalloys:			
Blast furnace do	16	15	22
Electric furnace do	152	152	175
Crude steel do	16,964	16,428	17,277
Steel semimanufactures: [2]			
Hot rolled:			
Wire rod do	805	832	887
Sections do	r 4,879	5,014	5,324
Plates and sheets do	r 5,559	5,671	5,534
Strip do	r 871	923	999
Railway track material do	161	134	142
Ingots, semis and solids for tubes do	1,131	1,068	1,106
Other do	646	713	772
Total hot rolled do	r 14,052	14,355	14,764
Castings and forgings do	r 320	333	361
Cold-rolled sheet do	r 2,748	2,896	2,941
Lead:			
Mine output, metal content	36,475	36,982	35,200
Metal:			
Primary	57,554	62,325	54,288
Secondary	18,600	17,700	25,000
Magnesium metal, primary	6,593	6,435	7,580
Manganese ore, gross weight	50,821	52,966	50,091
Mercury metal 76-pound flasks	53,317	48,733	44,382
Silicon, elemental	18,813	19,193	20,220
Silver metal thousand troy ounces	1,156	1,834	1,063
Tungsten mine output, metal content kilograms	2,578	515	--
Zinc:			
Mine output, metal content	139,800	132,300	110,700
Metal, primary	112,274	130,321	142,082
NONMETALS			
Asbestos	103,437	112,526	118,518
Barite	r 207,104	245,825	223,061
Cement, hydraulic thousand tons	r 29,549	31,348	33,120
Clays, crude:			
Bentonite do	r 251	277	321
Fire do	r 258	286	322
For cement do	4,544	4,444	NA
For common brick do	26,915	29,290	NA
Fuller's earth do	r 113	129	73
Kaolin do	r 105	114	101
Kaolinitic earth do	16	16	10
Diatomite	r 57,535	59,736	59,220
Feldspar	r 196,836	212,645	176,905
Fertilizer materials:			
Crude potassium salts, natural thousand tons	1,929	1,954	1,894
Manufactured, gross weight:			
Nitrogenous do	r 3,540	3,108	2,972
Phosphatic do	1,625	1,426	1,406
Potassic do	335	343	365
Mixed and unspecified do	r 2,067	1,719	1,762
Fluorspar, all grades	r 230,029	258,708	289,266
Graphite, all grades	r 1,413	1,719	2,088
Gypsum (except for dimension stone use) thousand tons	3,237	3,367	3,300
Lime (quicklime and hydrated) do	e 5,000	5,795	e 5,800
Pumice and related materials:			
Pumice and pumaceous lapilli do	795	776	1,127
Pozollan do	4,229	4,324	4,258
Pyrite, all kinds:			
Gross weight do	r 1,419	1,473	1,518
Sulfur content do	r 639	663	683

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
NONMETALS—Continued			
Salt:			
Marine, crude ______ thousand tons	1,292	1,147	1,497
Other including brine ______ do	2,626	2,800	2,871
Sand and gravel:			
Silica sand ______ do	4,017	4,486	NA
Volcanic sand ______ do	280	200	NA
Other sand and gravel ______ do	50,260	58,794	NA
Stone:			
Dimension stone:			
Calcareous:			
Alabaster and onyx ______ do	13	8	NA
Gypsum for cutting ______ do	83	92	120
Limestone ______ do	283	291	NA
Marble in blocks:			
White ______ do	792	827	NA
Colored ______ do	1,085	1,153	1,129
Lime schist ______ do	52	56	NA
Travertine ______ do	407	411	423
Tufa, calcareous ______ do	1,770	1,558	1,600
Other:			
Breccia ______ do	13	20	NA
Diorite ______ do	6	5	NA
Gneiss ______ do	128	144	152
Granite ______ do	62	69	57
Lava, basalt and trachyte ______ do	84	120	80
Porphyry ______ do	149	166	184
Quartz and quartzite ______ do	30	42	10
Sandstone ______ do	58	99	NA
Serpentine ______ do	166	291	304
Slate ______ do	67	67	65
Syenite ______ do	4	5	NA
Tuff, volcanic ______ do	371	238	NA
Crushed and broken:			
Calcareous:			
Dolomite ______ do	1,160	1,099	1,127
Limestone ______ do	39,622	41,204	NA
Marble, white and colored ______ do	1,736	1,771	NA
Marl for cement ______ do	5,460	5,777	6,439
Travertine ______ do	337	325	NA
Tuff, calcareous ______ do	5,790	5,272	NA
Other:			
Breccia ______ do	10	12	NA
Gneiss ______ do	11	10	NA
Granite ______ do	168	162	NA
Lava, basalt and trachyte ______ do	3,746	3,300	NA
Porphyry ______ do	17	18	NA
Quartz and quartzite ______ do	361	429	NA
Sandstone ______ do	338	326	NA
Tuff, volcanic ______ do	4,227	4,213	NA
Strontium minerals ______	778	925	845
Sulfur, native:			
Ore ______	541,098	419,068	354,218
Concentrate (85 to 90 percent sulfur) ______	90,506	64,046	54,720
Fused in briquets ______	7,027	1,320	1,681
Talc and related materials ______	r 120,889	139,954	154,818
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bituminous rock, natural:			
For distillation ______	r 197,123	126,776	111,199
For paving ______	r 68,022	85,865	93,455
Carbon black ______	93,310	104,252	123,559
Coal:			
Subbituminous (sulcis coal) ______ thousand tons	365	303	295
Lignite ______ do	r 1,729	1,933	1,393
Coke:			
Metallurgical ______ do	6,476	6,670	7,171
Gashouse ______ do	269	192	125
Gas, natural, marketed production ______ million cubic feet	367,744	422,335	463,953
Petroleum:			
Crude oil ______ thousand 42-gallon barrels	10,260	9,309	9,575
Refinery products:			
Gasoline ______ do	106,573	107,184	109,066
Jet fuel ______ do	13,634	13,144	12,128
Kerosine ______ do	19,834	25,515	25,622
Distillate fuel oil ______ do	131,724	148,373	171,222
Residual fuel oil ______ do	298,051	328,457	363,683
Lubricants ______ do	3,469	3,674	4,704

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products—Continued			
Other ... thousand 42-gallon barrels	81,990	88,953	131,765
Refinery fuel and losses ... do	51,703	67,617	64,932
Total ... do	706,978	782,917	883,122

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.

TRADE

As in the past, Italy had an intensive trade in mineral commodities during 1970. Preliminary data indicate that mineral commodities increased their share in the total value of the Nation's trade. The value of imported minerals and mineral-related products increased nearly 12 percent compared with that of 1969. Large increases in the value of crude oil and iron and steel, which together accounted for about 60 percent of the value of mineral commodities purchased abroad, was responsible for the higher imports.

Relationships between mineral commodity trade and total trade in 1968 and 1969, and the principle items constituting Italy's mineral commodity trade, are shown in the tables that follow.

Table 2.—Italy: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite	--	25	United Kingdom 15; Switzerland 10.
Oxide and hydroxide	11,620	12,612	Austria 6,623; Switzerland 1,826; Bulgaria 1,132; Czechoslovakia 865.
Metal including alloys:			
Scrap	264	63	West Germany 42; United States 19.
Unwrought	25,378	7,599	Argentina 2,868; Yugoslavia 1,148; France 1,127; West Germany 926.
Semimanufactures	43,896	49,951	West Germany 13,586; United States 7,688; France 6,829; Yugoslavia 4,178.
Antimony	(1)	236	Mainly to West Germany.
Arsenic:			
Natural sulfides	--	20	All to U.S.S.R.
Trioxide, pentoxide and acids	30	114	India 89; Albania 25.
Bismuth	NA	3	United Kingdom 1; West Germany 1.
Cadmium metal including alloys, all forms	10	39	Mainly to Netherlands.
Chrome, chromite	116	119	Austria 99; Yugoslavia 20.
Cobalt	NA	30	Netherlands 11; U.S.S.R. 10.
Copper:			
Ore and concentrate	8,194	8,385	Mainly to Spain.
Matte	107	21	Mainly to West Germany.
Metal including alloys:			
Scrap	871	743	Do.
Unwrought	8,016	5,087	West Germany 2,597; Netherlands 1,442.
Semimanufactures	32,566	25,401	West Germany 5,566; France 4,728; Romania 2,417; Switzerland 1,680; Israel 1,117.
Iron and steel:			
Ore and concentrate	23	77	All to Switzerland.
Roasted pyrite thousand tons	632	367	Austria 196; Netherlands 7; Switzerland 7; West Germany 4.
Metal:			
Scrap do	7	19	West Germany 9; France 8.
Pig iron including cast iron, spiegeleisen, powder and shot do	r 2	4	France 1; Switzerland 1; West Germany 1.
Ferroalloys do	20	18	West Germany 7; France 5; Austria 2.
Steel, primary forms do	328	130	Israel 38; Argentina 14; Switzerland 13; United States 12; Spain 11.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	617	531	West Germany 201; France 78; United States 34; mainland China 30.
Universals, plates and sheets do	714	566	France 99; West Germany 80; Yugoslavia 56; Spain 50; Bulgaria 42.
Hoop and strip do	68	59	Pakistan 15; France 8; Switzerland 7; Yugoslavia 6; Greece 4.
Rails and accessories do	13	7	Mainly to Switzerland.
Wire do	24	22	Romania 3; West Germany 3; Hungary 2; France 1; Algeria 1; Yugoslavia 1.
Tubes, pipes and fittings do	646	545	United Kingdom 81; United States 74; Libya 58; France 38; West Germany 34.
Castings and forgings unworked do	5	76	Bermuda 13; France 13; West Germany 5; Pakistan 4; Libya 3; Switzerland 3.
Lead:			
Ore and concentrate	3,297	7,525	Austria 3,548; Yugoslavia 2,517.
Metal including alloys:			
Scrap	1,945	2,778	Mainly to Belgium-Luxembourg.
Unwrought	77	18	Mainly to France.
Semimanufactures	205	707	Do.
Magnesium metal including alloys:			
Scrap	20	--	
Unwrought	7,112	4,932	Mainly to West Germany.
Semimanufactures	100	113	France 36; West Germany 28; Denmark 14.

See footnotes at end of table.

Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Manganese:			
Ore and concentrate	22	20	All to Netherlands.
Metal, all forms	40	--	
Mercury 76-pound flasks	34,673	34,056	East Germany 6,382; United Kingdom 5,889; West Germany 4,902; Japan 4,409; United States 4,090.
Nickel:			
Metal including alloys:			
Ore and concentrate	NA	23	All to France.
Unwrought including alloys	35	153	West Germany 86; France 49.
Semimanufactures	655	705	Spain 230; Morocco 140; West Germany 41.
Platinum-group metals and silver including alloys:			
Platinum group thousand troy ounces	28	33	Mainly to West Germany.
Silver do	1,774	607	Do.
Selenium, elemental kilograms	400	1,120	All to West Germany.
Silicon, elemental	10,735	7,693	West Germany 3,514; United Kingdom 2,286; Australia 410.
Tin metal, all forms long tons	318	321	France 116; Denmark 59; Austria 35.
Titanium oxides	21,921	16,879	West Germany 3,533; Hungary 1,620; France 1,289; Poland 1,160; Argentina 1,090; Romania 985; Netherlands 932.
Tungsten:			
Ore and concentrate	--	13	All to United Kingdom.
Metal including alloys, all forms	17	18	Mainly to West Germany.
Zinc:			
Ore and concentrate	32,186	39,657	Yugoslavia 28,349; Austria 11,282.
Metal including alloys:			
Blue powder	1,661	1,121	Mainly to Romania.
Unwrought	892	848	Mainly to Greece.
Semimanufactures	249	297	Mainly to Switzerland.
Other:			
Ash and residue containing nonferrous metals	NA	100,442	Mainly to United Kingdom.
Metal containing alloys, all forms	NA	12	Mainly to Belgium-Luxembourg.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, corundum, etc	316,383	321,665	United States 151,348; United Kingdom 39,699; Libya 38,735; France 33,693.
Dust and powder of precious and semiprecious stones kilograms	14	728	Mainly to Switzerland.
Grinding and polishing wheels and stones	3,861	5,087	France 1,063; West Germany 426; United Kingdom 381; Romania 356; Switzerland 198.
Asbestos	41,829	46,075	West Germany 19,730; France 8,640; Poland 3,423; Spain 2,606.
Barite and witherite	38,489	52,592	Mainly to United States.
Cement	280,750	159,197	Libya 87,703; France 14,246; Spain 10,318; Yugoslavia 6,209.
Chalk	706	684	Mainly to Switzerland.
Clays and products (including nonclay bricks):			
Crude n.e.s.:			
Bentonite	18,610	15,687	Mainly to Libya.
Kaolin	540	599	Mainly to Greece.
Other	30,042	33,133	Mainly to France.
Products:			
Refractory (including nonclay bricks)	33,023	40,725	Switzerland 4,376; Romania 3,674; Yugoslavia 3,442; Turkey 2,431; Portugal 2,241; Belgium-Luxembourg 2,153; Austria 1,986; West Germany 1,850; Argentina 1,400.
Nonrefractory	439,648	561,425	France 108,065; West Germany 92,894; Switzerland 78,445; Yugoslavia 57,568; Libya 43,035.
Diamond:			
Gem not set or strung value, thousands	--	$224	Mainly to Netherlands Antilles.
Industrial carats	NA		
Diatomite and other infusorial earths	3,480	1,976	Mainly to Switzerland.
Feldspar	25,179	27,401	West Germany 13,976; Switzerland 2,666; Netherlands 2,546.

See footnotes at end of table.

Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude	NA	38	All to Yugoslavia.
Manufactured:			
Nitrogenous	1,182	841	Mainland China 289; Turkey 224; Cuba 78; United Arab Republic 43.
Phosphatic	19	7	Kenya 2; Switzerland 1; Uganda 1.
Potassic	19	127	Poland 28; Cuba 15; France 15; Greece 13; United States 13.
Other	63	479	Cuba 78; Turkey 76; Spain 34; France 23; Thailand 23; Cyprus 13.
Ammonia	7,034	26,895	Israel 8,722; Yugoslavia 7,174; Greece 5,962.
Fluorspar	83,841	106,977	Mainly to United States.
Graphite, natural	1,568	1,532	France 993; Spain 152.
Gypsum and plaster	27,857	30,897	Yugoslavia 16,446; Switzerland 8,798; Austria 2,122; France 1,602.
Kyanite	NA	39	West Germany 21; Greece 18.
Lime	67,476	70,541	Mainly to Libya.
Magnesite	80	125	France 59; Switzerland 33.
Mica:			
Crude including splittings and waste	84	67	Switzerland 36; France 20.
Worked including agglomerated splittings	201	29	Yugoslavia 9; Republic of South Africa 7; Belgium-Luxembourg 5.
Precious and semiprecious stones, except diamond:			
Natural kilograms	453	734	Mainly to Switzerland.
Manufactured do	134	899	United Kingdom 547; Switzerland 176.
Pyrite (gross weight)	48,497	40,272	Switzerland 33,310; Austria 5,510.
Salt, all forms	20,357	29,387	Norway 16,069; France 8,551.
Sodium compounds n.e.s	256,479	180,442	U.S.S.R. 67,881; Belgium-Luxembourg 12,895; Turkey 11,444; United Arab Republic 11,065.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	281,337	277,613	West Germany 60,004; France 51,385; Belgium-Luxembourg 18,782; Spain 14,073; Lebanon 14,003; Switzerland 10,007.
Slate	4,073	4,501	Switzerland 1,484; West Germany 1,255.
Other	40,706	44,100	Switzerland 18,112; West Germany 10,684; Austria 6,542; France 3,556.
Worked, all forms	392,693	481,371	West Germany 210,996; France 115,666.
Dolomite, all grades	14,667	19,075	Switzerland 6,750; Yugoslavia 2,912; Austria 2,203; Argentina 1,645.
Gravel and crushed rock	422,762	460,436	West Germany 128,472; Switzerland 55,423; Belgium-Luxembourg 45,364; Libya 41,598; Malta 27,040.
Limestone (except dimension)	1,460	1,162	Mainly to Switzerland.
Quartz and quartzite	28,231	34,355	Switzerland 21,120; France 11,651.
Sand excluding metal bearing	366,614	265,141	Switzerland 216,128; Yugoslavia 26,094.
Strontium minerals	81	--	
Sulfur:			
Elemental, all forms	4,330	6,737	Mainly to Yugoslavia.
Sulfuric acid	123,024	114,229	Israel 28,621; Tunisia 22,255; Lebanon 14,973; Spain 14,230; United Arab Republic 10,415.
Talc, steatite, and soapstone	40,427	50,221	West Germany 16,336; United Kingdom 8,642.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	9,536	393	Tunisia 150; France 1; United Kingdom 1.
Carbon black	25,416	27,879	Turkey 4,883; Austria 3,676; France 2,994; West Germany 2,936; Czechoslovakia 2,325.
Coal excluding briquets, all grades	4,053	3,490	Yugoslavia 1,100; France 999; West Germany 505.
Coke and semicoke	233,974	346,476	Romania 166,069; Austria 32,913; France 32,691; Yugoslavia 31,128.

See footnotes at end of table

Table 2.—Italy: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum refinery products:			
Gasoline ------ thousand 42-gallon barrels --	42,942	49,122	United Kingdom 11,739; Belgium-Luxembourg 6,909; Netherlands 5,366; Sweden 5,041; Switzerland 412.
Kerosine and jet fuel ---------------- do ----	15,337	18,771	Ships 3,968; United States 2,241; Belgium-Luxembourg 1,464; Greece 1,421; Netherlands 1,335; Nigeria 982.
Distillate fuel oil ------------------ do ----	78,852	76,928	West Germany 19,254; France 10,377; Netherlands 9,795; Switzerland 8,460; Belgium-Luxembourg 8,199.
Residual fuel oil -------------------- do ----	61,026	77,909	United States 27,919; Ships 20,799.
Liquefied petroleum gases ------------ do ----	2,623	3,636	United Arab Republic 688; Turkey 608; France 600; Argentina 337; Lebanon 314; Austria 140.
Lubricants --------------------------- do ----	2,624	1,733	Netherlands 246; Belgium-Luxembourg 241; Switzerland 214; West Germany 169; Ships 74.
Bitumen and other -------------------- do ----	165	226	Libya 123; Algeria 57.
Mineral jelly and wax ---------------- do ----	11	13	Republic of South Africa 4; West Germany 2; Spain 2; Netherlands 1; Poland 1.
Other -------------------------------- do ----	44	1,973	Austria 682; Libya 509; Switzerland 193; Spain 38.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals --------------------	4,472	11,764	Yugoslavia 6,389; Greece 1,046.

r Revised. NA Not available.

[1] Less than 1 ton.

Source: Statistica Annuale Del Commercio Con L'Estero. V. II, 1969.

Table 3.—Italy: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	585,924	590,198	Yugoslavia 284,137; Indonesia 69,760; India 59,399.
Oxide and hydroxide	54,200	72,933	France 34,338; Greece 28,210.
Metal including alloys:			
Scrap	43,790	31,695	France 7,862; Hungary 3,037; West Germany 2,689; Austria 2,010; Switzerland 1,362; Yugoslavia 1,125.
Unwrought	85,860	156,551	France 33,123; Norway 18,041; Yugoslavia 14,664; Canada 13,862; United States 11,915.
Semimanufactures	23,970	29,594	West Germany 9,638; France 6,494; Greece 5,869.
Antimony:			
Ore and concentrate	183	659	Morocco 346; Thailand 184.
Metal including alloys, all forms	166	329	Mainly from Belgium-Luxembourg.
Arsenic:			
Natural sulfides	NA	20	All from U.S.S.R.
Trioxide, pentoxide and acids	NA	186	Mainly from mainland China.
Metal including alloys, all forms	NA	101	Mainly from Sweden.
Beryllium:			
Oxide kilograms	1,980	3,000	All from West Germany.
Metal including alloys, all forms do	600	2,362	Mainly from West Germany.
Bismuth metal including alloys, all forms	78	115	Peru 38; United Kingdom 23; Netherlands 17; France 12.
Cadmium	16	37	United States 16; Netherlands 8; France 3.
Chromium:			
Chromite	163,089	160,456	U.S.S.R. 58,720; Republic of South Africa 43,558; Albania 35,888; Turkey 15,157.
Oxide and hydroxide	1,029	450	West Germany 150; Netherlands 141; Poland 101.
Metal including alloys, all forms	79	74	Mainly from France.
Cobalt:			
Oxide and hydroxide	243	314	Mainly from Belgium-Luxembourg.
Metal including alloys, all forms	344	458	Do.
Copper:			
Ore and concentrate	131	6	Mainly from West Germany.
Matte	126	1,345	Belgium-Luxembourg 526; Congo (Kinshasa) 460; Chile 100.
Metal including alloys:			
Scrap	42,130	46,152	West Germany 12,717; France 9,252; Belgium-Luxembourg 2,119; Switzerland 2,042.
Unwrought	226,255	264,517	Zambia 69,523; Chile 55,786; United States 38,933; Congo (Kinshasa) 36,566.
Semimanufactures	10,432	12,275	West Germany 3,909; Yugoslavia 1,916; Switzerland 1,385; France 1,296.
Gallium, indium, and thallium kilograms	400	7,882	Mainly from West Germany.
Germanium do	1,300	3,033	Mainly from Belgium-Luxembourg.
Iron and steel:			
Ore and concentrate thousand tons	10,068	11,037	Liberia 2,197; Canada 1,264; Brazil 1,255; Venezuela 1,211; Mauritania 1,157.
Roasted pyrites do	--	6,044	All from Spain.
Metal:			
Scrap do	5,085	5,135	France 1,920; West Germany 1,636; United States 710; U.S.S.R. 230.
Pig iron including cast iron and speigeleisen do	883	805	West Germany 422; U.S.S.R. 136; Finland 56.
Sponge iron, powder shot do	23	14	France 6; Sweden 6; West Germany 1.
Ferroalloys:			
Ferromanganese do	87	113	France 57; Belgium-Luxembourg 17.
Other do	80	97	France 31; Norway 23; Republic of South Africa 11; Yugoslavia 10.
Steel, primary forms do	1,130	629	West Germany 185; France 154; United States 140; Belgium-Luxembourg 75.

See footnotes at end of table.

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

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and Steel—Continued			
Metal—Continued			
Semimanufactures:			
Bars, rods, angles, shapes and sections ..... thousand tons	497	575	West Germany 150; France 130; Belgium-Luxembourg 102.
Universals, plates and sheets ..... do	910	1,351	West Germany 261; France 258; Belgium-Luxembourg 246; United States 104.
Hoop and strip ..... do	77	125	France 38; West Germany 34; Belgium-Luxembourg 29.
Rails and accessories ..... do	57	118	France 54; West Germany 24; Belgium-Luxembourg 15.
Wire ..... do	24	40	Belgium-Luxembourg 11; Yugoslavia 6; Australia 5; West Germany 4.
Tubes, pipes, and fittings ..... do	107	150	West Germany 71; France 25; Yugoslavia 14.
Casting and forgings ..... do	4	22	West Germany 12; France 5.
Lead:			
Ore and concentrate	54,308	30,951	Morocco 12,846; Canada 5,880; Ireland 5,376.
Ash and residue containing lead	4,465	5,171	Australia 2,117; Hungary 1,419; West Germany 594.
Metal including alloys:			
Scrap	18,861	20,210	France 7,533; Switzerland 4,996; West Germany 3,235; Libya 794.
Unwrought	55,214	65,183	Mexico 9,988; Bulgaria 6,377; Zambia 5,495; West Germany 4,743; Republic of South Africa 1,307.
Semimanufactures	661	1,722	Yugoslavia 1,187; West Germany 242; France 194.
Magnesium metal including alloys:			
Scrap	145	1,244	Mainly from West Germany.
Unwrought	221	509	Mainly from United States.
Semimanufactures	72	20	Austria 8; West Germany 6.
Manganese:			
Ore and concentrate	169,560	160,592	Brazil 64,996; Republic of South Africa 32,406; Gabon 20,180; U.S.S.R. 14,822.
Oxides	1,240	1,694	Mainly from Japan.
Metal, all forms	1,101	2,039	Mainly from France.
Mercury ..... 76-pound flasks	643	638	Yugoslavia 290; mainland China 232.
Molybdenum:			
Ore and concentrate	1,065	--	
Metal including alloys, all forms	45	46	Austria 21; Netherlands 11.
Nickel:			
Ore and concentrate	NA	295	Cuba 135; Costa Rica 128.
Matte, speiss, and similar materials	4,404	4,553	Cuba 2,655; Canada 1,523.
Metal including alloys:			
Scrap	1,429	531	Switzerland 175; United States 128; France 76.
Unwrought	13,547	10,765	Canada 3,255; United Kingdom 2,536; Norway 1,885.
Semimanufactures	2,068	2,605	West Germany 1,074; France 327; United States 237.
Platinum-group metals and silver including alloys:			
Platinum group ..... thousand troy ounces	50	109	United Kingdom 55; United States 27.
Silver ..... do	21,216	32,822	West Germany 7,437; United Kingdom 6,493; Switzerland 4,174; Kuwait 4,035; U.S.S.R. 3,088.
Selenium, elemental	22	34	United States 15; Japan 8.
Silicon, elemental	304	840	Switzerland 371; Yugoslavia 328.
Tin:			
Metal including alloys:			
Scrap ..... long tons	44	19	France 7; United States 7.
Unwrought ..... do	7,062	7,458	Malaysia 5,288; Thailand 1,167.
Semimanufactures ..... do	45	101	West Germany 52; France 17.
Tantalum metal	--	6	United States 3; Belgium-Luxembourg 2.
Titanium:			
Ore and concentrate	137,851	96,323	Mainly from Norway.
Oxides	24,170	29,773	West Germany 12,537; France 5,928; Netherlands 3,756; United Kingdom 3,537.
Metal including alloys, all forms	203	676	United States 457; Japan 101; West Germany 77.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Tungsten:			
Ore and concentrate	54	61	Republic of Korea 27; Burundi 10; United States 10.
Metal including alloys, all forms	107	59	United States 19; France 15; West Germany 10.
Uranium and thorium metal ... kilograms	200	73	All from United Kingdom.
Zinc:			
Ore and concentrate	26,061	60,241	Algeria 21,501; Tunisia 11,200; Canada 7,773; Greece 6,084.
Ash and residue containing zinc	NA	9,821	Switzerland 4,446; West Germany 2,916.
Metal including alloys:			
Scrap	6,970	5,981	West Germany 2,482; France 1,998; Switzerland 1,169.
Blue powder	3,375	3,474	Mainly from Belgium-Luxembourg.
Unwrought	42,296	45,811	Yugoslavia 11,416; Bulgaria 5,728; West Germany 5,461; Canada 3,806; Congo (Kinshasa) 3,497.
Semimanufactures	371	2,999	Mainly from Belgium-Luxembourg.
Zirconium:			
Ore and concentrate	17,003	18,383	Mainly from Australia.
Oxides	236	560	Mainly from West Germany.
Metal including alloys, all forms ... kilograms	5,800	4,655	United Kingdom 2,769; West Germany 720; United States 601.
Other:			
Ore and concentrate	NA	4,272	United States 1,552; Netherlands 1,008; Canada 553.
Ash and residue containing nonferrous metals ... kilograms	NA	580	Yugoslavia 173; Netherlands 127; Romania 125.
Base metals including alloys	NA	3,780	France 1,600; Belgium-Luxembourg 637; United States 592.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, etc	3,987	3,522	West Germany 1,657; Greece 1,202.
Dust and powder of precious and semiprecious stones ... value, thousands	r $2,120	$3,351	Congo (Kinshasa) $808; Belgium-Luxembourg $547; Switzerland $546.
Grinding and polishing wheels and stones	3,650	4,233	West Germany 1,206; United Kingdom 803; Austria 791; France 485.
Asbestos	51,272	58,229	Republic of South Africa 30,880; Canada 18,182; U.S.S.R. 7,822.
Barite and witherite	5,898	5,838	France 3,236; mainland China 2,400.
Borates, crude, natural	81,999	96,388	Turkey 82,115; United States 11,078.
Cement	132,276	476,622	France 148,950; Tunisia 82,239; Greece 57,075; Yugoslavia 41,734.
Chalk	6,540	7,794	Mainly from France.
Clays and products:			
Clays:			
Bentonite	--	9,975	Mainly from Greece.
Kaolin	457,738	487,669	Mainly from United Kingdom.
Other	623,000	679,330	France 309,250; West Germany 210,203.
Products:			
Refractory (including nonclay bricks)	68,944	80,610	West Germany 33,730; France 16,719.
Nonrefractory	15,887	16,162	West Germany 10,451; Switzerland 3,222; United States 457.
Cryolite and chiolite	NA	732	Mainly from Denmark.
Diamond:			
Gem not set or strung ... value, thousands	$4,827	$2,616	Mainly from Belgium-Luxembourg.
Industrial ... kilograms	14,146	8	All from Belgium-Luxembourg.
Feldspar	12,272	14,671	Portugal 3,833; West Germany 3,249; Sweden 2,356.
Fertilizer materials:			
Crude:			
Nitrogenous	--	40	East Germany 20; West Germany 20.
Phosphatic ... thousand tons	2,162	1,896	United States 1,191; Morocco 429; Israel 114.
Potassic	51,207	47,774	Mainly from France.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials—Continued			
Manufactured:			
Nitrogenous	11,453	20,412	France 9,779; Netherlands 3,811; Austria 2,139; Belgium-Luxembourg 1,615.
Phosphatic	141,831	179,569	Belgium-Luxembourg 74,282; France 35,652; United States 23,716; Tunisia 16,572.
Potassic	206,308	232,526	France 70,574; Israel 53,075; U.S.S.R. 31,045; West Germany 29,908; Spain 23,162.
Other	28,769	82,293	United States 39,384; West Germany 12,530; Greece 10,420.
Fluorspar	21,613	29,402	France 10,312; Mexico 9,828; Republic of South Africa 8,145.
Graphite	13,575	14,012	Austria 10,275; West Germany 2,389.
Gypsum and plasters	1,373	1,798	West Germany 875; United States 667.
Lime	NA	938	Mainly from Yugoslavia.
Magnesite	53,686	48,305	Greece 15,306; Yugoslavia 12,624; Austria 12,167.
Mica:			
Crude including splittings and waste	NA	2,556	Portugal 949; India 372; Republic of South Africa 366; United Kingdom 280.
Worked including agglomerated splittings	170	230	France 59; Belgium-Luxembourg 54; United States 42; West Germany 27.
Pigments, mineral, iron oxides	5,460	12,743	West Germany 8,129; France 2,406; Spain 955.
Precious and semiprecious stones, except diamond:			
Natural ... value, thousands	$857	$1,020	Belgium-Luxembourg $192; India $170; West Germany $136; Thailand $95; Brazil $84.
Manufactured ... do	$1,268	$1,176	Switzerland $713; France $223.
Pyrite, gross weight ... thousand tons	1,099	857	U.S.S.R. 464; Cyprus 294.
Salt	236	3,183	All from West Germany.
Selenium	--	34	United States 15; Japan 8; Belgium-Luxembourg 5.
Sodium and potassium compounds	14,107	22,275	Mainly from France.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous including marble	r 119,958	167,637	Portugal 55,962; Yugolslavia 49,238; Greece 12,573.
Slate	9,543	3,186	West Germany 2,172; France 640.
Other	68,437	100,042	Republic of South Africa 27,194; Norway 15,489; Sweden 12,352; Yugoslavia 7,260.
Worked, all types	1,020	1,616	France 358; West Germany 287; Belgium-Luxembourg 181; Norway 161.
Dolomite	1,530	1,485	France 800; Norway 356; West Germany 167.
Gravel and crushed rock	15,075	12,235	Mainly from France.
Quartz and quartzite	55,939	96,114	Portugal 35,499; Switzerland 18,622; Belgium-Luxembourg 14,587; West Germany 13,238.
Sand excluding metal bearing	930,854	1,020,059	Belgium-Luxembourg 518,492; France 322,218; Netherlands 73,307.
Sulfur:			
Elemental, all forms	r 146,850	207,928	United States 51,320; France 48,744; Poland 42,065.
Sulfur dioxide	--	2,360	West Germany 1,683; France 676.
Sulfuric acid	205,029	14,612	Yugoslavia 14,140.
Talc, steatite, soapstone, and pyrophyllite	15,879	17,870	Austria 10,923; Australia 2,469; France 1,844; Norway 685.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	2,062	2,663	Mainly from United States.
Carbon black	15,787	23,856	France 7,960; United States 5,546; United Kingdom 2,915.
Coal and briquets:			
Anthracite and bituminous ... thousand tons	10,542	11,406	West Germany 3,384; United States 3,252; Poland 2,154; U.S.S.R. 1,670.
Briquets of bituminous coal and anthracite ... do	62	78	West Germany 40; Gabon 15; France 15.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
Mineral fuels and related materials—Continued			
Coal and briquets—Continued			
Lignite and lignite briquets..thousand tons..	202	236	West Germany 161; Yugoslavia 36; East Germany 34.
Coke and semicoke....do....	314	203	West Germany 63; Hungary 43; France 39.
Peat including briquets....do....	11	15	West Germany 9; Romania 2.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels..	653,318	758,813	Libya 216,346; Iraq 155,353; Kuwait 130,977; Saudi Arabia 104,302.
Refinery products:			
Gasoline....do....	390	867	United States 439; Spain 101; Tunisia 89.
Kerosine and jet fuel....do....	210	597	Libya 192; Iraq 151; U.S.S.R. 94; Saudi Arabia 87.
Distillate fuel oil....do....	2,021	1,638	U.S.S.R. 471; Tunisia 461; Yugoslavia 441; Spain 140.
Residual fuel oil....do....	22,537	20,846	U.S.S.R. 5,492; France 4,416; Spain 2,327; Venezuela 1,906.
Lubricants....do....	1,020	898	United States 327; West Germany 147; France 140.
Other:			
Mineral jelly and wax....do....	333	365	West Germany 113; United States 73; U.S.S.R. 42.
Petroleum, coke and pitch coke do....	1,747	1,910	Mainly from United States.
Bitumen....do....	1,078	1,451	Do.
Liquefied petroleum gases....do....	63	56	West Germany 22; France 12; Yugoslavia 11.
Unspecified....do....	20	17	France 7; United Kingdom 5.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals....	46,371	46,829	Czechoslovakia 12,155; U.S.S.R. 7,294; Yugoslavia 6,632; West Germany 6,437.

r Revised. NA Not available.

Source: Statistica Annuale Del Commercio Con L'Estero. V. II, 1968 and 1969. World Trade Annual III, 1969.

COMMODITY REVIEW

METALS

Aluminum.—Output of primary aluminum increased nearly 4 percent over that of 1969. Most of the production was consumed by transportation and construction industries. Montecatini Edison S.p.A. (Montedison) with smelters in Fusina, Bolzano, and Mori was the Nation's largest producer of aluminum metal.

Domestic bauxite production increased nearly 4 percent over that of 1969, thus reversing the trend of declining output of the past 5 years. Higher production from the Palmariggi, Poggiardo, and Otranto mines operated by Società Montevergine accounted for increased output in 1970.

Construction of Montedison's aluminum smelter at Fusina (Venice) was completed at midyear. The highly automated plant was designed to produce 36,000 tons of primary aluminum metal annually. Ease of expansion was incorporated in the design of the smelter.

An aluminum and electrochemical complex was in the process of construction in Western Sicily. The project is a joint venture comprised of the private sector (Montedison) and the Government Ente Nazionale Idrocarburi (ENI) to cope with the problem of rising imports. Italy imports more than half of its primary aluminum metal requirements. The facility will have a designed capacity of 150,000 tons of aluminum, 30,000 tons of magnesium, and 30,000 tons of phosphates annually. The project was scheduled for completion in 1973.

Antimony.—Output of stibnite rose to 1,299 metric tons of contained antimony in 1970, and approximated that of 1969. Production of the mineral came from the Tafone open-cast mine, near Marciano in Tuscany. The mine was operated by Azienda Minerali Metallici Italiane S.p.A. (AMMI), a State-owned company for nonferrous metals. An antimony smelter currently is under construction at Manciano.

Iron and Steel.—The Italian iron and steel industry is the third largest among the European Coal and Steel Community (ECSC) and fourth largest in Western Europe. In 1970, the Nation produced 17.3 million tons of steel, or 16 percent of ECSC steel output and 2.9 percent of world output. As compared with 1969 levels. both output and capacity of the iron and steel industry rose substantially during the year, but production failed to meet 1970 requirements because of dislocation of production processes due to labor disputes and floods. The iron and steel industry was operated at about 82 percent of its theoretical capacity. Per capita consumption of steel was 378 kilograms in 1970, the lowest among countries in the European Economic Community (EEC).

Italy is both an exporter and importer of steel or steel-related products. In 1970 imports exceeded exports by about 3.8 million tons; imports having increased 28 percent and exports decreased 8 percent compared with 1969 figures.

The Nation's consumption of steel was more than doubled in the past decade, increasing from 9.1 million tons in 1961 to 20.3 million tons in 1970. The demand is projected to 30 millions tons by 1980. Italy is expected to achieve self-sufficiency in steel in 1974 with output of 25.8 million tons, up 8.5 million tons from 1970.

To meet the Nation's projected requirement for steel, Finanziaria Siderurgica (Finsider) a State steel agency, announced plans to invest $3 billion for construction of an integrated steel complex and expansion and/or modernization of present steel making facilities. An estimated $1.5 billion will be expended on a steel complex slated for construction in Calabria. The facility will produce from 5 to 10 million tons of steel annually and employ approximately 7,500 workers. At Taranto, currently Italy's largest integrated Steel center, Finsider will spend an equal amount of funds to increase output from an estimated 4.2 million tons to about 10.3 million tons of steel annually. The target dates for completion of the projects is 1982 for the former and 1976 for the latter.

A new cold strip mill was placed in operation during the year at the Taranto steelworks. The facility was designed to process 500,000 tons of steel annually but operating capacity may be easily doubled to meet market demand.

Fiat and Italsider S.p.A. announced a joint venture to expand the steel-processing facility near Piombino. Fiat purchased a 50-percent interest in the plant to meet its increasing steel requirements. The company-owned steel works in the Turin area was unable to meet its requirement.

Iron Ore.—Domestic production of iron ore was slightly lower than reported in 1969. Italy's output of iron ore has been declining since the early 1960's. The decrease in mining activity was apparently due to the relatively high costs of production and increased imports of higher grade ore. The average iron content of domestic iron ores is usually below 40 percent, hence all of the ores must be beneficiated before use. Italy imported 10.8 million tons of iron ore in 1970.

Pig Iron.—The output of pig iron totaled 8.3 million tons, an increase of 7 percent over that of 1969. Italsider remained the largest producer of pig iron in Italy, accounting for over 94 percent of total output.

The Italsider group, Alti Fornie e Acciaierie Riunite Ilva e Cornigliano S.p.A., produced 9.7 million tons of crude steel and accounted for about 56 percent of Italy's steel output, about half in Linz-Donawitz (LD) converters at Taranto and Bagnoli and most of the remainder in openhearth furnaces at Corniglianа and Piombino.

Scrap.—Iron and steel scrap imports in 1970 approximated those of 1969. The scrap resources in 1970 amounted to 11.9 million tons, of which 36 percent originated within the industry, 21 percent derived from the home market, and the remaining 43 percent was imported. The steel scrap consumption and distribution by source for the last 2 years was as follows:

	Quantity (thousand metric tons)	
	1969	1970
Raw steel output	16,417	17,269
Scrap consumption in steelmaking	10,633	11,897
Source:		
Own arising	4,130	4,280
Home supplies	2,365	2,523
Imports:		
From ECSC countries	2,712	3,543
From third countries	1,260	1,406
Yearend stocks	1,300	1,155

Special Steel—Production of all types of special steels totaled 2.7 million tons, or about 17 percent above 1969 figures. The national output of carbon and alloy steel in the last 2 years was as follows:

	Quantity (thousand metric tons)	
	1969	1970
High-carbon steel:		
Structural	r 1,115	1,286
Tool	3	2
Total	r 1,118	1,288
Alloy steel:		
Structural	864	1,057
Tool	22	29
Bearing	106	107
Stainless	221	245
High speed	2	1
Other	2	3
Total [1]	1,218	1,443
Grand total	2,336	2,731

r Revised.
[1] Data may not add to totals shown because of independent rounding.

Lead and Zinc.—Output of lead and zinc contained in concentrates dropped significantly in 1970, the former over 5 percent and the latter over 16 percent compared with 1969 figures. Production declines in both metals was reportedly due to removal of a protective tariff on both metals by the EEC. In addition, increased labor costs and the decreasing quality of domestic ores also were contributing factors to decreased production.

Ente Mineraria Sarda (EMS), a Sardinian Regional Government agency for mineral industry management, obligated $8 million for exploration of ferrous and nonferrous minerals, principally copper, iron, lead, and zinc. Most likely target areas for new lead and zinc mineral deposits include the Island of Sardinia and the vicinity of Raibl, northeastern Italy. EMS also announced completion of a reorganization of lead and zinc operations in Sardinia. New production schedules were established for the operating mines at 2,000 tons of ore per day. Proven reserves of lead and zinc were reported at 8 million tons, sufficient for 15 years of operation at current production rates.

At yearend AMMI acquired control of Montedison's three lead and zinc smelters located at Porto Marghera (Mestre), San Gavino Monreale, and Monteponi. The three smelters have a total operating capacity of 98,000 tons and employ about 1,300 workers.

AMMI also operates a zinc smelter at Ponte Nossa, north of Bergamo, with a capacity of 33,000 tons. Also, the public enterprise was building a plant, employing Imperial Smelting Corp.'s pyrometallurgical treatment of low-grade lead-zinc ores near San Antioco (Porto Verme), Sicily. The facility, scheduled for completion in 1971, will have a designed capacity of 60,000 tons of zinc and 40,000 tons of lead. In addition, a total of 105,000 tons per year of sulfuric acid will be produced along with an undisclosed amount of cadmium.

Mercury.—Mine output of mercury estimated at 44,382 76-pound flasks was 9 percent below that of 1969. Lower production for the past 2 years was attributed to a sluggish world market and curtailment of production in order to stabilize price. Antipollution measures in relation to abnormal mercury levels allegedly found in fish were responsible for a decrease in demand.

As in previous years, most mercury production came from mines east of Grosseto which were operated by the Government-controlled Società Minerario Monte Amiata and by the private concern Stabilimento Minerario del Siele. These two companies accounted for over 90 percent of production from cinnabar ores, averaging 0.5 percent mercury.

NONMETALS

Asbestos.—The 1970 production of asbestos totaled 118,518 tons, an increase of 5 percent over 1969 figures. The rise in output in 1970 was reportedly due to increased domestic consumption as well as greater exports of fiber and asbestos cement.

Most of Italy's asbestos was obtained from the Balangero open pit mine, near Turin—the largest producing mine in Western Europe. S.A. Amiantifera di Balangero, operating company of the mine, modernized its mining and processing facilities at yearend to reduce production costs and hence improve the company's competitive position among foreign producers.

Barite.—Barite output in 1970 decreased by 23,000 tons and was 9 percent less than in 1969. Italy's barite production is dependent on foreign markets and the level of activity in drilling by the domestic oil and gas industry. In 1970, the drop in exports exceeded the increased demand for drilling mud, resulting in lower barite production for the year. The important producing mines during 1970 were Su-Benatzu, Santa Lucia; Mont' Ega, Sardinia; and Buca della Vena and Mastricarro, Italian mainland. EMS was reportedly conducting exploration drilling on a mineralized area near the Su-Benatzu and Mastricarro mines.

Cement.—Italy's production of 33.1 million tons of cement increased more than 5 percent over 1969 figures. A large demand for cement by the industrial and highway construction industries accounted for the higher output. Italy's cement industry ranked second to West Germany among West European countries. The industry comprised 120 plants, of which one-half were in Northern Italy.

The cement industry operated at about 91 percent capacity. Consumption of cement rose to 32.9 million tons from 31.4 million tons reported in 1969.

Cementerie del Tirreno S.p.A. (Cementir), a government-controlled enterprise, reported cement production of 3.7 million tons, an increase of 6 percent over that of 1969. Cementir accounts for over 10 percent of Italy's cement output.

Despite increased cost of labor, fuel, transportation, and other production costs over the past 9 years, Italian cement prices remained the lowest in Western Europe. The Associazione Italiana Tecnico Economica del Cemento (AITEC), an Italian Cement Association, continued to urge relaxation of price controls.

Fluorspar.—The 1970 output of fluorspar increased by 31,000 tons and was 12 percent more than in 1969. Factors contributing to the higher production were heavy exports to foreign countries and a strong demand for fluorite by the domestic chemical inustry. Italy ranks sixth among the countries producing fluorite in the world. The fluorite mines in Sardinia accounted for most of Italy's production, although mines in Northern Italy near Trento operated by Montedison also were important producers.

Magnesium Compounds.—The Sardamag Company, Italy's only producer of magnesium compounds, authorized expenditures of $13.4 million for expansion of its San Antioco facility in Sardinia. The production capacity of the plant will be increased from 50,000 tons to 120,000 tons of pelletized oxide annually. Completion of the project was scheduled for early in 1971. The plant utilizes sea water and limestone. Its requirements for limestone will be increased by 300,000 tons, all supplied from quarries located in the immediate area.

Potassium Salts.—Output of potassium salts totaling 1.9 million tons approximated that produced in 1969 and 1968. As in the past, all production came from mines in Sicily. Montedison remained the principal producer accounting for over 60 percent of total output.

The Industria Sali Potassici e Affini S.p.A. (ISPEA) increased production capacity for potassium chloride at its Pasquasia mine to 100,000 tons annually. Also, ISPEA continued with the construction of a plant for the production of nearly one-quarter of a million tons of potassium sulfate near Enna, Sicily.

Pyrite.—The output of pyrite totaled more than 1.5 million tons, an increase of 3 percent over 1969 figures. Increased output resulted from higher production rates at Montedison Niccioleta and Gavorrano mines in Tuscany. Italy continued to rank second to Spain among West European countries in the production of pyrite.

About half of Italy's production was processed at Montedison's Scarlino facility, yielding 880,000 tons of sulfuric acid and 339,000 tons of pelletized iron oxide. The iron pellets were used in blast furnaces at Piombino. Montedison planned to increase the capacity of the Scarlino plant to 1.4 million tons of sulfuric acid, 700,000 tons of iron oxide pellets, and over 300 million kilowatt-hours of electricity.

Salt.—The 1970 output of marine salt increased compared with 1969. Production totaled 1.5 million tons, an increase of 3 percent over 1969 figures. The expanded government operated facilities at Margherita di Savoia, mainland, and San Antioco, Sardinia, accounted for the increased output.

Montedison completed construction of a 120,000-ton annual capacity chlorine plant near Brindisi. The facility was placed on stream at midyear; raw material came from local marine salt resources. Azienda Nazionale Idrogenazione Combustibili S.pA. (ANIC) announced plans to design and construct a 100,000-ton annual capacity plant for the production of chlorine and soda ash in Sicily.

The production of rock salt totaled 2.9 million tons, an increase of nearly 3 percent over 1969. Development of a rock salt deposit near Realmonte, Sicily, was continued during the year. The $14 million mine, chlorine plant, and shipping facility project was scheduled for completion in 1972. Montedison completed construction of an anhydrous salt facility near Ciro in Calabria Province, having an annual capacity of 1 million tons. An additional one-half million-ton annual capacity was in the process of construction in 1974.

A tax on human consumption of salt, the oldest tax in Italy, will be abolished on January 1, 1972. A law repealing the tax was approved by the Nation's legislative body at midyear. In 1970, the tax yield was over $500 million.

Sulfur.—The Italian production of sulfur ore continued to decline primarily because of mining lower grade ores. The Nation's 12 operating mines were modernized in 1969 but increased productivity did not reduce production cost sufficiently to compete with imports of low-cost sulfur.

The sulfur industry is expected to require employment of fewer people, hence a government program was initiated to relocate sulfur workers to industrialized areas outside of Sicily. Eventually, Italy's sulfur requirements will be met by imports.

MINERAL FUELS

Consumption of energy in Italy increased about 5 percent to 105.8 million tons of standard coal equivalent. Liquid fuel (petroleum) continued to be the principal energy source, supplying 72 percent of the Nation's energy market, compared with 9 percent for natural gas and 9 percent for solid fuels. The remaining 10 percent was provided by hydroelectric power and nuclear sources. Italy's energy market is projected to increase by about 80 percent during the next decade. Liquid fuels are expected to account for an increasingly larger share of this market at the expense of solid fuels.

Coal and Coke.—Coal continued to rank high on the list of Italian imports of mineral commodities. In 1970, the imports of coal totaling 13.2 million tons were a record high for the commodity. Coking coal accounted for about 72 percent of coal imported, the remaining 28 percent was steam coal, anthracite, and gas coal.

Output of coal from Italy's two remaining mines, in Sardinia, declined over 2 percent from 1969 figures. The production of lignite decreased by 540,000 tons and was nearly 28 percent less than in 1969. Most of the domestic coal and lignite was consumed for electric power generation.

The production of coke continued to rise as demand increased from the iron and steel industry which regularly accounts for about two-thirds of total consumption. Italsider S.p.A. completed construction of a 335,000-ton capacity coke oven (metallurgical grade) at the steel center near Taranto.

Carbochimica Pugliese, a subsidiary of Italgas, announced construction of a coke processing plant near Taranto. The facility will consume 180,000 tons of raw material (coke) to produce 70,000 tons of pitch, 43,000 tons of tar oil, and 9,200 tons of naphthalene.

Despite increased industrial activity and consequently larger energy consumption, the use of coal in all sectors of the industry declined because of high costs. Also, the utilization of liquid fuels afford greater convenience, hence are more attractive to the Italian consumer.

Production of lignite at the Valdarno and Baccinello mines was reduced by Ente per l'Energia Elettrica (ENEL) because of high operating costs. Operations at the Mercure Mine were discontinued at midyear. All lignite production is used to fuel thermoelectric powerplants located at mine sites.

Natural Gas.—Italy was the second largest producer of natural gas in the EEC. Italy's output accounted for about 21 percent of EEC's production. The Netherlands, by far the largest producer, supplied over half of EEC production.

Increased production of natural gas from the Po Valley fields, Adriatic fields, and those in central and southern Italy was responsible for a 10-percent rise in national output in 1970. Natural gas production was reported at 13.1 billion cubic meters, up 1.4 billion cubic meters from 1969.

ENI planned to expand production at the San Salvo gasfield to 2 billion cubic meters annually. The gasfield has 79 production wells, which recover natural gas from an average depth of 4,265 feet. The increased production was scheduled for 1971.

At midyear, Italian natural gas reserves were reported at 178 billion cubic meters.

Consumption of natural gas continues to increase at a greater rate than domestic production. Italy expects to import natural gas to meet its increasing demand and as a consequence has negotiated supply contracts with the U.S.S.R., Libya, and the Netherlands. An agreement with the U.S.S.R. was concluded late in 1969 and provides for delivery of natural gas via pipeline from Czechoslovakia through Austria late in 1972.[2] At yearend, a 20-year delivery contract was signed by ENI and N.V. Nederlandse Aardolie Maatschappij (NAM), a Netherlands natural gas producer. The agreement provides for delivery of about 6 billion cubic meters of natural gas annually via a pipeline passing through West Germany and Switzerland. Italy also will import liquefied natural gas (LNG) from Libya. Esso Libya, a subsidiary of Standard Oil Co. of New Jersey, signed a 15-year contract to deliver 3 billion cubic meters of natural gas annually (in liquefied form) to regassification plants, one at Panigaglia in northwest Italy and another currently under construction on the east coast of Sicily. The first LNG tanker shipments from Libya were scheduled for 1971.

Petroleum.—Domestic production of crude petroleum was 3 percent more than in 1969. Increased output in 1970 resulted from higher production rates at the offshore oilfields in the Adriatic sea.

Exploration.—The Adriatic Sea and Offshore Sicily were Italy's most promising areas for new oil and gas resources. At yearend, 188 offshore permits for oil and gas exploration were reportedly issued. The permits cover an area totaling 3.8 million hectares. The Westates-Montedison-Union (WMU) combine, a consortium consisting of Italy's Montedison and several international companies, made interesting discoveries on mainland areas in the Po Valley and near Abruzzi. The Accuttura gasfield in southern Italy was extended for a distance of two-thirds of a mile. At midyear WMU resumed drilling on its Riccione Mare permit in the Adriatic Sea.

Pipelines.—The 20-inch Ravenna-Chieti trunkline was completed for a distance of 180 miles, thus connecting the northern and southern gas network into a national pipeline system. As such, it connects the Po Valley fields of the north, the Adriatic fields, those in central and south Italy, and the newly constructed terminals for the importation of natural gas from the U.S.S.R., the Netherlands, and Libya.

Società Nazionale Metanodotti Progetti (SNAM), a natural gas transportation and distribution branch of ENI, initiated construction of a 112-mile lateral to supply inland areas. A north traversal of this pipeline will join the Adriatic main line with the West Coast main line, making it possible to deliver gas in either direction. Other laterals, as part of the project, will deliver natural gas to Foligno, southeast of Perugia, and Terni.

A feasability study of a submarine pipeline crossing the Mediterranean Sea for transporting natural gas from Algeria was conducted by EMS. Bechtel Corp., a U.S. construction and engineering firm, was employed to make the survey and to determine financial and economic advantage of transporting natural gas via a pipeline rather than in liquefied form by way of a tanker.

At the end of 1970, Italy's pipeline network totaled 5,340 miles. About 249 miles of new pipelines was under construction.

Crude Oil Imports.—Imports of crude oil increased by 10.9 million tons and was nearly 11 percent higher than in 1969. Italy was the largest importer of crude oil in Western Europe. The principal sources

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[2] Sondermayer, Roman V. The Mineral Industry of Italy. BuMines Minerals Yearbook 1969, v. 4, 1971, pp. 417–418.

were Libya (30.8 percent), Iran (18.7 percent), Saudi Arabia (14.5 percent), Kuwait (12.3 percent), and the U.S.S.R. (7.7 percent). Over 32 percent of Italy's crude oil imports came from the Persian Gulf area transported by seagoing tankers around the Cape Route of Africa. The eastern Mediterranean area was the source of about 24 percent of Italy's crude imports.

Refining.—The operating capacities of 38 active refineries totaled 3.4 million barrels of crude per standard day, an increase of nearly 5 percent compared with 1969 figures. An additional capacity of about 230,000 barrels per standard day was planned and/or under construction at year-end. These included plans by ENI's subsidiary, ANIC, to build a 50,000-barrel-per-standard-day refinery at Civitavecchia, a 130,000-barrel-per-standard-day refinery at Novi Ligure, and a 50,000 barrel-per-standard-day refinery currently under construction at Sibari by Liquigas. The following tabulation shows the location of refineries and their throughput capacity in crude, cat-cracking, and cat-reforming capacity.

Company and refinery	Crude capacity (barrels per standard day)	Cat-cracking capacity (barrels per standard day)	Cat-reforming capacity (barrels per standard day)
Agip Mineraria, S.p.A., Cortemaggiore	3,000	2,300	------
Amoco Italia, S.p.A., Cresmona	100,000	--	10,000
ANIC, S. p. A., Gela (Sicily)	75,000	20,000	12,000
ANIC, S. p. A., San Nazarro (Pavia)	100,000	20,000	23,000
Anonima Petroli Italian, Falconara	75,000	--	7,000
Aquila, S.p.A., Triestei	62,000	5,000	5,700
Asfalti Bitumi-Cementic Derivati, S.A., Ragusa	5,000	--	7,000
BP Italiano S.p.A., Volpiano	80,000	--	12,500
Dellepiane Raffaele, Genoa	1,700	--	500
Fina Italiana, S.p.A., Genoa	20,000	2,000	2,000
Fina Italiana, S.p.A., Milan	8,500	--	--
Garrone, Edoardo, Genoa	140,600	--	14,400
Industria Chimiche Italiana del Petrolio, Manova	82,000	--	10,000
Industria Leganti Stradali del Affini, Como	8,000	--	1,500
Industria Raffinazione Oli Minerali, Port Marghera	90,000	--	12,000
Industria Piemontese Lavorazione Oli, Minerali, Busalla (Genoa)	33,000	--	1,500
Lombarda, Petroli, Villasanta (Milan)	26,000	--	3,000
Mediterranea S.p.A., Milazzo (Sicily)	340,000	40,000	10,000
Mobil Oil Italiana, S.p.A. Naples	143,000	15,000	13,000
Montecatine Edison, S.p.A., Brindisi	35,000	--	--
Nuova Raffineria NILO, Milan	12,000	--	1,000
Raffineria Monti, Gaeta	42,000	--	12,500
Raffineria di Roma, S.p.A., Rome	85,000	--	13,000
Raffineria Oli Lubricanti, Viguzzola	1,500	--	--
Raffineria Sarde, SARAS, Cagliari (Sardinia)	270,000	30,000	10,500
Raffineria Sicilano Oil Minerali, Augusta (Sicily)	312,000	27,000	16,000
Sanquirico Industria Petrolifera, Genoa	18,000	--	1,500
Ste. Sardoil, Porto Sorres (Sardina)	120,000	--	--
Shell Italiana, S.p.A., La Spezia	100,000	--	11,000
Shell Italiana, S.p.A., Rho	84,000	15,000	18,500
Shell Italiana, S.p,A., Taranto	89,200	--	17,000
Societa Industriale Catanese, Priolo	180,000	20,000	10,000
Societá Azionaria Raffinazione Oli Minerali, Ravenna	268,000	--	14,000
Stanic Industria Petrolifera, Bari	74,000	--	11,000
Stanic Industria Petrolifera, Leghorn (Livorna)	84,000	--	13,000
Sta. per Azioni Raffineria Padana Oli Minereli Novara	152,000	13,200	29,600
Sta. Petrolifera Italiana, Fornovo (Parma)	20,000	--	--
Sta. Petrolifera Italiana, Arcola (La Spezia)	20,000	--	1,300

The Mineral Industry of Japan

By A. F. Grube [1]

Japan's mineral industry probably ranked third or fourth globally in terms of value of output, with most of the activity oriented around smelting, refining, and processing of imported foreign raw materials. The value added from downstream activities in minerals and metals outweighed domestic mine production by at least 5 to 1. With 1970 gross national product (GNP) at an estimated $196 billion,[2] third after the United States and the U.S.S.R., a rough guess of the mineral contribution would be perhaps 4 percent.

Most of Japan's economic progress during the year occurred in the first half. In the second half of 1970, an abrupt slowdown in industrial production put an end to the continued advances made over the past 4½ years. Sluggishness in world demand for Japanese products and tight credit controls imposed since September 1969 contributed to this turn of events. Construction of new industrial facilities was postponed in many instances and negotiations were made to cut down imports of raw materials. Efforts to reduce prices of imports received a jolt when oil-producing countries forced world prices to rise instead of to decrease. Observations early in 1971 indicated that recession could well last through the year.

Production indexes (1965 = 100) for the mining and selected mineral and metal industries for recent years were as follows:

	1968	1969	1970
Mining	105.3	104.6	100.5
Iron and steel	168.4	202.9	230.9
Nonferrous metals	162.9	191.1	211.4
Petroleum and coal products	158.3	187.4	216.9
Ceramics including stone and clay products	144.4	158.3	175.8
Chemicals including fertilizers and petrochemicals	153.3	179.5	204.0

According to a survey by the Ministry of International Trade and Industry (MITI) of 1,321 firms, plant investment plans for the major mineral industries during fiscal year 1971 (FY 71) were as follows, in million dollars:

Sectors	Total fiscal year 1971
Electric power	2,723.6
Nonferrous metals	176.1
Iron and steel	2,326.7
Oil refining	1,053.9
Petrochemicals	806.6
Fertilizers	152.2
Cement	187.5
Aluminum refining and rolling	278.9
All industries, total	13,311.1

The figures above refer to investment within Japan. Japanese overseas investments amounted to $2,683 million at the end of 1970 of which $892 million was for mineral resources development.

PRODUCTION

Japan's mineral and metal production registered significant gains during 1970 over that of 1969, as illustrated by crude steel which increased by about one-eighth. Production of primary refined copper, primary refined lead, and cement increased 11 to 16 percent. However, the production of aluminum rose by 30 percent, whereas that of zinc declined by about 4 percent. Output of refined oil products moved up sharply, as follows: Gasoline, 13 percent; naphtha, 27 percent; kerosine, 36 percent; distillate fuel oil 18 percent; and residual fuel oil, 12 percent.

The country's world ranking in certain major mineral and metal products during

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[2] Where necessary, values have been converted from Japan Yen (JY) to U.S. dollars at the rate JY360 = US$1.00.

1970 were as follows: steel (3rd), aluminum (4th), refined copper (2nd), refined lead (5th), slab zinc (2nd), cement (3rd), chemical fertilizers (2nd), pyrite (2nd), coke (4th), and refined oil products (3rd). Since most raw materials are imported, Japan's mine output is generally much lower than metal or product output.

Shipment value for selected industry sectors covering 1969, the latest available data of this nature, and value added were as follows:

Sector	Shipment value (million dollars)	Value added (million dollars)
Chemicals and allied products	$7,184	$2,803
Petroleum and coal products	2,267	318
Stone, clays, and glass products	2,700	1,184
Iron and steel	7,396	1,734
Nonferrous metals and products	3,158	648

Table 1.—Japan: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Alumina, gross weight	826	1,064	1,285
Metal:			
Primary	482	569	737
Secondary	227	r 281	320
Antimony:			
Mine output, metal content ... tons	19	5	6
Antimony oxide ... do	2,142	2,963	2,828
Metal ... do	2,678	3,497	4,954
Arsenic, white ... do	r 583	r 580	884
Bismuth ... do	724	695	678
Cadmium ... do	2,195	2,765	2,541
Chromium:			
Chromite, gross weight ... do	27,891	29,782	10,893
Metal ... do	1,212	1,205	1,596
Columbium and tantalum, tantalum ... do	11	15	25
Copper:			
Mine output, metal content	120	r 121	124
Metal:			
Blister	438	501	606
Refined:			
Primary	477	522	603
Secondary	71	108	102
Germanium:			
Oxide recovered ... tons	24	22	NA
Metal ... do	22	27	27
Gold:			
Mine output, metal content ... thousand troy ounces	239	r 246	255
Metal ... do	614	677	709
Indium ... do	565	553	585
Iron and steel:			
Iron ore and iron sand concentrate	2,172	1,854	1,583
Roasted pyrite concentrate	1,968	1,918	1,904
Pig iron and blast furnace ferroalloys	46,397	58,147	68,048
Electric furnace ferroalloys:			
Ferrochrome	214	259	362
Ferromanganese	344	382	444
Ferronickel	134	180	265
Ferrosilicon	167	225	302
Silicomanganese	190	230	270
Other [1]	17	21	24
Steel:			
Crude	66,893	82,166	93,222
Semimanufactures hot rolled:			
Ordinary steel	50,509	60,483	68,552
Special steels	5,178	6,577	7,381
Lead:			
Mine output, metal content	63	r 63	64
Metal:			
Primary	165	187	209
Secondary	42	48	46
Magnesium:			
Primary ... tons	5,657	9,382	10,337
Secondary ... do	6,107	6,425	NA
Manganese:			
Ore and concentrate, gross weight	312	r 301	271
Oxide	32	38	41
Metal ... tons	7,036	7,218	9,444
Mercury:			
Mine output, metal content ... 76-pound flasks	5,084	5,613	5,105
Metal, primary ... do	7,676	6.543	5,860

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS—Continued			
Molybdenum:			
Concentrate output, metal content ..... tons	r 292	279	275
Metal ..... do	202	297	285
Nickel, primary ..... do	9,586	10,241	13,393
Platinum group:			
Palladium ..... troy ounces	3,651	3,877	4,610
Platinum ..... do	2,785	3,140	3,296
Rare earth, cerium ..... tons	74	116	153
Selenium, elemental ..... do	181	197	203
Silicon ..... do	47	87	200
Silver:			
Mine output, metal content ..... thousand troy ounces	10,693	r 10,811	10,795
Metal, primary ..... do	r 25,875	27,893	29,582
Tellurium, elemental ..... tons	14	23	35
Tin:			
Mine output, metal content ..... long tons	930	r 730	780
Metal, primary ..... do	r 1,862	1,377	1,711
Titanium:			
Concentrate, gross weight ..... tons	5,871	4,066	NA
Slag ..... do	NA	NA	7,877
Metal ..... do	r 5,427	r 6,462	9,230
Tungsten:			
Mine output, metal content ..... do	534	r 609	854
Metal ..... do	1,141	1,389	1,785
Uranium:			
Oxide ..... kilograms	308	902	NA
Metal ..... do	6,869	5,654	NA
Zinc:			
Mine output, metal content	264	r 269	280
Oxide	18	20	61
Metal, primary	606	712	676
Zirconium ..... kilograms	r 38,745	r 54,654	17,460
NONMETALS			
Asbestos	22	r 22	21
Barite	59	62	66
Bromine, elemental ..... tons	6,330	7,118	9,532
Cement, hydraulic	48,009	51,386	57,189
Clays:			
Fire	1,964	2,217	2,315
Kaolin	170	r 193	217
Feldspar [2]	422	r 497	553
Fertilizer materials:			
Crude, potassic (potassium carbonate) gross weight	15	19	20
Manufactured:			
Nitrogenous, nitrogen content [3]	2,035	2,099	2,152
Superphosphates	1,147	980	852
Fluorspar, all grades	13	12	8
Graphite (crystalline) ..... tons	1,489	1,726	1,465
Gypsum	r 563	r 562	581
Iodine, elemental ..... tons	3,591	4,619	5,898
Lime (quicklime)	3,625	4,225	9,172
Pyrite and pyrrhotite (including cupreous):			
Gross weight	r 2,916	r 2,966	2,750
Sulfur content	r 1,342	r 1,365	1,286
Salt, all types	967	981	961
Stone, sand and gravel, n.e.s.:			
Crushed and broken stone:			
Dolomite	2,221	2,355	2,603
Limestone	91,528	103,204	116,626
Sulfur, elemental:			
Native, other than Frasch [4]	261	204	238
Byproduct (recovered from petroleum refining)	76	144	103
Sulfuric acid	6,591	6,760	6,928
Talc and related materials:			
Pyrophyllite	r 1,547	r 1,657	1,733
Talc	149	r 154	140
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	219	261	295
Coal:			
Anthracite	1,489	1,225	1,039
Bituminous [5]	45,085	43,466	42,611
Lignite	335	274	438
Total	46,909	44,965	44,088
Coke:			
Metallurgical	26,136	31,013	36,374
Gashouse	4,470	5,009	4,778

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued			
Fuel briquets, all grades	3,802	3,241	2,978
Gas, natural:			
Gross production million cubic feet	72,617	77,890	83,311
Marketed do	71,077	76,173	[6] 82,682
Natural gas liquids:			
Natural gasoline thousand 42-gallon barrels	33	35	33
Liquefied natural gas do	559	539	NA
Liquefied petroleum gas (from natural gas):			
From field plants do	138	127	120
From petrochemical plants do	24,861	33,338	NA
Peat [e]	70	70	70
Petroleum:			
Crude oil thousand 42-gallon barrels	5,490	5,538	5,656
Refinery products:			
Gasoline:			
Aviation do	548	532	496
Other do	102,573	115,709	130,892
Jet fuel do	18,726	21,061	15,074
Kerosine do	65,919	81,216	110,053
Distillate fuel oil do	97,630	115,714	136,012
Residual fuel oil do	429,481	515,072	578,982
Lubricants do	10,690	12,881	15,104
Other:			
Asphalt and bitumen do	15,114	17,396	21,703
Liquefied petroleum gas do	29,256	32,832	39,807
Naphtha do	81,696	107,864	137,500
Paraffin do	778	913	1,058
Petroleum coke do	448	462	914
Refinery fuel and losses do	21,799	42,311	44,341
Total do	874,658	1,063,963	1,231,936

[e] Estimate. [p] Preliminary. Revised. NA Not available.
[1] Includes (but not limited to) ferromolybdenum, ferrotungsten, and ferrovanadium.
[2] Includes aplite as follows, in thousand tons 1968–351; 1969–428; 1970–479; and saba as follows in thousand tons: 1968–5; 1969–8; 1970–10.
[3] Year ended June 30 of that stated.
[4] Includes a 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

Overall commodity trade amounted to an alltime-high of $38,199 million in 1970. Of this total, exports came to $19,318 million and imports to $18,881 million. Mineral imports in 1970 were $8,381 million and mineral exports were $3,468 million. The United States was Japan's largest trading partner in both overall and mineral trade. Summaries of mineral exports and imports during 1968–70 were as follows in million dollars:

Exports	1968	1969	1970
Metals:			
Iron and steel	1,715	2,172	2,850
Other	195	231	298
Total	1,910	2,403	3,148
Nonmetals:			
Cement	27	30	29
Fertilizer materials	170	138	130
Other	90	116	107
Total	287	284	266
Mineral fuels and related materials:			
Petroleum refinery products	29	47	42
Other	8	8	12
Total	37	55	54
Grand total	2,234	2,742	3,468
All commodities	12,972	15,990	19,318

Imports	1968	1969	1970
Metals:			
Iron and steel:			
Iron ore	834	969	1,208
Scrap	158	209	341
Other metal	246	233	276
Other:			
Ores and concentrates [1]	584	715	1,053
Metal [2]	752	1,034	1,105
Total	2,574	3,160	3,983
Nonmetals:			
Fertilizer materials	122	111	122
Other	249	292	366
Total	371	403	488
Mineral fuels and related materials:			
Coal and coke	524	679	1,016
Petroleum:			
Crude	1,685	1,907	2,236
Refinery products	466	456	631
Other	3	5	27
Total	2,678	3,047	3,910
Grand total	5,623	6,610	8,381
All commodities	12,987	15,024	18,881

[1] Includes alumina.
[2] Includes some oxides and other chemicals.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal destinations, 1969
METALS				
Aluminum:				
Bauxite and concentrate ____ tons	330	145	110	All to Taiwan.
Oxide and hydroxide	29	113	126	United States 71; Republic of Korea 23; Thailand 7.
Fused alumina ____ tons	1,551	2,216	3,234	Republic of Korea 1,081; Taiwan 736; Hong Kong 216.
Metal including alloys, all forms	r 37	45	54	United States 13; Hong Kong 4; South Vietnam 4.
Arsenic, trioxide, pentoxide, and acids tons	64	6	8	India 5; Thailand 1.
Bismuth including alloys, all forms do	391	261	290	Netherlands 154; United Kingdom 61; United States 24.
Cadmium including alloys, all forms do	r 709	772	945	Netherlands 391; Belgium 97; United Kingdom 74.
Chromium:				
Chromite ____ do	1	--	--	
Oxides and hydroxides ____ do	2,786	3,154	3,569	United States 1,958; Republic of Korea 404; Taiwan 363.
Cobalt, oxides and hydroxides ____ do	1	3	5	Mainly to Republic of Korea.
Columbium and tantalum, tantalum do	--	1	2	NA.
Copper:				
Ore and concentrate ____ do	8,819	--	--	
Metal including alloys, all forms	r 54	53	86	United States 14; mainland China 10; Taiwan 7.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal destinations, 1969
METALS—Continued				
Iron and steel:				
Ore and concentrate tons	--	6	5	All to Taiwan.
Roasted pyrite do	--	150	12,794	All to Philippines.
Metal:				
Scrap do	43,672	80,368	82,804	Republic of Korea 61,883; Taiwan 11,861.
Pig iron including cast iron do	687	730	48	Republic of Korea 610; Taiwan 70.
Sponge iron, powder and shot do	4,075	5,778	5,884	United States 1,299; Hong Kong 1,063; Australia 1,033.
Ferroalloys:				
Ferromanganese	7	11	8	United States 6; Australia 3.
Others	12	12	8	United States 5; Australia 1; Netherlands 1.
Steel, primary forms	1,249	1,934	1,988	United States 474; Republic of Korea 311; Spain 177.
Semimanufactures:				
Bars, rods, angles, shapes, and sections	1,948	2,112	2,334	United States 1,027; mainland China 289; Thailand 120.
Plates and sheets, uncoated	5,514	6,724	7,770	United States 1,943; mainland China 509; Philippines 458.
Tinned plates and sheets	487	549	611	United States 163; mainland China 38; Taiwan 37.
Other coated plates and sheets	r 861	1,020	1,190	United States 512; mainland China 52; Italy 42.
Hoop and strip	254	376	392	United States 104; Thailand 53; Canada 29.
Wire	r 404	460	475	United States 282; Thailand 24; Indonesia 22.
Tubes, pipes, and fittings	1,973	2,261	2,686	United States 754; mainland China 291; Iran 226.
Rails and accessories	55	54	66	Republic of Korea 21; Taiwan 15; Chile 6.
Castings and forgings rough	1	1	6	Mainly to the United States.
Lead:				
Oxides tons	239	116	122	Taiwan 65; Singapore 20; Cambodia 9.
Metal including alloys, all forms	5	3	7	Mainly to Republic of Korea.
Magnesium including alloys, all forms tons	78	974	77	Mainland China 441; West Germany 150; Australia 100.
Manganese:				
Ore and concentrates do	1,355	2,277	2,947	Pakistan 705; Hong Kong 427; Republic of Korea 264.
Oxides	27	31	34	United Kingdom 3; Hong Kong 2; France 2.
Mercury 76-pound flasks	r 487	1,096	366	Taiwan 303; North Korea 290; Republic of Korea 247.
Molybdenum including alloys, all forms tons	6	18	17	Taiwan 13; West Germany 3.
Nickel:				
Ores and concentrates do	41	--	--	
Metal all forms do	507	522	1,231	Netherlands 124; Thailand 71; Republic of South Africa 50.
Phosphorus, elemental (red) do	527	645	655	India 278; United States 220; Pakistan 32.
Platinum group:				
Waste and sweepings (including silver waste and sweepings) do	--	--	988	
Metal thousand troy ounces	132	61	47	Mainland China 20; United States 20; West Germany 9.
Selenium, elemental tons	51	28	26	United Kingdom 6; United States 4; West Germany 4.
Silver including alloys thousand troy ounces	711	1,489	257	United Kingdom 1,224.
Tin:				
Oxides long tons	9	13	32	Spain 7; Republic of Korea 2; United States 2.
Metal including alloys, all forms do	458	751	1,556	Taiwan 357; Thailand 82; Hong Kong 60.
Titanium:				
Oxides (rutile and others)	35	42	37	United States 16; U.S.S.R. 4; Taiwan 3.
Metal including alloys, all forms tons	r 3,471	4,695	5,022	United States 3,610; United Kingdom 517.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal destinations, 1969
METALS—Continued				
Tungsten including alloys, all forms tons	23	34	51	West Germany 12; U.S.S.R. 11.
Uranium and thorium, oxides, including rare earth oxides do	5	59	97	United Kingdom 54; West Germany 2.
Zinc:				
Ore and concentrate do	2	50	--	All to Republic of Korea.
Oxide do	1,863	2,588	726	United States 948; Taiwan 326; Philippines 294.
Metal including alloys, all forms do	90	r 101	80	United States 47; Philippines 10; mainland China 7.
Other:				
Ore and concentrate:				
Of titanium, molybdenum, tantalum, vanadium, and zirconium do	74	90	53	All to Republic of Korea.
Of base metals n.e.s do	53	6	122	Thailand 5.
Ash and residues, containing nonferrous metals do	325	1,849	3,489	United Kingdom 605; Belgium 600.
Oxides, hydroxides, and peroxides of metals n.e.s do	1.003	1.651	2,045	United States 597; Netherlands 170; Republic of Korea 142.
Metals including alloys, all forms:				
Phosphorus and other metalloids do	47	338	261	India 154; Australia 104; Taiwan 39.
Alkali, alkaline-earth, and rare-earth metals do	13	63	149	Canada 21; United States 17; Republic of Korea 16.
Pyrophoric alloys do	158	140	114	Hong Kong 27; Singapore 25; United States 21.
Base metals including alloys, all forms n.e.s do	3.581	3.025	6.672	United States 643; West Germany 621; Netherlands 521.
NONMETALS				
Abrasives, natural n.e.s.:				
Pumice, emery, natural corundum, etc.:				
Emery tons	909	807	672	Taiwan 393; Thailand 177; Republic of Korea 145.
Natural abrasives do	1,608	2,200	4,253	Ryukyu 1,975; U.S.S.R. 85.
Dust and powder of precious and semiprecious stones thousand carats	r 761	824	410	United States 724; United Kingdom 98.
Grinding and polishing wheels and stones tons	1,980	2,546	2,800	United States 460; Thailand 183; Taiwan 174.
Asbestos do	192	1,471	169	Republic of Korea 1,270; Taiwan 142.
Barytes and witherite do	2,943	3,502	--	Indonesia 3,499.
Boron materials, boric acid and oxide do	32	64	61	Taiwan 29; Ryukyu 14; Republic of Korea 12.
Cement	r 1,908	2,134	2,112	Indonesia 331; Saudi Arabia 306; Kuwait 306.
Chalk tons	4,781	2,360	700	Hong Kong 1,336; Malaysia 400; Ceylon 200.
Clays and products (including all refractory brick):				
Crude n.e.s do	30,585	41,768	63,719	Taiwan 12,277; Philippines 10,517; Republic of Korea 3,614.
Products [2] do	137,974	135,344	135,885	United States 35,829; Thailand 14,199; Republic of Korea 7,960.
Cryolite and chiolite do	--	49	300	All to the United States.
Diamond:				
Gem not set or strung carats	3,015	325	330	Mainly to Hong Kong.
Industrial thousand carats	77	118	80	United Kingdom 83; United States 23.
Diatomite and other infusorial earths tons	773	2,007	1,021	Cuba 934; Malaysia 371; Thailand 177.
Feldspar and fluorspar do	3,517	10,617	4,968	Taiwan 4,575; U.S.S.R. 2,625; Republic of Korea 2,000.
Fertilizer materials:				
Manufactured:				
Nitrogenous [3]	1,614	1,112	1,147	Mainland China 628; Taiwan 109; Republic of Korea 90.
Other	222	r 223	228	Thailand 113; Ryukyu 33; India 20.
Ammonia tons	38,284	11,667	91,812	Philippines 10,751; Hong Kong 573.
Graphite do	21,001	960	758	Thailand 580; Burma 111.
Gypsum and plasters	14	17	28	Singapore 7; Taiwan 5; Ryukyu 2.
Iodine tons	3,003	3,581	4,653	United States 1,590; West Germany 506; United Kingdom 349.
Lime do	2,739	8,688	5,904	South Vietnam 6,638; Ryukyu 1,147.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal destinations, 1969
NONMETALS—Continued				
Magnesite ____ tons	10,749	191	742	Mainly to Ryukyu and Philippines.
Mica ____ do	163	142	80	Taiwan 88; Thailand 18; Republic of Korea 12.
Pigments, mineral including processed iron oxides ____ tons	704	1,080	1,482	Taiwan 743; United States 126.
Precious and semiprecious stones, except diamonds ____ thousand carats	57,521	102,395	63,101	United States 29,920; Hong Kong 24,420; Republic of Korea 14,953.
Salt and brines ____ tons	398	1,305	344	United States 1,131.
Sodium and potassium compounds n.e.s.	128	214	207	Australia 149; U.S.S.R. 28; Indonesia 10.
Stone, sand and gravel:				
Dimension stone	8	3	3	Republic of Korea 1; Italy 1.
Dolomite chiefly refractory grade	3	4	5	Philippines 2; Ryukyu 1.
Gravel and crushed rock ____ tons	1,146	3,419	873	Republic of Korea 2,316.
Limestone (except dimension)	702	828	826	Australia 470; Hong Kong 349.
Quartz and quartzite ____ tons	78	130	241	Thailand 85; Taiwan 26.
Sand (excluding metal bearing)	4	8	11	Philippines 5; Hong Kong 2.
Sulfur:				
Elemental, all forms	26	30	2	Taiwan 24; Republic of Korea 5.
Sulfur dioxide ____ tons	28	72	115	Australia 60; Taiwan 6; Thailand 5.
Sulfuric acid	2	2	1	Mainly to Hong Kong and Indonesia.
Talc and steatite ____ tons	895	443	825	Ryukyu 103; Philippines 103.
Other n.e.s.:				
Crude	4	10	11	Singapore 4; Taiwan 2; Hong Kong 2.
Slag, dross, and similar waste, not metal bearing	24	6	14	Ryukyu 3; Philippines 1.
Oxides, hydroxides, and peroxides of magnesium, strontium, and barium	22	49	61	Australia 22; United States 17.
Fluorine and bromine ____ tons	2	2	1	North Vietnam 1; Republic of Korea 1.
Building materials of asphalt, asbestos, fiber, cement, and unfired nonmetals n.e.s	31	31	107	United States 24; Ryukyu 2; Thailand 1.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen natural ____ tons	75	15	3	All to Republic of Korea.
Carbon black	16	16	19	Taiwan 4; Thailand 3; Singapore 2.
Gas carbon ____ kilograms	500	9	61	All to Philippines.
Coal, all grades including briquets	32	23	16	Republic of Korea 15; Ceylon 7.
Coke and semicoke of coal, lignite, or of peat	63	84	94	Republic of Korea 64; Philippines 9.
Gas, hydrocarbon	19	21	43	Ryukyu 11; Hong Kong 7; Taiwan 2.
Hydrogen and rare gases (helium, neon, argon, krypton, and xenon) ____ tons	245	186	307	Taiwan 27; Pakistan 26; Philippines 25.
Peat including peat briquets and litter ____ do	30	20	70	All to Taiwan.
Petroleum:				
Crude and partly refined ____ thousand 42-gallon barrels	17	3	720	All to Republic of Korea.
Refinery products:				
Nonbunker:				
Gasoline ____ do	r 1,064	562	472	Australia 246; Guam 148; Ryukyu 76.
Naphtha ____ do	r 70	135	37	Singapore 94; Ryukyu 28; Taiwan 13.
Kerosine and jet fuel oil ____ do	r 1,519	4,361	1,188	United States 1,537; India 873; Ceylon 678.
Distillate fuel oil ____ do	851	593	204	Hong Kong 347; Singapore 183; Guam 54.
Residual fuel oil ____ do	41	8	275	United States 3; West Germany 3.
Lubricants ____ do	r 1,110	r 1,628	2,231	Singapore 493; Republic of Korea 487; Taiwan 205.
Bitumen ____ do	r 794	r 1,202	1,043	Indonesia 728; U.S.S.R. 241; Cambodia 67.
Other ____ do	r 482	r 833	1,042	Taiwan 271; Republic of Korea 230; Ryukyu 91.
Bunker: [4]				
Kerosine and jet fuel ____ do	6,451	7,350	NA	NA.
Distillate fuel oil ____ do	7,058	7,594	NA	NA.
Residual fuel oil ____ do	78,878	89,657	NA	NA.
Other ____ do	162	179	NA	NA.

r Revised. NA Not available.

[1] Excludes exports under Japanese-United States Mutual Defense Agreement or for account of U.S. Military Forces.

[2] Excludes mosaic tile valued at (thousand yen): 1968, 13,121,800; 1969, 19,308,846; 1970, 13,461,658.

[3] Excludes exports of following amounts of urea containing more than 45 percent nitrogen: 1968, 1,443,736 tons, 1969, 1,400,601 tons; and 1970, 1,416,665 tons.

[4] From supplementary trade data.

Source: Japan Ministry of Finance. Japan Exports and Imports, Commodity by Country, 1968, 1969, and 1970.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal sources, 1969
METALS				
Aluminum:				
Bauxite and concentrate	2,450	3,122	3,660	Australia 1,558; Indonesia 768; Malaysia 669.
Oxide and hydroxides	r 179	223	351	Australia 220.
Metal including alloys:				
Scrap	24	19	11	United States 10; Australia 2.
Unwrought	169	r 314	258	Canada 127; United States 90; U.S.S.R. 37.
Semimanufactures	4	5	3	United States 3; Romania 1.
Antimony:				
Ore and concentrate tons	8,074	12,657	17,344	Bolivia 7,924; mainland China 2,845; Republic of South Africa 1,381.
Metal including alloys, all forms do	63	5	20	Mainly from Yugoslavia.
Arsenic:				
Natural sulfides do	74	50	57	All from mainland China.
Trioxide, pentoxide, and acids do	3,419	2,638	933	France 1,179; mainland China 570; U.S.S.R. 493.
Bismuth including alloys, all forms do	3	37	32	United States 31; United Kingdom 3.
Cadmium including alloys, all forms do	18	9	--	Mainly from North Korea.
Chromium:				
Ore and concentrate	636	733	1,150	Republic of South Africa 246; India 159; U.S.S.R. 157.
Oxide and hydroxide tons	246	262	520	West Germany 235; United States 27.
Cobalt:				
Oxides and hydroxide do	497	561	729	Belgium 532; Canada 21.
Metal including alloys, all forms do	1,974	4,231	4,638	Congo (Kinshasa) 3,438; Congo (Brazzaville) 359.
Columbium and tantalum, tantalum:				
Ore and concentrate do	124	108	115	West Germany 58; Mozambique 17.
Metal including alloys, all forms do	14	22	43	United States 18.
Copper:				
Ore and concentrate	1,061	1,120	1,565	Philippines 485; Canada 370; Peru 82.
Matte	24	31	24	New Caledonia 12; Chile 12.
Metal including alloys:				
Scrap	58	50	66	United States 24; Hong Kong 7; Canada 5.
Unwrought	292	r 361	313	Zambia 190; Chile 47; United States 21.
Semimanufactures	2	5	2	Australia 2; United States 1; Mexico 1.
Germanium:				
Dioxide kilograms	12,850	24,345	26,013	Belgium 21,225; Italy 2,920.
Metal including alloys, all forms do	47	1,587	706	Belgium 1,574.
Iron and steel:				
Ore and concentrate (including roasted pyrites)	68,164	r 83,247	102,090	Australia 23,235; India 13,633; Peru 8,623.
Metal:				
Scrap	3,948	4,878	5,793	United States 3,684; Australia 521.
Pig iron including cast iron	4,456	3,577	2,854	Republic of South Africa 683; India 583; U.S.S.R. 545.
Sponge iron, powder and shot	42	46	41	North Korea 34; Sweden 10.
Ferroalloys	63	85	149	Republic of South Africa 35; India 28; Norway 17.
Steel primary forms	97	106	80	Australia 85; North Korea 12.
Semimanufactures	18	37	38	Bulgaria 10; United States 9; Austria 7.
Lead:				
Ore and concentrate	144	180	210	Peru 56; Canada 48; Australia 42.
Oxides tons	22	30	75	United Kingdom 21; United States 9.
Metal including alloys:				
Scrap do	780	2,013	2,639	Ryukyu 1,025; South Vietnam 977.
Unwrought	12	8	2	Australia 2; Zambia 1; Canada 1.
Semimanufactures tons	4	22	38	United States 19; West Germany 2.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal sources, 1969
METALS—Continued				
Magnesium including alloys, all forms tons	443	102	2,280	United States 101.
Manganese ore and concentrate [2]	1,751	2,025	2,584	India 672; Republic of South Africa 600; Australia 416.
Mercury 76-pound flasks	r 26,070	25,573	36,103	Mexico 11,411; Italy 5,529; Yugoslavia 2,347.
Molybdenum:				
Ore and concentrate tons	9,539	12,237	15,121	United States 7,974; Canada 3,077.
Trioxide do	103	112	457	United States 111.
Metal including alloys, all forms do	52	106	144	West Germany 81; Netherlands 11; United States 10.
Nickel:				
Ore and concentrate	2,712	3,395	4,670	New Caledonia 3,077; Indonesia 268.
Matte, speiss, and similar materials	13	17	18	New Caledonia 7; Canada 5.
Scrap tons	580	1,323	1,425	United Kingdom 527; United States 373.
Metal including alloys, all forms do	5,293	8,327	12,949	U.S.S.R. 4,132; Canada 1,403; Norway 744.
Platinum group including alloys:				
Platinum thousand troy ounces	r 215	278	465	U.S.S.R. 132; United Kingdom 80; West Germany 33.
Palladium do	600	492	633	U.S.S.R. 440; United Kingdom 42.
Rare earth:				
Oxides and crude chlorides tons	2,039	2,772	2,420	India 1,905; Brazil 703.
Metals (yttrium and scadium) do	1	7	(3)	United States 5; West Germany 2.
Selenium, elemental kilograms	6,842	3,377	5,848	United States 2,297; Mexico 1,000.
Silicon tons	2,896	4,744	4,285	Yugoslavia 2,273; Switzerland 1,998.
Silver:				
Ore and concentrate do	3,131	10,266	5,840	Republic of Korea 10,036; Chile 230.
Metal including alloys, all forms thousand troy ounces	r 12,308	10,460	13,282	United States 4,022; Peru 3,640; Australia 1,523.
Tellurium kilograms	99	122	4,101	All from the United States.
Tin:				
Ore and concentrate long tons	1,102	22	245	Indonesia 20.
Metal including alloys, all forms do	r 20,266	r 25,565	26,468	Malaysia 23,864; Thailand 1,186.
Titanium:				
Ore and concentrate do	364	410	588	Australia 156; Malaysia 131; Ceylon 73.
Oxides (includes slag) tons	5,694	4,192	6,155	United Kingdom 2,108; Australia 1,100; West Germany 458.
Tungsten:				
Ore and concentrate do	2,881	4,865	6,160	Republic of Korea 1,328; United States 1,006; Peru 534.
Metal including alloys, all forms do	44	67	125	West Germany 48; France 13; United States 3.
Uranium and thorium:				
Ore and concentrate do	22	111	50	Ceylon 101; Australia 10.
Oxides (compounds of thorium or uranium depleted in U-235) kilograms	6,370	34,184	83,407	Australia 24,846; United States 9,338.
Metals including alloys, all forms do	5,277	11,267	2,745	All from the United States.
Vanadium, pentoxide tons	1,213	2,180	2,807	Republic of South Africa 1,228; West Germany 434; United States 343.
Zinc:				
Ore and concentrate	857	847	973	Peru 361; Australia 151; Canada 123.
Oxide kilograms	98,299	152,911	383,097	Denmark 73,320; West Germany 61,100.
Metal including alloys, all forms	9	8	22	North Korea 5; Canada 2.
Zirconium ore and concentrate (including zircon sand) tons	58,369	62,106	94,275	Australia 56,559; India 3,000.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal sources, 1969
METALS—Continued				
Other:				
Ore and concentrate n.e.s.:				
Of base metals (including niobium) tons	2,428	3,678	3,332	Australia 1,908; Nigeria 1,045.
Ash and residue containing nonferrous metals do	15,178	18,176	15,941	India 4,505; United States 2,574; Australia 2,359.
Oxides, hydroxides, and peroxides of metals n.e.s.[4] do	1,721	1,140	1,509	United States 818; West Germany 194.
Metals:				
Metalloids [5] do	1,530	2,260	2,835	United States 1,503; U.S.S.R. 757.
Alkali and alkaline-earth metals [6] do	65	467	602	United Kingdom 430; U.S.S.R. 20.
Pyrophoric alloys (ferrocerium) do	8	17	13	Austria 8; Australia 5; France 2.
Base metals including alloys, all forms n.e.s.[7] do	359	402	761	U.S.S.R. 280; United States 75.
NONMETALS				
Abrasives, natural, except diamond n.e.s.:				
Crude tons	4,224	5,049	4,347	Italy 2,119; United States 1,940.
Grinding and polishing wheels and stones [8] do	147	210	246	United States 84; United Kingdom 67.
Asbestos	199	237	298	Canada 118; Republic of South Africa 80.
Barite and witherite	6	29	29	Mainland China 16; India 12.
Boron materials:				
Crude, natural borates	12	22	28	Turkey 18.
Oxide and acid	11	14	15	United States 10; mainland China 2.
Cement	2	2	3	United States 1.
Clays and products:				
Crude n.e.s.:				
Kaolin	124	137	243	United States 78; Republic of Korea 36.
Kyanite, andalusite, and sillimanite	31	35	39	Republic of South Africa 21; India 13.
Other	220	230	351	United States 86; Republic of South Africa 57; mainland China 44.
Products:				
Refractory (including nonclay bricks) tons	9,548	6,874	6,852	United States 5,880; United Kingdom 437.
Nonrefractory do	105	455	2,273	United States 236; Republic of Korea 130.
Cryolite	8	9	9	Denmark 7; Greenland 1.
Diamond:				
Gem not set or strung thousand carats	324	591	266	Israel 461; Belgium 68; United States 21.
Industrial stones do	753	651	772	United States 184; United Kingdom 176; Belgium 144.
Powder and dust do	3,499	4,936	5,446	United States 3,099; United Kingdom 888; Ireland 565.
Diatomaceous earth tons	964	1,487	2,944	United States 1,456.
Feldspar do	11,274	10,355	5,915	Canada 6,009; Republic of Korea 1,870; mainland China 1,500.
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrate)	15	15	15	All from Chile.
Phosphatic	3,417	2,964	3,125	United States 1,967; Morocco 430; Nauru 230.
Other (guana) tons	123	1,062	63	Mainly from Peru.
Manufactured:				
Nitrogenous	9	13	11	Chile 10; Norway 3.
Phosphatic	19	17	13	All from the United States.
Potassic	1,318	1,361	1,333	Canada 546; United States 359; U.S.S.R. 192.
Other including mixed	30	30	49	Mainly from the United States.
Fluorspar	494	522	521	Thailand 255; mainland China 122; Republic of South Africa 69.
Graphite, natural	63	58	77	Republic of Korea 42; North Korea 6; Ceylon 4.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal sources, 1969
NONMETALS—Continued				
Gypsum and plasters	57	61	77	Morocco 54; United States 4.
Magnesite	25	27	59	North Korea 19; mainland China 5.
Mica, all forms	18	7	11	India 4; Republic of Korea 2.
Pigments, mineral, including processed iron oxides ... tons	1,228	1,689	2,546	West Germany 1,278; United States 265.
Precious and semiprecious stones, except diamond:				
Natural ... thousand carats	2,271,261	3,615,186	4,493,513	Brazil 2,623,237; Republic of South Africa 371,655; United States 120,753.
Manufactured ... do	9,875	21,194	45,390	United States 17,723; Switzerland 3,043.
Pyrite (gross weight)	--	55	184	Philippines 36; Canada 19.
Salt (excluding brines)	5,023	5,657	6,490	Mexico 2,346; mainland China 1,022; Australia 756.
Sodium and potassium compounds, n.e.s.:				
Caustic soda ... tons	1	61	5,757	Mainly from West Germany.
Caustic potash, sodium peroxide ... do	10	15	40	Sweden 10.
Stone, sand and gravel:				
Dimension stone	59	77	115	Republic of South Africa 30; Sweden 13; Italy 5.
Dolomite including agglomerated dolomite	11	17	27	Mainly from Republic of Korea.
Gravel and crushed rock	25	18	24	France 7; Republic of Korea 6; mainland China 4.
Quartz and quartzite	97	152	208	Republic of Korea 137; North Korea 5; mainland China 4.
Sand excluding metal bearing	109	122	186	Australia 101; South Vietnam 13; Republic of Korea 5.
Sulfur, colloidal, sublimed or precipitated ... kilograms	8,369	23,039	44,224	United States 20,864; West Germany 2,175.
Talc, steatite, soapstone, pyrophyllite	127	155	158	Republic of Korea 50; mainland China 48; North Korea 25.
Other nonmetals n.e.s.:				
Crude:				
Meerschaum, amber, jet ... kilograms	220	205	100	U.S.S.R. 200.
Other	84	107	137	Philippines 45; Ryukyu 17; Republic of South Africa 13.
Slag, dross, and similar waste, and ash, including kelp, not metal bearing	182	157	137	India 73; Republic of Korea 42; North Korea 25.
Oxides, hydroxides, and peroxides of magnesium, strontium, and barium ... tons	179	404	224	United States 343; France 43; West Germany 10.
Bromine and iodine ... kilograms	--	60,416	124,800	Mainly from Israel.
Fluorine ... do	68	34	53	All from the United States.
Building materials of asphalt, asbestos-cement, cellulose fiber-cement, or the like ... tons	542	2,793	4,587	Canada 2,366; Belgium 284; United States 124.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3	3	3	All from the United States.
Carbon black	5	3	5	Mainly from the United States.
Coal and briquets:				
Anthracite	1,457	1,301	1,405	Republic of South Africa 321; North Vietnam 252; Republic of Korea 227.
Bituminous:				
Heavy coking coal less than 8 percent ash	16,958	19,794	21,838	United States 15,975; Australia 1,904; Poland 988.
Heavy coking coal more than 8 percent ash	6,817	10,417	16,960	Australia 7,246; U.S.S.R. 1,287; United States 879.
Other coking coal	7,193	9,650	9,970	Australia 6,394; United States 2,209; U.S.S.R. 849.
Lignite and lignite briquets	r 16	26	14	All from Australia.
Coke and semicoke	235	173	146	Australia 120; United States 45.

See footnotes at end of table.

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

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued				
Gas, hydrocarbon (liquefied natural gas)---thousand 42-gallon barrels--	--	r 619	10,008	All from the United States.
Hydrogen, helium, and rare gases kilograms--	34,508	59,445	71,859	United States 50,204; Canada 8,391.
Peat including peat briquets and litter tons--	381	448	547	United Kingdom 301; Denmark 117.
Petroleum:				
Crude and partly refined:				
Crude thousand 42-gallon barrels--	r 780,211	r 963,484	1,142,173	Iran 445,001; Saudi Arabia 139,637; Indonesia 105,542.
Partly refined--------do----	r 99,284	r 89,623	97,597	Saudi Arabia 45,795; Saudi Arabia-Kuwait Neutral zone 30,339; Kuwait 7,291.
Refinery products:				
Naphtha------------------	r 19,862	r 28,321	41,317	Kuwait 10,387; Saudi Arabia 7,000; India 3,200.
Kerosine and jet fuel--do----	r 1,117	1,541	2,103	Singapore 1,270; United States 250.
Distillate fuel oil-----do----	r 18,782	r 12,008	15,713	Netherlands-West Indies 3,819; Kuwait 2,912; Venezuela 2,317.
Residual fuel oil------do----	r 90,927	r 96,609	142,857	Singapore 20,486; Indonesia 18,384; Kuwait 14,145.
Lubricants----------do----	r 3,220	r 2,863	2,339	United States 2,452.
Liquefied petroleum gas do----	r 20,570	r 25,942	31,660	Kuwait 12,251; Saudi Arabia 10,103; Canada 2,839.
Petroleum coke------do----	r 9,654	r 10,697	14,150	United States 9,441.
Other---------------do----	r 1,097	r 5,740	313	United States 5,668.

r Revised.
[1] Excludes imports under Japanese–United States Mutual Defense Agreement or for account of U.S. Military forces.
[2] Includes ferruginous manganese and manganese dioxide.
[3] Less than ½ unit.
[4] Includes lithium hydroxide, beryllium oxide, mercury oxide, antimony trioxide, cupreous 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, scrap of indium, germanium, or their alloys and scrap of base metals.
[8] Excludes cutting and grinding wheels of agglomerated diamonds valued at: 1968, 90,266,000 Yens; and 1969, 117,609,000 Yens. (Included in total value).

Source: Japan Ministry of Finance. Japan Exports and Imports, Commodity by Country, 1968, 1969, and 1970.

COMMODITY REVIEW

METALS

Aluminum.—Although 1970 production of primary aluminum increased by 30 percent over 1969 production, it was still short of meeting domestic demand. Japan's 1970 imports of unwrought aluminum amounted to about 260,000 metric tons. In order to meet this increasing demand for aluminum, major producers are engaged in a dramatic 5-year plan to boost Japan's aluminum capacity from 1,009,500 metric tons to a planned capacity of 2,445,000 by 1975. Planned capacities for individual Japanese aluminum producers were as follows, in thousand metric tons:

Company and location	Annual capacity	
	1970	1975 p
Nippon Light Metal Co., Ltd.:		
Kambara	111.0	111
Niigata No. 1	59.0	143
Niigata No. 2	--	100
Tomakomai	130.0	350
Showa Denko Co., Ltd.:		
Kitakata	43.0	43
Omachi	42.0	42
Chiba No. 1	83.0	83
Chiba No. 2	80.0	130
Oita	--	100
Sumitomo Chemical Co., Ltd.:		
Kikumoto	30.0	30
Nagoya	50.0	50
Isoura	75.0	75
Toyoma	112.0	168
Niihama	--	175
Mitsubishi Chemical Industries, Ltd.:		
Naoetsu	157.0	157
Sakaide	--	290
Mitsui Aluminum Industry Co., Ltd.:		
Omuta	37.5	150
Showa Denko Co., Ltd. and Sumitomo Chemical Co., Ltd.:		
New Zealand [1]	--	112
Showa Denko Co., Ltd.:		
Northwest U.S.A	--	136
Total	1,009.5	2,445

p Preliminary.
[1] One-half of this plant to be shipped to Japan.

The main addition to Japanese aluminum capacity during 1970 was that of the Nippon Light Metal Co., Ltd., which completed construction of a 72,000-ton reduction facility at Hokkaido early in January 1971. The company had previously completed the construction of another 58,000-ton facility at this location in October so that the plant now has a total capacity of 130,000 tons per year, making this the largest plant in Japan. Also during 1970 the Sumitomo Chemical Co., Ltd., started full-scale operations at their Toyoma plant, which is rated at 56,000 tons of ingot per year. Sumitomo Chemical plans to increase the capacity of this plant to 168,000 tons by March 1972. Finally, the Mitsui Aluminum Industry Co. Ltd. completed the first stage of their production plant at Omuta. This plant is expected to produce 37,500 metric tons of primary aluminum annually when full-scale operations are launched, probably sometime in 1972.

For the development of overseas resources five aluminum smelters formally inaugurated their joint enterprise Aluminum Resource Development Company on December 11, 1970. Capitalized at $280,000, this firm will develop bauxite, anthracite, and fluorite in Africa, Australia, Indonesia, and Latin America. As the first project, a survey team was sent to Ghana in January 1971 to secure data for planning, mining, and refining in that country.

This is the second Japanese survey team that has visited Ghana. The first survey team discovered deposits with nearly 380 million metric tons of bauxite reserves. During early 1971 three aluminum producers, Nippon Light Metal, Showa Denko, Co. Ltd. and Sumitomo Chemical Co. Ltd. sent a representative to the Fiji Islands to sign a development contract with that government. At yearend 1970 five Japanese aluminum producers applied to the Government of Okinawa for approval to establish a joint company "Okinawa Aluminum Company." Capitalized at $300,000, this company is expected to commence construction of a plant in 1972. Plans call for 50,000 tons per year by 1974, to be expanded eventually to 200,000 tons. Aluminum Co. of America (Alcoa) previously had been granted approval to build a similar project in Okinawa but decided against it in May 1971.

Three Japanese aluminum companies Sumitomo, Showa Denko and Nippon Light Metal were conducting negotiations with Indonesian representatives regarding the construction of a 200,000-metric-ton aluminum refinery at Yadan, North Sumatra, Indonesia.

Early in 1971 negotiations between Mitsubishi Chemical Industries Ltd. and Alcoa of the United States were in process regarding the construction of a

50,000-metric-ton aluminum reduction plant in Singapore.

Early in 1971 five Japanese aluminum smelters signed a contract with the U.S.S.R. for the importation of 50,000 metric tons of primary aluminum in 5 years beginning in 1971.

In January 1971 the Japanese Government approved the application of the Swiss Aluminum Company for establishment of a 100-percent owned subsidiary in Japan to be called AL SWISS Japan. The projected firm will be capitalized at $10 million.

Late in 1970 Mitsubishi Metal Mining Co. Ltd. announced plans for the production of aluminum cans to commence in April 1972. Annual production is set at 150 million cans per year. For this production Mitsubishi Metal has signed a technical agreement with Reynolds Metals Co. of the U.S. by which Mitsubishi will use Reynolds "Draw and Iron System" which is able to produce 200 to 250 cans per minute.

Antimony.—Hibino Kinzoku, a major antimony metal producer and sole purchaser of mainland China antimony concentrates, expected to export 2,500 tons of antimony during the first half of 1971. Japanese trading firms are currently negotiating sales contracts with European purchasers.

Copper.—In the past decade Japanese demand for refined copper had grown sharply from approximately 250,000 metric tons in 1959 to nearly 900,000 tons in 1969, making Japan the world's second largest consumer of copper. Industry and government officials were forecasting a national demand for as much as 1.4 million tons by 1975.

Japan's importance in copper is such that if it maintains an average increase of 10 percent per year in copper consumption, the international market could adjust in an orderly way to such a requirement. On the other hand, if the country overestimates local copper demand and secures too much in the way of concentrates for future delivery, there could clearly be far-reaching implications for the rest of the world.

As of June 1970 copper smelters in Japan had an annual capacity of 831,000 metric tons with breakdown by company and plant as follows, in thousand metric tons: [3]

Company and facility	Annual capacity	
	March 1965	June 1970
Nippon Mining Co., Ltd.:		
Saganoseki	78	168
Hitachi	48	72
Mitsubishi Metal Mining Co., Ltd.:		
Naoshima	--	84
Osaka	68	84
Sumitomo Metal Mining Co., Ltd.:		
Besshi-Niihama	70	120
Mitsui Mining and Smelting Co., Ltd.:		
Takehara	49	76
Furukawa Electric Co., Ltd.:		
Nikko	36	42
Dowa Mining Co., Ltd.:		
Kosaka	23	40
Okayama	11	11
Toho Zinc Co., Ltd.:		
Onahama No. 1	7	14
Jointly owned: [1]		
Onahama No. 2	--	120
Total	390	831

[1] Mitsubishi Metal Mining Co., Ltd., Dowa Mining Co., Ltd., and Furukawa Electric Co., Ltd.

In order to meet the smelting requirements dictated by the growing flood of copper concentrates, Japanese industry is planning and executing massive increases in capacity. By 1972, for example, combined copper refining capacity of the nine operating companies will total over 1.1 million tons per year. Japan has also strengthened its position as the world's largest custom smelter of copper. In recent months, because of air pollution restrictions, U.S. producers have been shipping more copper concentrates to Japan for smelting and refining on a toll basis.

Japan's indigenous copper mining industry, though providing only a small proportion of the concentrates smelted, continued to be of some consequence. During 1970 the Mitsubishi Metal Mining Co. discovered two additional copper veins at its Shimokawa mine in Kamikawa district, Hokkaido. The new reserves have been initially estimated at 2 million tons of 2.7- to 6.8-percent ore, and this total probably will be significantly increased as a result of prospecting work being undertaken. Accordingly, Mitsubishi has decided to increase ore dressing capacity from 26,500 tons of 2.3-percent ore per day to 28,000 tons by 1971 and to 30,000 tons by May 1972. With these recent discoveries the Shimokawa mine had total proven ore reserves of 5 million tons as of yearend 1970, making it Japan's third largest copper

[3] American Metal Market. Sec. 2, v. 72, No. 242, Dec. 21, 1970, p. 22A.

mine after Dowa Mining Co.'s Matsumime and Uchinotai mines.

Since Japan produced only about a sixth of the copper-in-concentrates fed to smelters in 1970, the quest for overseas copper for immediate and future delivery has been a major aspect of the country's mineral policy. Success here has contributed significantly to Japan's jump to third place as a world industrial power, after the United States and the U.S.S.R. In 1970 imports of copper concentrates and ores amounted to 1,565 million tons (with a copper content of about 400,000 tons). In addition there were landings of 313,000 tons of blister and refined copper plus 66,000 tons of scrap and alloy material. These imports, together with domestically mined copper (about 124,000 tons in 1970) and locally recovered scrap, roughly matched the demand.

Japan's efforts to secure long-term supplies of copper concentrates from abroad have only just begun to bear fruit. In 1970 the country obtained about 300,000 tons of mine copper (or copper-in-concentrates) from already developed sources under long-term contracts, with the tonnage expected to drop to 250,000 tons in a few years. In addition, however, there was a supplementary tonnage from new mines and expansion projects totaling 52,000 tons in 1970. By 1971 this supplementary tonnage will be tripled and then doubled again to some 370,000 tons by 1972. By the mid-1970's, Japan's intake of mine copper, under the terms of supply contracts starting in 1970 and subsequent years, could reach 663,000 metric tons per year, according to officials of the Sumitomo Metal Mining Co.

Canada, ranking second to the Philippines as a supplier of mine copper to Japan in 1970, may eventually take over first place. Its many projects, developed mainly for the Japanese market, include: Lornex Mining Corporation Ltd. with the short form of the Company name in parentheses, (Rio Tinto), Port Hardy (Utah Construction), Valley Copper Mines (Cominco and Bethlehem Steel), Similkameen (Newmont Mining), Granduc Mines, Ltd., (Newmont Mining and ASARCO), Fox Lake (Sherritt Gordon), and Brenda Mines Ltd. (Noranda Mining). Specific new projects from elsewhere that will supply Japan with substantial amounts of mine copper include: Bougainville Copper Pty. Ltd. (near Papua and Australia), Ertzberg in Indonesia, Marcopper Mining Corp. in the Philippines, Mamut in Malaysia, Rio Blanco and Sagasca in Chile, Asmara in Ethiopia, and Katanga in the Congo (Kinshasha).[4]

In mid-1970 Mitsubishi Metal Mining signed a new agreement with Atlas Consolidated Mining and Development Corporation, owner of the Toledo mine located on Cebu Island, Philippines. Under terms of the agreement Mitsubishi is providing a $20 million loan for the purpose of increasing copper production from about 43,000 metric tons of contained copper in 1971 to an annual rate of 80,000 tons commencing in the summer of 1971. Additionally, an ore dressing plant with a capacity of 28,000 tons of ore per day will be added by yearend 1971. Completion of this program will strengthen Toledo's position as Japan's largest single source of copper ore.

Japan's big copper project in the Katanga area of Congo near the border of Zambia moved ahead impressively during 1970. The operating company is Société de Développement Industriel et Minièr du Congo (SODEMICO), 15 percent owned by the Congolese Government and 85 percent owned by a consortium of Japanese nonferrous companies headed by Nippon Mining Co. Of the two subdivisions, Musoshi, with about 30 million metric tons of 3.6-percent copper ore plus 70 million tons of 2.1-percent copper ore, was well underway in 1970. The plan was to produce approximately 53,000 tons of mine copper (in 36-percent concentrates) annually from Musoshi beginning in October 1972.

Preliminary estimates place reserves at Kinsenda, the other subdivision, at about 35 million tons of 5-percent copper ore. Kinsenda is expected to yield 70,000 to 80,000 tons of mine copper annually by 1975 or 1976. When both subdivisions are fully developed, possibly in 15 years, the Japanese feel that as much as 300,000 tons of mine copper can be shipped to Japan from Katanga each year. Each project could cost as much as $100 million. Nippon Mining was investing $7.5 million initially and other Japanese companies were investing lesser amounts. Apparently, the Japanese Government was planning to arrange a loan of $80 million to SODEM-

[4] Mining Journal (London). V. 275, No. 7040 Sept. 4, 1970, p. 1.

ICO. The terms of the contract with the Congolese Government call for eventual construction of local refining facilities. This is the largest Japanese-owned and managed copper project that Japan has ever had in a foreign country.

Nippon Mining signed a 30-year contract with the Government of Ethiopia in January 1971 to develop copper deposits in the Asmara district of Eritrea. According to preliminary surveys, almost 10 million tons of 3-percent copper ore have been discovered. Nippon Mining will provide $417,000 initially to survey an area of 2,800 square kilometers. If survey results prove promising, a joint venture of Nippon Mining, Nissho-Iwai, Co. Ltd., and the Govennment of Ethiopia (20 percent interest) will be formed.

Japan has already signed long-term contracts for the importation of 900,000 tons of mine copper by 1975. Assuming that imports of refined and blister copper and scrap metal are maintained at roughly the current combined level and that domestic Japanese mine production makes only limited progress over the next 5 years, it would seem that the total amount of copper available to Japan by 1975 could be over 1.4 million tons. This matches MITI's high consumption forecast.

The Japanese Government has had an embargo on copper exports for many years. In 1970, however, permission was granted to smelters to export 50,000 tons of refined copper, in order to reduce inventories. Whether or not Japan will continue to have an outflow of copper would depend upon Japanese forecasts of growth in domestic consumption. If the estimates prove wide of the mark, Japan could either find itself in a position of some permanency as a net refined copper exporter or else be obliged to cut back on acquisition of copper concentrates from overseas. The rapid buildup of smelting capacity in recent years coupled with the slowdown of the economy in 1970 have contributed to the perhaps temporary oversupply situation in copper.

Ferroalloys.—Producers of ferroalloys reported a significant increase in production. Total output of electric furnace ferroalloys in 1969 was 1.3 million metric tons compared with 1.7 million metric tons in 1970. Production of ferrochrome registered the largest increase (nearly 40 percent) during 1970 as compared with 1969 (see table 1). Late in 1970 Japanese ferrochrome producers sent a five-man team to the Philippines to negotiate for increased shipments of ore to Japan. At present the Acoje Mining Co. Inc. in the Philippines produces 140,000 to 150,000 metric tons of metallurgical chromite ore per year for export to Japan, and Japanese ferrochrome producers hope to raise the tonnage to at least 200,000 to 250,000 metric tons per year in the future. The Japanese will extend financial assistance to the Philippine mine if necessary. Reportedly, the Japanese have also made a contract to purchase 12,000 tons of Albanian chrome ore, through the Japanese trading company Toko Hussan.

Iron and Steel.—Despite the fact that the 93,222,000 metric tons of crude steel produced in 1970 was below forecast, Japan strengthened its position as the world's third largest steel producer, following the United States and the U.S.S.R. Japan also remained as the world's foremost steel exporter. Output of the Nippon Steel Corp. in 1970 was much larger than that of the United States Steel Corp. The world's 10 leading producers of crude steel were as follows, with output in thousand metric tons: [5]

1970 ranking	Company	1970 production
1	Nippon Steel Corp.[1]	33,640
2	United States Steel Corp	28,120
3	British Steel Corp	25,650
4	Bethlehem Steel Corp	18,680
5	Nippon Kikan Co.[1]	12,890
6	August-Thyssen Huette A. G. (West Germany)	12,250
7	Hoesch (West Germany-Netherlands)	11,290
8	Sumitomo Metal Industries, Ltd.[1]	11,200
9	Kawasaki Steel Corp.[1]	11,030
10	Republic Steel Corp	8,760

[1] Denotes Japanese firm.

The Nippon Steel Corp. is a new company formed as the result of the merger of Japan's two largest steel producers, Yawata Iron and Steel Co., Ltd., and Fuji Iron and Steel Co., Ltd. The merger formally took place in March 1970, some 24 months after intentions to merge were first announced The new company currently controls about 36 percent of Japan's total crude steel production.

The year 1970 may well mark the end of the great growth years for the Japanese

[5] Japan Metal Bulletin (Osaka). Feb. 13, 1971, p. 2.

steel industry. During this period competition for future market shares had dominated all activities and had led to continuous and massive capital outlays for new equipment. In 1970, however, difficulties in sales hit the industry for the first time since the mid-1960's, causing a rapid increase in stocks. Thus, beginning in the fall of 1970, major Japanese steel companies began to move back their schedules for expansion of facilities. Plans were made to commence construction on five new blast furnaces and related conversion facilities in the last quarter of 1970; but with predictions indicating that crude steel demand in 1975 would be 20 million metric tons below what was initially estimated (150 million metric tons), startup schedules were postponed to 1971 or later, with the blessing of the Japanese Government. Specific delays on construction included Kobe Steel Work Ltd.'s 3,885-cubic-meter blast furnace at Kakogawa; Nippon Steel's 4,000-cubic-meter furnace at Oita; Sumitomo Metal's 4,000 cubic-meter-furnace at Kashima; and Kawasaki Steel's 4,500-cubic-meter furnace at Mizushima. Although the Japanese Government and steel industry have not been able to agree on long-term estimates of steel demand, they firmly concur that existing and on-going facilities will provide more than enough capacity to meet demand in the next few years. During 1970 three blast furnaces were completed and three more were under construction at yearend as follows:

Company	Location: Completed	Location: Under construction	Size (cubic meters)
Nippon Steel Corp	Hirohata	---	2,548
Kobe Steel Works, Ltd	Kakogawa	---	2,840
Kawasaki Steel Corp	Mizushima	---	3,367
Sumitomo Metal Industries, Ltd. [1]	---	Kashima	3,100
Nippon Kikan Co.[1]	---	Fukuyama	4,000
Nippon Steel Corp.[1]	---	Kimitsu	4,000

[1] Estimated dates of completion: Kashima—January 1971; Fukuyama—April 1971; and Kimitsu—May 1971.

A MITI survey of 99 Japanese steel companies indicated that construction of new plant facilities during fiscal 1971 (from April 1971 to March 1972) would be valued at $2,777 million, up 20.7 percent over that of 1970, and actual payments would be $2,363 million, up 17.1 percent. These growth rates compare with 22.1 percent and 31.2 percent, respectively, for 1970 over those of 1969. Thus, actual investment, though declining, still remains high. The advisability of continued expansion in facilities was being questioned on the basis of a new forecasted 1975 demand of 130 million metric tons of crude steel. Actual output was considerably below the 1970 forecast and there was already idle capacity by the fourth quarter. Nonetheless, Japanese steel producers still have ambitious long-range plans to expand and diversify facilities.

Softening of the domestic market began shortly after midyear as the Government's tight money policies inaugurated in September 1969 to control inflation finally began to take hold. Accordingly steel producers cut back production during the fourth quarter of 1970 to reduce stockpiles to a maximum quantity equivalent to 90 percent of monthly production. The rise in raw material prices during 1970, increased labor costs, and sales below forecasts resulted in considerable declines in profit. For five major steel companies during the first half of fiscal 1970, total sales increased 5.9 percent of $4,447 million, whereas profits after taxes decreased 14.5 percent to $95.4 million. The Japanese special steel industry aided by exports to the United States, however, enjoyed good profits through October 1970.

Japan's 1970 pattern of crude steel production was as follows in thousand metric tons: basic oxygen furnaces—73,854; electric furnaces—15,619; and open hearth furnace—3,854.

At yearend 1970, Japan's last operating open hearth furnaces, those of Kobe Steel Works were phased out. In October 1970, Kawasaki Steel blew in the world's largest blast furnace at the Mizushima Steel works. The furnace, measuring 12.4 meters in hearth diameter and 3,363 cubic meters in inner volume is capable of producing 7,300 metric tons of pig iron per day.

Because of the many large and efficient blast furnaces in use, Japan's steel industry has been able to lower the average coke ratio to a record low of 440 kilograms per ton of pig iron.

According to a source,[6] Japan's steel productivity measured in man-hours per net ton surpassed that of the United States by 6.91 to 7.17 in 1969 and 5.70 to 7.31 in 1970.

Failure of crude steel production to reach the 100 million metric tons forecasted was due to the worsening market situation in Japan resulting from the Government's retrenchment program and, to a lesser extent, the voluntary restrictions on steel exports to the United States. Exports of crude steel and steel semimanufactures to the United States in 1970 amounted to 5,579,000 metric tons compared with 5,265,000 tons in 1969. The 1971 steel export quota for the United States was set at 5,751,681 metric tons.

Of the 1971 quota to the United States, 5,541,400 tons will be supplied by eight Japanese steel producers belonging to the Steel Export Quantity Control Cartel, according to the following breakdown, in metric tons:

Ordinary steel items	3,991,700
Special steel items	271,500
Stainless steel items	59,000
Galvanized steel sheet	526,100
Wire rod and products	416,200
Welded steel pipe	195,800
Bright steel bar	67,600
Polished hoop	13,500

Despite the limitations imposed upon steel exporters selling to the United States, Japan's total exports of crude steel and steel semimanufactures during 1970 came to a total of 17,518,000 metric tons, an increase of 13.1 percent over 1969 figures. Iron and steel export items in 1970 registering increases larger than the average 12.5 percent included rails, shaped bars, heavy plates, sheets, and welded pipes and tubes. Heavy plates exported during 1970 made the greatest gain—31.6 percent over those in 1969. This reflected the booming worldwide shipbuilding business during the year. Special rolled steel exports increased 21 percent during 1970. In contrast, wire rods, hot coils for rerolling and hoops registered decreases in 1970 compared with 1969.

To produce 100 million tons of crude steel, a very probable annual output level in the near future, Japan needs about 120 million tons of iron ore and 60 million tons of coal. Accordingly, the Japanese steel industry has been and will be extremely active in seeking additional sources of raw materials to supplement the many contracts already signed. A few examples of iron ore contracts are described here, whereas coking coal contracts are mentioned under coal.

Six Japanese steel companies made an agreement with Brazilian firms for the importation of 105 million metric tons of iron ore during a 15-year period commencing in 1973. Imports will consist of 64,400,000 tons of fine ore for sintering, 23,975,000 tons of special lump ore, and 16,625,000 tons of ordinary lump ore. The Japanese will provide funds and technical assistance to develop a new mine.

In 1969 Japanese steelmakers commenced importation of iron ore from Canada. Plans call for much expanded imports when the current contract expires in 1973. In fact, under a new contract Japan hopes to import 5 million tons per year. India has been a large iron ore supplier for many years. An agreement was recently concluded for Japan to import 61,260,000 tons of iron ore from the Bailadilla mine in India during 1971–80.

Australia probably will become Japan's most important future source of iron ore. Large-scale development is already under way at Mount Newman, Hamersley, and Goldsworthy, primarily to furnish iron ore to Japan. In addition, plans are under way to develop the Robe River Mine in Australia. According to this plan, Mitsui and Company will put up 30 percent of the total capital estimated at Australian $260 million. This mine will ship 87 million tons of pellets to Japan during a 21-year period commencing in 1972.

Japanese companies were also investigating iron prospects in Gabon where reserves may exceed 800 million tons of ore. For the development of above prospects, Japanese steel firms hope to enlist the help of trading companies in financing the project. So far, the United States Steel Corp., Bethlehem Steel Corp., and European steel companies have already agreed to participate in this venture. The consortium organized in 1970 spent $6.2 million by year-end, out of a total of $250 million that might be required to develop the Gabon project as a whole.

[6] Industry Week (New York). V. 169, No. 8, May 24, 1971, p. 1.

In addition to being the world's largest trader in steelmaking raw materials and steel products, Japan has also become a major supplier of equipment and techniques for the production of steel.

Lead and Zinc.—Japan's zinc consumption over the past 10 years has grown at an annual average rate of 15 percent, and if this growth rate continues Japan will use more than 1 million metric tons by 1973. Since domestic mines supplied only 280,000 tons of mine zinc in 1970, the Japanese smelting industry must import increasingly larger amounts of zinc concentrate. Peru, Canada, and Australia are the main suppliers.

A parallel situation exists for lead. Consumption is forecast at 300,000 metric tons by 1973, but the expansion of smelting capacity and heavy dependence on imported concentrates are the same. Canada and Peru are Japan's major sources of lead concentrate.

Early in 1971 five of Japan's major zinc producers set up a joint venture under the name of Akita Seiren and started the construction of a refinery located at Iijima. Full-scale operations are expected to start in April 1972 when 6,500 metric tons of zinc a month will be produced. By June 1974 capacity will be doubled to 13,000 tons per month. Owners of this new smelter and their ownership share in percent are as follows: Dowa Mining Co., 52 percent; Nippon Mining Co., 14 percent; Sumitomo Metal Mining Co. 14 percent; and 5 percent each by Mitsubishi Cominco Smelting Co. Ltd., and Toho Zinc Co. All ores required will be supplied at first by Dowa Mining (4,500 metric tons in terms of zinc), Sumitomo (1,000 metric tons) and Nippon (1,000 tons). Finally, however, when capacity of plant is increased other firms will also be supplying ores.

Early in 1971 five zinc smelters of Japan, Dowa Mining, Mitsui Mining and Smelting, Mitsubishi Metal Mining, Nippon Mining, and Sumitomo Metal Mining decided upon the joint imports of zinc concentrate and copper concentrate on a long-term basis from Priesca Mining Company of South Africa. Over a 5-year period, Japanese firms expect to receive from this source 250,000 metric tons of zinc concentrate (containing 137,500 tons of zinc) and 90,000 tons of copper concentrate (containing 22,500 tons of copper).

Processing facilities of lead and zinc companies at yearend 1969 were as follows:

Company and facility	Annual capacity (thousand metric tons)	
	Lead	Zinc
Dowa Mining Co., Ltd.:		
Kosaka	2	18
Hachinohe Refining Co., Ltd.:		
Hachinohe	28	64
Mitsubishi Cominco Smelting Co., Ltd.:		
Naoshima	36	--
Mitsubishi Metal Mining Co., Ltd.:		
Akita	--	102
Hosokura	20	22
Mitsui Mining and Smelting Co., Ltd.:		
Hikoshima	--	60
Kamioka	20	56
Miike	--	76
Takehara	10	--
Nippon Mining Co., Ltd.:		
Mikkaichi	--	108
Saganoseki	29	--
Nippon Soda Co., Ltd.:		
Aizu	5	30
Sumiko Imperial Smelting Process Co., Ltd.:		
Harima	30	42
Sumitomo Metal Mining Co., Ltd.:		
Kumitomi	20	--
Toho Zinc Co., Ltd.:		
Annaka	--	174
Chigirishima	54	--
Total	254	752

Manganese.—Late in 1970 Tekkosha Company, Ltd., began trial operations of their new electrolytic managanese plant located at Hyuga Kyushu, Japan. The plant has a capacity of 500 metric tons a month. Tekkosha is currently producing 530 metric tons at the Yamagata works; therefore, the company's total production will be 1,030 tons of electrolytic manganese per month. The new Hyuga plant, including an 11,000 kilowatt electric powerplant, cost about $7 million. Most of the manganese ore needed for making ferroalloys and steel is imported with 1970 imports in excess of 2.5 million tons.

Mercury.—Toward the end of 1970 the Nomura Mining Co. Ltd. resumed extraction of mercury, producing about 300 to 350 flasks (76-pound) per month from mercury ores and concentrates imported from Canada. Additionally, the company hopes to produce 29 to 45 flasks of mercury per month from the company's Itomuka mine within Japan.

Molybdenum.—A consortium that consists of the United States firm, American Metal Climax, Inc. (AMAX), and 10 Japanese companies plan to construct a 5,443-

metric-ton-per-year molybdenum roaster in Japan. AMAX will have a 34 percent interest in the $5.5 million project. The plant is scheduled for completion during 1971. The new plant will account for a substantial portion of Japanese consumption. Consumption in 1969, all met by imports, amounted to about 7,500 metric tons of contained molybdenum. By 1976 consumption is forecast to be 14,000 metric tons.

Nickel.—Production of nickel metal during 1970 increased by nearly 31 percent over that in 1969, or 13,393 metric tons. Despite the remarkable growth in the production of nickel in Japan, the country is completely dependent upon imported raw materials. Supplies are imported either as ores or concentrates for smelting, matte for refining, and ferronickel for direct use in the steel industry. Since 1959 Japanese nickel consumption has grown at an annual compound rate of 20 percent, reaching 82,170 metric tons in 1969. The growth rate of the free world for the same period of time is estimated at 7 percent per year. Most of the nickel consumed in Japan is used in the manufacture of special and stainless steels.

During 1970 the U.S.S.R. sold several hundred tons of nickel cathodes to Japan. Future purchases of Soviet nickel were being negotiated by Sumitomo Metal Mining Co. The Soviets sought Japanese assistance in the development of nickel mines in the Kazakh area, proposing that Japan provide about $100 million worth of machinery in return for 5,000 to 10,000 metric tons of nickel matte per year for a period of 10 years after 1974.

Kobe Steel Works, Mitsui Mining and Smelting, and other unspecified Japanese firms are expected to provide the Marinduque Mining and Industrial Corp. with $60 million for the development of nickel deposits on Nonoc Islands of the Philippines. According to a proposal, 35,000 metric tons of powder and briquets and 12,000 metric tons of matte (24-percent nickel and 9-percent carbon oxide) are to be produced annually. The Japanese firms would get 12,000 tons of the nickel matte and 6,000 tons of briquets annually beginning at the end of 1971. A French Government decision to curb exports of nickel ore from New Caledonia, a major Japanese source, could result in Japan's taking more from Australia. The French Government wanted Japan to buy processed nickel products as well as ores.

Japan's Sulawesi Nickel Development Company (SUNIDECO), Celebes, signed a supplementary contract with Indonesia to buy 200,000 metric tons of nickel ore for delivery in 1970. This is in addition to an earlier contract for 600,000 tons to be imported from June 1970 to May 1971. In December 1970, however, the Indonesian Minister of Mines indicated that his government wished to postpone for a short while the development of nickel resources in the Pomala district of the Celebes Islands.

Mitsui Mining and Smelting was negotiating for the prospecting and mining of a nickel deposit in Australia jointly with the Australian company, Northman Gold Mine Pty.

Tin.—As the world's second largest consumer of tin, Japan continued to rely mainly on foreign (principally Malaysian) metal to meet demand. In 1970, imports topped 26,000 long tons. The most important use was in tinplating, and at yearend Japan had about 10 large tinplate lines in operation. Mitsubishi Metal Mining Co., with mines at Akenobe and Ikuno, was the only important Japanese tin producer.

Titanium.—Japan has been the third-ranking world producer of both sponge and ingot titanium for some years, after the United States and the U.S.S.R. Late in 1970 the New Metals Industries Co., subsidiary of Nippon Soda and Teijin Ltd., started up trial operations at its new plant at Nihongi (Nakago). This plant uses metallic sodium in a new single-step reduction process, in contrast to the conventional two-step Kroll magnesium reduction process employed by Japan's two other sponge titanium producers—Osaka Titanium Co. Ltd. and Toho Titanium Co. Ltd. Monthly capacities for these three plants were as follows, in metric tons: Osaka—400; Toho—350; and New Metals—180.

Kobe Steel produces two-thirds of Japan's ingot titanium; monthly capacity of its Takasago plant was about 250 tons in 1970. Three other companies produced ingot: Nippon Mining (parent company of Toho Titanium), Nippon Stainless Co. (sister company of Osaka Titanium and both companies are subsidiaries of Sumitomo interests), and Furukawa Electric Co. The same four firms were in the titanium-rolling business. Expansion plans were as follows, in metric tons per month of ingot: Kobe Steel—500 (already 400 early in 1971), Nippon Mining—80; Nippon Stainless—50, and Furukawa—30. Mitsubishi Metal Mining is building a facility of 30 to 50 tons per month. The only titanium slag producer of note in Japan during 1970 was Hokuetsu Metal Company. Japan has long been an important world producer of titania pigment.

Uranium.—The Japan Atomic Energy Industry Conference has forecast that in the 5 years between 1975 and 1980 electricity generated by nuclear energy will rise from an estimated 6 million kilowatts to 27 million kilowatts. This latter figure is expected to double again by 1990 and the predicted accumulated demand for uranium oxide over the next 20 years will be between 190,000 and 200,000 tons per year. Japan's long-term contracts for uranium oxide are currently running at only 30,000 tons annually; consequently, Japan must obtain significant new sources of uranium oxide to meet the above targets. Japan's domestic uranium reserves are small.[7]

Other Metals.—Japan was a major world producer and consumer of a great many other metals, including highpurity metals. Because of its considerable nonferrous-base-metal smelting and refining capacity, the country ranked within the first five in the world in metals like bismuth, cadmium, selenium, tellurium, magnesium, and germanium.

NONMETALS

Fertilizer Materials.—On August 15, 1970, Japan negotiated a contract to deliver about 1.165 metric tons N (contained nitrogen) in all fertilizers to mainland China, including 793,000 tons N of urea (conversion factor is 0.454), 204,000 tons N of ammonium sulfate (conversion factor is 0.212), and 165,000 tons N of ammonium chloride (conversion factor is 0.262), for delivery before July 1971. The contract prices for Japanese shipments, c.i.f. China ports, were $56 for urea, $31 for ammonium sulfate, and about $30 for ammonium chloride, respectively. The overall Japanese contract, therefore, would amount to roughly $135 million, including transport. China was represented by the National Chemical Import and Export Corporation. The Japanese contracting groups were the Japan Union Fertilizer Company (for ammonium chloride), the Japan Ammonium Sulphate Industry Association, and the Japan Urea and Ammonium Sulphate Export Company.

On the supply side Japan and the Government of Saskatchewan, Canada, signed an agreement whereby Japan will purchase at least 1 million tons of potash during the next 5 years at a guaranteed price of $18.75 per ton even though world prices might drop below this level. In recent years Saskatchewan has provided about 40 percent of Japan's potash requirements. Three major privately owned Saskatchewan companies will provide the potash.

Quartz and Silicon.—During 1970 silicon metal, silicon alloys, and ferrosilicon were in short supply in Japan. In May the Nippon Heavy Chemical Company closed its Ono Works, the only plant-producing metallic silicon. As a result of heavy subsequent demand, however, Nippon instead of reopening the Ono Works acquired the Wakagawa Works of Tohoku Heavy Chemical Industries Company and began production of metallic silicon at this latter plant in Iwate prefecture. Due to repair work in September and October, monthly production averaged only 150 metric tons, one-half the plant capacity. To insure an adequate supply of high-grade lump quartz needed for the production of silicon metal and alloys, The Nisho-Iwa Co., a trading company, signed a contract with the Sona Quartz Works of India for delivery of quartz with a silica content of 98 percent or better.

Sulfur.—Due to high levels of sulfur consumption and the unexpectedly low rate of sulfur recovery at Japanese petroleum refineries, Japan found it necessary to import 44,224 metric tons of sulfur during 1970 to supplement that produced from indigenous resources. Tentative forecasts of the Japan Sulfur Consumers Council indicated that sulfur demand in fiscal 1971 (April 1971-March 1972) will be 430,077 metric tons, an increase of slightly more than 100,000 metric tons over estimated consumption of 328,726 tons in fiscal 1970.

Part of this increase is due to the completion of a new sulfuric acid plant of

[7] Mining Journal (London). V. 275 No. 7050, Oct. 2, 1970, p. 1.

Nihon Rinjan which is using elemental sulfur as the raw material. This is the first plant of its kind ever built in Japan as the other plants manufacture sulfuric acid exclusively from pyrites and smelter gas and not elemental sulfur. The Japanese Government approved of this type plant due to an extreme shortage of sulfuric acid. The plant produces 1,000 metric tons of sulfuric acid per day, consuming approximately 300 metric tons daily of elemental sulfur.

Japan retained its position as the world's foremost pyrite producer with output on the same order as the 3 million metric tons reported for 1969. Production of elemental sulfur from oil refining increased nearly 17 percent to approximately 238,000 metric tons in 1970, whereas production from sulfur mines was cut in half dropping to not much more than 100,000 tons.

MINERAL FUELS

Coal.—The worldwide shortage of coking coal caused the Japanese to intensify efforts to secure additional long range suppies. The steel boom in Japan has been without parallel, with most of the growth achieved in the last decade. A conservative estimate of Japan's annual steel output by the late 1970's would be 150 million metric tons, which in turn would require as much as 90 million metric tons of coking coal. Japan's domestic coal production is currently running at only 12 million metric tons of usable coking coal per year and 44 million tons all told, with the downward trend continuing. Thus, low volatile foreign coking coal has been and will be indispensable to the Japanese steel industry for blending with indigenous coal and for direct use.

Many major coal supply contracts have been negotiated by Japanese firms during recent years. For example, a contract for 27,400,000 metric tons of Witbank coal was signed early in 1971 by Japanese steel makers and the Transvaal Coal Owners Association. This coal from South Africa will be delivered over a 13-year period beginning in 1972.

In Australia an agreement was reached with Central Queensland Coal Associates, a subsidiary of Utah Construction & Mining Co. of the United States, for the purchase of 85 million tons during 13 years commencing in 1971. Japan has already contracted for more than 150 million tons of Australian coal, all told, to be delivered in about 15 years.

Early in 1971, Japanese steel mills were negotiating with the Canadian firm, McIntyre Porcupine Coal Mines, Ltd., for roughly 45 million tons of coking coal over a 15-year period. The contract worth approximately $1 billion will involve shipments to commence around 1974 from the Smokey River properties in Alberta. The Japanese will furnish loans for the development of a new mine and related installations. Previously, in August 1970, McIntyre had signed another contract for 30 million tons of coking coal in 15 years from a different property. So far, Japan has contracted to import a total of approximately 220 million metric tons of coal from Canada for delivery within the next 18 years. Late in December 1969, 11 Japanese coal mining companies joined 10 steel companies to form the Japan Overseas Coking Coal Development Co., Ltd., which undertook as its firm's major project an intensive exploration program in western Canada.

To facilitate coal imports from the U.S.S.R., a major Japanese steamship company—Yamashita Shinnihon—signed a contract with the Soviets to develop Vrangel Port. The Japanese will provide $80 million in credits for the Soviet purchase of Japanese equipment and materials for this project. Construction will begin in 1971; when completed in 1973, the Vrangel Port will be able to handle 10 million metric tons of coal per year. Resumption of large-scale imports of coking coal from mainland China was also being investigated.

During 1970, however, the United States remained Japan's principal source of coking coal, supplying about 25 million metric tons, or more than half of Japan's total imports of coking coal. The Japanese have been attempting to diversify sources of coking coal so as to reduce dependency on the United States to about one-fourth by 1975. The current U.S. shortage of coking coal and higher transportation costs as compared with Canadian or Australian coal are added inducements for Japanese steel firms to seek other sources. In further moves to cut down on coking coal cost, the Japanese plan to reduce spot-contract coking coal purchases and sign more long-term and industry-wide contracts.

Because of anticipated cutbacks in steel production for 1971, Nippon Steel Corp. renegotiated some contracts with U.S. firms to reduce coal deliveries by approximately 2 million metric tons. Despite this cutback, Japan still intended to import about 25 million tons of U.S. coking coal during fiscal year 1971. During 1970, Japanese steel industry representatives also visited the United States to urge U.S. coal companies not to increase prices on the coal to be delivered in fiscal 1971.

In 1970 Nippon Steel entered into an agreement with the Island Creek Coal Co., through the intermediary Nissho Iwa Co., to help develop a new coking coal mine in Virginia. The Japanese agreed to a loan of $25 million in exchange for a contract to obtain 30 million tons of high-quality coking coal over a 15-year period. This project was unprecedented in Japanese-U.S. minerals trade representing the first large-sale Japanese loan to a wholly owned U.S. company for mine development.

Other contracts with the United States have been long-term or short-term purchase contracts only. The bulk of U.S. coal shipped to Japan originates from the Appalachian area. One recent purchase contract, however, was for western coal. During the year, Nissho Iwa signed a contract with North American Resources Corp. for the delivery of 5 million tons of coking coal during a 15-year span from the Thompson Creek Coal mine at Carbondale, Colorado, with shipments to begin late in 1971.

Petroleum.—In 1970 Japan strengthened its position as the world's third largest refiner and consumer of petroleum following the United States and the U.S.S.R. Refining capacity was increased by about 15 percent. Japan's refinery throughput during the year was approximately 1.2 billion barrels, roughly equivalent to the output. Breakdown of 1970 production was as follows, in percent: Residual fuel oil, 47.0; distillate fuel oil, 11.5; naphtha, 11.5; gasoline, 10.7; kerosine, 9.3; and others, 10.0.

At yearend Japan had 40 refineries owned by 26 refiners. The country's primary distillation capacity was 4,545,600 barrels per stream day, comprised of 40 atmospheric type units with aggregate capacity of 3,668,800 barrels and 27 vacuum (may be primary or secondary distillation capacity) type units totaling 871,700 barrels. Breakdown of the secondary distillation capacity, also in terms of barrels per stream day, was as follows: 31 catalytic reforming units totaling 358,800 barrels; 14 fuel oil desulfurization units totaling 368,760 barrels; 12 catalytic cracking units totaling 175,600 barrels; and 3 hydrocracking units totaling 12,500 barrels.

Late in 1970 MITI approved the expansion plans of 18 refining companies which would add 1,513,560 barrels per stream day to Japan's primary atmospheric crude distillation capacity. With these additional units going on stream by 1972 and 1973, Japan will have a primary atmospheric crude capacity of 5.18 million barrels per stream day by the end of 1973. The vacuum type of primary distillation capacity is excluded from this figure. Major additions to Japan's atmospheric crude distillation capacity by yearend 1973 will be as follows, in barrels per stream day: [8]

Company [1]	Dec. 31, 1970	Dec. 31, 1973
Idemitsu Kosan Co., Ltd	430,000	630,000
Nippon Oil Refining Co., Ltd	342,000	552,000
Toa Nenryo Co., Ltd	290,500	430,000
Mitsubishi Oil Co., Ltd	244,440	325,000
Maruzen Oil Co., Ltd	242,500	282,500
Nippon Mining Co., Ltd	209,350	249,350
Showa-Yokkaichi Oil Co., Ltd	180,000	290,000
Koa Oil Co., Ltd	149,000	229,000
Asia Oil Co., Ltd	125,000	185,000
Kashima Oil Co., Ltd	120,000	180,000
Toa Oil Co., Ltd	100,000	200,000
Kyushu Oil Development Co., Ltd	100,000	170,000
Kyokuto Oil Co., Ltd	60,000	100,000
Nichimo Oil Refining Co., Ltd	57,000	150,000
Seibu Oil Co., Ltd	50,000	110,000
Fuji Kosan Co., Ltd	47,600	77,600
Nihonkai Oil Co., Ltd	30,000	60,000
Tohoku Oil Co., Ltd	--	70,000

[1] Four large refiners (capacity in parentheses) with no expansion plans were: Showa Oil Co., Ltd. (195,000); General Oil Refining Co., Ltd. (175,000); Fuji Oil Co., Ltd. (140,000); and Kansai Oil Co., Ltd. (110,000).

During 1970 Japan's domestic production of crude oil amounted to 5,656,000 barrels or a mere one-half percent of the refinery throughput or total supply. Natural gas production at 2.36 billion cubic meters was also very small by world standards. In contrast, imports were indeed substantial and were growing sharply each year. Thus, sources of crude oil, whether the crude is produced by foreign or Japanese companies abroad, and the delivered price to Japan are basic factors affecting the Japanese refiners and industrial consumers of petroleum.

[8] Japan Petroleum Weekly (Tokyo). Japan Petroleum Consultants, Ltd. Jan. 18, 1971, p. 2.

The recent increase in the price of Middle East crude oil, the source of 84.7 percent of Japan's 1970 imports, has had significant repercussions. In accordance with agreements between oil companies operating in the Middle East and the Organization of Producing and Exporting Countries (OPEC), crude oil prices were raised an average of $0.28 per barrel. In addition, tanker rates were also increased substantially during late 1970 and early 1971. The Japanese have estimated that the combined increased cost of crude oil to them after June 1, 1971, will amount to $0.45 per barrel. Crude oil prices before and after price increases have been estimated as follows:

Type of crude	F.o.b. price per barrel	
	Before Nov. 13, 1970	After June 1, 1971
Iranian heavy	$1.240	$1.695
Iranian light	1.310	1.715
Arabian medium	1.230	1.683
Arabian light	1.320	1.725
Kuwait	1.220	1.675
Murban Abu Dhabi	1.380	1.783
Minas, Indonesia	1.700	2.210
Average	1.320	1.770

Following the recent OPEC oil crisis, the Japanese cabinet instructed MITI to formulate a program to intensify Japan's petroleum development efforts with a view to diversifying supply sources and increasing the share of crude oil output controlled by Japanese capital. MITI felt that a minimum of $1.68 to $1.96 billion would be required for this purpose during fiscal years 1971-75. It also believed that this amount would not be forthcoming from private sources. Accordingly, MITI proposed that new financing be provided for the Japan Petroleum Development Corporation (JPDC) by amending its charter to permit a 80- to 90 percent share (JPDC plus private) in Japanese exploration and development expenditures by fiscal year 1972. The Japan Export Import Bank also will be encouraged to increase its financing and investment in the petroleum field. Another suggestion is the issuance of resource development bonds by Japanese companies.

The need to secure funds for the promotion of large-scale production projects and to increase the domestic storage capacity for petroleum products has become apparent, and MITI has made a proposal to establish a Special Petroleum Account with funds provided by crude oil tariff revenues and transfers from general accounts. The total amount would be about $420 million. The recent oil crisis with the spectre of an oil embargo threatening Japan made it apparent that domestic stocks of petroleum were inadequate to tide the nation over another crisis. MITI's draft plan provides for the JPDC to begin the purchase of crude oil directly from producing nations and to maintain the oil in reserve stocks. It has been proposed that stocks on hand be raised from a 45-day to a 60-day supply. The 15-day increase in stocks would be divided between the Government and private companies in the ratio of 2 to 1.

By yearend 1970 Japanese companies had only limited success in the development of oilfields outside of Japan. The Arabian Oil Co. Ltd. produces oil in the Kuwait-Saudi Arabia Neutral Zone, and the North Sumatra Oil Development Cooperation Co. Ltd. produces in Indonesia. The Abu Dhabi Oil Co. Ltd. discovered oil in Abu Dhabi in 1970. During 1970 JPDC provided 20.8 billion yen (about $58 million) in financial aid to Japanese companies searching for oil overseas. The Japanese have long-term, ambitious plans to produce large quantities of oil in foreign countries. As of September 1970, Japanese companies operating abroad were as follows:

Area and name of companies	Date registered	Area of operation	Acreage (square kilometer)
Middle East:			
Arabian Oil Co., Ltd.[1]	February 1958	Offshore Neutral Zone	4,000
Abu Dhabi Oil Co., Ltd.[1]	January 1968	Offshore Abu Dhabi	3,000
Middle East Oil Co., Ltd	September 1968	do	6,500
Qatar Oil Co., Ltd	April 1969	Offshore Qatar	9,066
Egypt Oil Development Co., Ltd	July 1970	Offshore Egypt	100
Far East:			
North Sumatra Oil Development Cooperation Co., Ltd.[2]	June 1960	North Sumatra, Indonesia	3,300
Sabah Teiseki Oil Co.[2]	July 1964	South East Sabah	20,000
Japex Indonesia, Ltd.[2]	February 1966	Offshore North Sumatra	23,000
		Offshore East Kalimanton	34,000
		Offshore South Kalimanton	130,000
Kyushu Oil Development Co., Ltd.[2]	July 1967	Offshore South East Kalimanton	65,000
Sabah Marine Areas Co., Ltd [2]	December 1969	South East Sabah	3,712
Australia:			
Japex (Australia)	October 1966 (Australia)	New Guinea	25,000
		Offshore Queensland	20,738
North America:			
Japex Canada, Ltd	August 1966	West Canada	2,142
Alaskan Petroleum Development Co., Ltd.	September 1966	Cook Inlet and Bristol Bay	1,300
North Slope Oil Co	February 1970	(3)	--------

1 Producing companies.
2 Production-sharing contracts.
3 Being prepared for acquisition.

Source: World Petroleum. December 1970, v. 241, p. 43.

Japanese and foreign companies have begun the search for oil in offshore areas. Hitherto, Japan's offshore activity has been limited to areas close to Akita and Niigata. Mitsubishi interests, jointly with Shell, formed the West Japan Oil Exploration Company to search for oil in the offshore area covering over 61,000 square kilometers of promising sectors. This company had planned to start exploration drilling in February 1971 and was hopeful that favorable geological formations uncovered by seismic surveys would prove to have economic oil reservoirs.

Nippon Oil Development Company has applied for drilling rights (including search rights) over an area of 29,000 square kilometers in the East China Sea. The company will start seismic surveys in the fall of 1971. Caltex Petroleum Corp., which holds a 50-percent interest in Nippon Oil Refining Co., Ltd., will jointly explore in the area noted above.

Teikoku Oil Company has also applied for drilling rights on some 27,000 square kilometers in the offshore areas west and south of Kyushu Island and east and south of northern Honshu Island. Idemitsu Kosan Company is carrying out seismic surveys over an area of 23,000 square kilometers in collaboration with Standard Oil Co. of Indiana.

Japex and Mitsui Mining and Smelting Co. have applied for drilling rights offshore to the north of Hokkaido, Japan's northernmost island. Thus, major parts of Japan's offshore areas have already been examined for oil or are in the process of being explored.

In view of the growing interest in offshore oil, MITI plans to promote more exploration by Japanese companies. Full-scale geological surveys of the Continental Shelves around Japan are planned by the Industrial Technical Agency of MITI. If any oil or gas is found, the oil-hungry Japanese market can easily absorb this. Such domestic reserves will of course contribute to security in oil and diversification of supply sources for Japan. Additional offshore activities in more distant areas are dependent upon the establishment of offshore boundaries between the Republic of Korea and mainland China.

Domestic consumption of petroleum products continued to rise sharply. The 1.17 billion barrels consumed was 11 percent higher than in 1969.

Two separate petroleum product pipeline projects were being investigated, one by the oil industry and another by the Japan National Railway Corporation. The objective would be to supply motor gasoline, kerosine, and automotive diesel oils to inland customers in the Kanto area including Tokyo, Chiba, Saitama, Ibaraki

Gumma, Tochigi, and partially Yamanashi and Nagano prefectures starting in 1975.

The Chu or central project proposed by the Japan Petroleum Pipeline Company, which was formed October 30, 1970, by 28 Japanese refiners and marketers would have the following components:

Line	Pipe diameter (inches)	Length (kilometers)
Anegasaki to Goi	18	11
Goi to Tokyo terminal	20	20
Tokyo terminal to Saitama terminal	22	38
Foric station to Tichigi terminal	14	38
Foric station to Gumma terminal	14	60

The Japan National Railway loop project, with the objective of accommodating 35.8 million barrels per day throughput in 1975 and 142.6 million in 1985, is summarized as follows:

Line	Pipe diameter (inches)	Length (kilometers)
West line:		
Keihin gathering line	12	38
Tsurumi/Kawasaki Station to Takasaki Terminal	16	40
Hachioji Terminal to Takasaki Terminal (via Komogawa)	16	94
East line:		
Sodegaura Station to Mianami Saitama Terminal	20	84
Minami Saitama Terminal to Utunomiya Terminal	20	79
Loop: Komagawa to Minami Saitama Terminal	16	31

Product distribution and the marketing system in Japan have relied upon coastal tankers and railroads for refinery-to-terminal transportation and upon trucks for terminal-to-customer destinations. It is now felt, however, that pipelines can play an important part in the inland distribution system, which is becoming paralyzed because of increasing traffic congestion on the railways as well as on the roads.

The Mineral Industry of Kenya, Tanzania, and Uganda

By Robert G. Clarke [1]

Kenya, Tanzania, and Uganda comprise the East African Common Market (EACM) and belong to the East African Common Services Organization (EACSO) which administers railways and harbors, collection of customs and excise revenue, postal and telecommunications services and civil aviation. The EACM mineral production in 1970 was valued at $84.9 million, an increase of $1.4 million over that of 1969.[2] The increase was due principally to cement and soda ash production in Kenya. Trade activity of the EACM in 1969 in million dollars is summarized in the following tabulation:

EACM exporting country	External EACM exports	EACM exports	Within EACM: Kenya	Within EACM: Tanzania	Within EACM: Uganda
Kenya	177.3	80.7	--	36.0	44.7
Tanzania	233.4	14.6	11.3	--	3.3
Uganda	195.7	26.6	21.8	4.8	--
Total	606.4	121.9	33.1	40.8	48.0

KENYA

Kenya's mineral industry held a small place in the country's economy in 1970. Mineral production was valued at $27.3 million compared with $18.8 million in 1969. Major commodities were cement 801,615 tons and soda ash 167,477 tons.

By amendments to the Mining Act, the Government of Kenya encouraged prospecting and exploitation of mineral resources by both foreign and native enterpreneurs.[3] The changes were made to help both small and large operators; the Mines and Geological Department identified or analyzed over 5,000 samples in 1970. As a further example of the Government's interest in promoting development of Kenya's natural resources, construction was begun on a new building in Nairobi to house the headquarters of the Mines and Geological Department.

PRODUCTION AND TRADE

The available data for mineral production and trade are given in the following tables:

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[1] Physical scientist, Division of Nonmetallic Minerals.

[2] Where necessary, values have been converted at the following rates: Kenya shilling 1, Tanzania shilling 1, and Uganda shilling 1=US$0.14.

[3] Omamo, W. O. New Horizons in Mineral Development. Inside Kenya Today, No. 11, March 1971, pp. 8–10.

Table 1.—Kenya: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Beryllium, beryl concentrate, gross weight	r 11	3	4
Copper mine output, metal content	r 38	77	79
Gold mine output, metal content troy ounces	r 31,988	17,903	--
Silver mine output, metal content do	r 2,770	1,668	--
NONMETALS			
Abrasives, natural, corundum	43	119	60
Barite	r 351	435	447
Carbon dioxide, natural	819	761	763
Cement, hydraulic	r 543,194	642,381	801,615
Clays:			
Bentonite	NA	NA	56
Kaolin	1,332	1,472	1,770
Diatomite	2,055	2,303	1,601
Feldspar	535	1,560	895
Fertilizer materials, crude phosphatic, guano	41	360	638
Fluorspar	192	1,861	3,904
Gaylussite [1] kilograms	62	15,000	204
Gem stones, precious and semiprecious:			
Amethyst carats	13,608	680,388	290
Apatite (gem quality) do	6,805	85	--
Aquamarine do	30,000	38,980	56,700
Chrysoprase kilograms	9	--	--
Garnet [2] do	210	116	7,460
Ruby carats	45,359	11,955	12,385
Sapphire do	28,055	14,195	4,515
Tourmaline do	445	3,020	70,450
Zircon do	--	--	3,035
Gypsum and anhydrite:			
For cement production	41,602	61,365	59,020
Other	501	480	1,067
Total	r 42,103	61,845	60,087
Magnesite, crude	68	503	4
Meerchaum kilograms	82	1,851	70
Mica	371	--	--
Salt:			
Marine	27,807	37,363	35,420
Rock	33,194	4,924	3,851
Total	61,001	42,287	39,271
Soda, raw crushed (trona)	2,283	2,568	2,879
Soda ash	r 117,244	105,908	167,477
Stone, sand and gravel:			
Calcareous:			
Calcite not further described	NA	NA	51
Kunkur for cement manufacture	65,752	95,702	57,118
Limestone for cement manufacture thousand tons	NA	832	1,048
Limestone, other	NA	NA	24
Limestone products not further described	18,568	2,409	24,149
Quartzite	11	--	22
Sand, glass sand only	NA	NA	12,348
Shale	89,534	123,613	144,000
Volcanic ash for cement manufacture	3,919	1,666	863
Vermiculite	279	776	1,668
Wollastonite	1,382	691	100
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor thousand 42-gallon barrels	r 2,203	2,508	2,663
Jet fuel do	879	1,192	2,365
Kerosine do	r 729	946	574
Distillate fuel oil do	2,956	3,230	3,306
Residual fuel oil do	r 6,391	6,760	7,439
Other do	347	419	797
Refinery fuel and losses do	649	805	341
Total do	r 14,154	15,860	17,485

p Preliminary. r Revised. NA Not available.
[1] Hydrous sodium-calcium carbonate mineral.
[2] Quality (gem or industrial) not specified.

Table 2.—Kenya: Exports of major mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Beryllium, beryl ore and concentrate	7	--
Gold, unworked or partly worked troy ounces	24,772	16,044
Iron and steel:		
Metal:		
Scrap	2,406	3,739
Semimanufactures	2,421	3,035
Other nonferrous, scrap	1,882	2,200
NONMETALS		
Abrasives	569	619
Cement	239,039	309,041
Fertilizer materials manufactured	1,374	1,425
Lime	7	22
Salt and brines	1,580	210
Sodium compounds, soda ash, sodium carbonate	112,495	86,260
Stone, sand and gravel	59	558
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon	2,172	733
Petroleum:		
Refinery products:		
Gasoline thousand 42-gallon barrels	191	157
Kerosine and jet fuel do	559	1,302
Distillate fuel oil do	802	674
Residual fuel oil do	4,152	3,701
Other do	133	147

[1] Excludes reexports.

Table 3.—Kenya: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	724	983
Copper metal including alloys, all forms	588	585
Gold ..... troy ounces	7,318	7,030
Iron and steel:		
Ore and concentrate	--	5,762
Metal:		
Scrap	1	--
Pig iron, ferroalloys and similar materials	961	577
Steel primary forms, ingots and other	270	16
Semimanufactures:		
Bars, rods, angles, shapes, sections	29,270	33,776
Universals, plates, and sheets	606,262	832,322
Hoop and strip	1,586	2,144
Rails and accessories	12,040	3,414
Wire	7,233	7,543
Tubes, pipes, and fittings	12,932	7,279
Castings and forgings, rough	89	--
Lead metal including alloys, all forms	279	316
Tin metal including alloys, all forms ..... long tons	1,024	1,073
Zinc metal including alloys, all forms	1,181	1,924
Other nonferrous, scrap	121	143
Nickel metal including alloys, all forms	5	4
NONMETALS		
Asbestos	--	3
Cement	r 1,265	1,215
Clays and products (including all refractory brick):		
Crude n.e.s	r 857	861
Products	r 1,744	2,123
Feldspar, fluorspar, cryolite, and chiolite	962	310
Fertilizer materials:		
Crude:		
Nitrogenous	--	29
Phosphatic	151	--
Other	14	--
Manufactured:		
Nitrogenous	23,303	11,084
Phosphatic	19,422	17,864
Potassic	2,316	2,548
Other including mixed	12,071	33,737
Ammonia	36	53
Graphite, natural	10	5
Lime	108	91
Mica, all forms	32	23
Salt and brines	7,692	4,387
Stone, sand and gravel:		
Dimension stone	34	104
Dolomite	62	48
Gravel and crushed rock	528	604
Quartz and quartzite	1	--
Sand	30	46
Limestone [1]	11,289	94
Sulfur, elemental, all forms	519	543
MINERAL FUELS AND RELATED MATERIALS		
Coal including briquets all grades	40,302	31,358
Coke and semicoke	1,373	1,190
Petroleum:		
Crude and partly refined ..... thousand 42-gallon barrels	r 14,441	15,206
Refinery products:		
Gasoline ..... do	422	171
Kerosine and jet fuel ..... do	r 647	644
Distillate fuel oil ..... do	227	264
Residual fuel oil ..... do	71	1
Lubricants ..... do	239	205
Other ..... do	r 34	26

r Revised.
[1] Includes gypsum, plasters, and similar stone used for the manufacture of lime or cement.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—Kenya's first steel rolling mill was opened in the autumn of 1970.[4] The mill was estimated to cost $2.8 million and will have a capacity of 36,000 tons of rolled steel bars and about 12,000 tons of wire products per year when fully operative. Expansion plans include a

[4] International Financial News Survey. New Steel Rolling Mill in Kenya. V. 23, No. 7, Feb. 24, 1971, p. 54.

wire galvanizing line and an electric arc furnace at a total cost of about $1.4 million.

The Mines and Geological Department evaluated a lead-silver-zinc deposit that contained 1 million tons of minable ore in an area just north of the Port of Mombasa. A joint Romania-Kenya Government consortium started mining operations and carried out further prospecting in the area to expand the reserves.

South of Mombasa, at Mrima Hill in Kwale district, a French company commenced pilot plant extraction operations to remove columbium and europium from rare earths in a recently discovered deposit.

Nonmetals.—*Fluorine.*—The Government owned Industrial and Commercial Development Corp., Bamburi Portland Cement Co. Ltd., and Continental Ore Corp. of New York signed an agreement to establish a project in the Kerio Valley, near Eldoret, for the production of acid-grade fluorspar. The new company, Fluorspar Co. of Kenya Ltd., will have a capacity of 20 times the present output of fluorite in Kenya and will produce mostly for export.

Mineral Fuels.—*Petroleum.*—Oil exploration continued, particularly along the coast, but no positive indications of economic deposits of oil were found. The Kenyan Government announced acquisition plans of a 50-percent shareholding in the Mombasa oil refinery after discussions with representatives of British Petroleum Ltd., Caltex, Esso, and Shell, the owners of East African Oil Refineries Ltd.[5] The throughput at the refinery dropped, but the value of the output increased owing to the manufacture of high-value petroleum greases.

TANZANIA

Diamond continued to be the most important mineral mined and accounted for about 88 percent of the total value of mineral exports. Diamond production in 1970 was valued at $22.5 million compared with $25 million in 1969. The value of total mineral production in 1970 was $25.7 million; minerals exported were valued at $24.7 million, 9 percent less than in 1969. The Government owned National Development Corp. (NDC) had varying percentages of ownership in many companies. Its holding in the diamond industry were the largest profitmaker for 1970. All diamond sales are through the Central Selling Organization.

An NDC subsidiary, the National Steel Corp., received approval for a plan to develop iron ore deposits located in the Livingstone Mountains of southwestern Tanzania.[6] Williamson Diamonds Ltd. was especially active in prospecting for diamond and other minerals. The Mineral Resources Division of the Ministry of Commerce and Industries continued investigations for a variety of minerals.[7]

Prospecting for gem stones was quite competitive at the beginning of the year, but in August the Government issued orders restricting prospecting for gem stones by private individuals. A detailed prospecting program in northeastern Tanzania, where tanzanite (blue zoisite) occurs, was carried out in order to further the understanding of the underlying geological factors. Four residential courses in mineral exploration studies were held for prospectors at Morogoro, and two mobile courses were held in Dodoma and Ruvuma Regions. General contractors to the Tanzania Petroleum Development Corp. conducted seismic surveys, both land and sea, throughout the year. Underground prospecting for gold at Buck Reef in Rwamagaza in the Geita District was done, but no success was reported. Likewise, the drilling program of the copper anomaly in the Chunya District was discouraging.

By the end of 1970, a staff of more than 50 experts from the U.S.S.R., based at Dodoma, were working on a project to geologically map 17,000 square miles of western Tanzania. Field data were ready

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[5] Kenya. International Financial News Survey. V. 23, No. 1, Jan. 13, 1971, p. 6.

[6] Jenga. Studies Continue on Giant Iron and Coal Project. No. 7, 1970, p. 11.

[7] Mineral Resources Division, Ministry of Commerce and Industries (Dodoma). Review of the Mineral Industry of Tanzania for the Year 1970, 1971, 11 pp. (This review provided a great amount of the information for other parts of this subchapter.)

on four quarter-degree sheets at yearend. Detailed mineral prospecting will be based on the results of the overall survey.

Powell Duffryn Technical Services Ltd., British mining consultants, started preparation of a feasibility report on the quantity and quality of ore reserves in the magnesite deposit at Chambogo, in northeastern Tanzania, for Tanganyika Magnesite Mines Ltd.[8]

PRODUCTION AND TRADE

The available data for mineral production and trade are shown in the following tables:

[8] Industrial Minerals (London). PDTS to Report on Reserves. No. 38, November 1970, pp. 33–34.

Table 4.—Tanzania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Gold refined troy ounces	17,473	16,015	[1] 7,859
Silver refined do	2,387	2,123	1,062
Tin mine output, metal content long tons	r 203	112	104
Tungsten mine output, metal content	r 16	6	--
NONMETALS			
Clays, kaolin	r 586	721	464
Cement, hydraulic	r 156,337	169,637	167,296
Diamond:			
Gem e 2 carats	356,114	394,086	359,030
Industrial e 2 do	346,281	383,203	349,115
Total do	702,395	777,289	708,145
Gem stones, precious and semiprecious, except diamond:			
Amethyst kilograms	67	NA	153
Aquamarine do	4	10	--
Beryl (gem only) do	--	19	17
Chrysoprase and opal do	23	--	2
Corundum (gem only) do	80	57	142
Garnet do	156	66	146
Ruby and sapphire do	295	239	61
Tourmaline do	136	87	46
Zircon do	39	10	4
Zoisite (tanzanite) do	21	20	66
Gypsum and anhydrite, crude	r 4,321	10,684	20,718
Lime (quicklime and hydrated)	r 6,446	10,570	346,025
Magnesite, crude	r 1,401	1,498	775
Meerschaum kilograms	1,180	10,860	9,760
Mica:			
Sheet	r 69	94	45
Scrap	r 231	111	13
Salt, all types	29,328	33,015	41,944
Stone, sand and gravel:			
Ornamental stones:			
Artstone	3	10	66
Amethystine quartz	3	7	(3)
Glass sand	2,023	2,625	3,938
Vermiculite	30	123	150
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	3,257	2,479	2,664
Petroleum refinery products:			
Gasoline, motor thousand 42-gallon barrels	927	926	1,039
Jet fuel do	300	291	350
Kerosine do	251	256	234
Distillate fuel oil do	901	972	1,144
Residual fuel oil do	r 1,996	2,076	2,341
Other do	253	37	48
Refinery fuel and losses do	307	358	373
Total do	r 4,935	4,916	5,529

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

[1] Exports.

[2] Data presented on gem and industrial diamond are 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 mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal, including alloys; semimanufactures	81	169
Gold unworked or partly worked ... troy ounces	17,474	16,017
Iron and steel:		
Metal:		
Scrap	1,293	3,483
Semimanufactures	1,949	740
Silver including alloys ... troy ounces	2,386	2,023
Tin ore and concentrate ... long tons	385	176
Tungsten ore and concentrate	31	20
Other nonferrous, scrap	1,028	1,150
NONMETALS		
Artstone [2]	3	11
Cement	29,076	1,812
Diamond, all grades ... carats	682,651	780,210
Gypsum and plasters	31	--
Magnesite	1,080	1,367
Mica, all forms	260	199
Precious and semiprecious stones, except diamond ... kilograms	820	513
Salt and brines	10,779	12,887
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon	390	579
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	r 1,084	1,153
Kerosine and jet fuel ... do	368	293
Distillate fuel oil ... do	1,455	1,726
Residual fuel oil ... do	1,233	800
Other ... do	--	5

r Revised.
[1] Excludes reexports.
[2] Corundum-zoisite rock; includes rough amethystine quartz.

Table 6.—Tanzania: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys:		
Unwrought	2,056	2,774
Semimanufactures	164	284
Copper metal including alloys, all forms	r 148	171
Gold troy ounces	62	152
Iron and steel:		
Ore and concentrate	2,258	1,450
Metal:		
Pig iron, ferroalloys and similar materials	1,014	1,357
Steel primary forms, ingots and other	1	2
Semimanufactures:		
Bars, rods, angles, shapes, sections	16,289	13,627
Universals, plates, and sheets	516,787	808,122
Hoop and strip	2,700	2,719
Rails and accessories	19,130	5,643
Wire	4,131	3,098
Tubes, pipes, and fittings	13,398	11,978
Castings and forgings, rough	1	--
Lead metal including alloys, all forms	65	85
Tin metal including alloys, all forms long tons	r 116	34
Zinc metal including alloys, all forms	1,851	1,984
Other nonferrous, scrap	154	143
NONMETALS		
Abrasives, natural, n.e.s	99	52
Cement	r 5,092	6,459
Clays and products (including all refractory brick):		
Crude n.e.s	r 199	335
Products	r 1,460	2,340
Feldspar, fluorspar, cryolite and chiolite	30	--
Fertilizer materials:		
Manufactured:		
Nitrogenous	2,354	4,121
Phosphatic	2,676	3,029
Potassic	1,449	1,688
Other including mixed	12,963	15,150
Ammonia	50	27
Graphite, natural	31	1
Lime	639	312
Mica, all forms	24	13
Salt and brines	r 5,791	17,090
Stone, sand and gravel:		
Dimension stone	224	84
Dolomite	15	16
Limestone [1]	5,739	112
Gravel and crushed rock	409	488
Sand	12	29
Sulfur, elemental, all forms	414	290
MINERAL FUELS AND RELATED MATERIALS		
Coal including briquets all grades	48	119
Coke and semicoke	920	332
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	r 5,600	4,594
Refinery products:		
Gasoline do	472	663
Kerosine and jet fuel do	r 112	156
Distillate fuel oil do	r 927	1,896
Residual fuel oil do	4	--
Lubricants do	92	90
Other do	r 13	71

r Revised.

1 Includes gypsum, plasters, and similar stone used for the manufacture of lime or cement.

COMMODITY REVIEW

Metals.—*Gold and Silver.*—Production of gold, and silver derived as a byproduct of gold, continued to decline. Mining operations of Buhemba Mines Ltd., a subsidiary of Williamson Diamonds, ceased in June 1970, when development underground at Nyasanero failed to prove extensions of the ore body. The tonnage milled in 1970 up to the time of closing was 16,000 tons, compared with 73,000 tons milled in 1969; production of gold was 7,859 ounces, less than half of that of 1969. Gold mining on a small scale continued in the Geita, North Mara, Lupa, and Mpanda areas.

Buhemba Mines was retained as a company by NDC to manage the exploration and development program at Buck Reef in the Rwamagaza area, Geita District. Preliminary evidence from shaft sinking and horizontal development on three levels indicated grades and reserves at 6.0 pennyweight per ton for about 100,000 tons versus 12.5 pennyweight per ton for 365,000 tons found in 1968 by a drilling program by the United Nations Special Fund and the Mineral Resources Division of Tanzania.

Iron and Steel.—National Steel Corp., was placed in charge of studies to develop a steel industry that would produce initially about 150,000 tons per year. The proposed plant site is in the Livingstone Mountains between the towns of Songea and Mjombe. Iron ore deposits are estimated at 130 million tons and nearby coal deposits at 200 million tons. Limestone, which is used as flux in steel, is found in ample supply in the same area. Vanadium is present in the iron ore in significant amounts. Development of the project will be paired with construction of the Tanzam railway, which, when completed, will provide Zambia with an outlet to the sea through Tanzania and will assist in developing southern Tanzania.[9]

Tin.—Tin took second place in terms of mineral export value in 1970. At Kaborishoke, Kyerwa Syndicate Ltd., under new management, operated the open pit mine, from which 248,000 long tons of ore were mined and treated to produce 96.9 tons of concentrates, average grade 73.1 percent SnO_2. The mine is not yet working at a profit. Other small operators accounted for the remaining production of about 48 tons.

Nonmetals.—*Cement.*—The consumption of cement in 1970 was estimated at 240,000 tons and to be growing at a rate of 10 percent per year. Cement production at the Wazo Hill plant of Tanzania Portland Cement Co. Ltd., of Dar es Salaam, was 1 percent less than that of 1969 owing to breakdowns, but was well above the 160,000 ton rated capacity of the plant. To catch up with the anticipated demand, a construction program was started to increase the Wazo Hill plant capacity to 400,000 tons per year by November 1971. A feasibility study was also being carried out by NDC for construction of a cement plant near Tanga to serve the northern and eastern regions of the country.

Cement production consumed 16,500 tons of gypsum, or about 90 percent of the domestic consumption of gypsum.

Clay and Quartz (glass sand).—Tanzania Refractories and Bricks Ltd. started beneficiation of kaolinitic sandstone from deposits in the Pugu Hills and accounted for all reported kaolin and glass sand.

Diamond.—Once again, the entire diamond production came from Williamson Diamonds, and its two subsidiary companies, New Alamasi Ltd. and Kahama Mines Ltd. At the Mwadui mine of Williamson Diamonds, 3.3 million tons was mined and treated to produce 657,200 carats at a grade of 20.11 carats per 100 tons. The grade was 1.4 carat less than in 1969. Costs per ton mined increased slightly owing to the lower tonnage mined and the decreased grade of ore compared with the tonnage and grade of 1969. Sampling during the year in ground to the north of the pipe and along the southern margin added significant tonnage to the ore reserves.

At the New Alamasi mine, 608,627 tons of ore were treated yielding 35,927 carats of diamond, at a grade of 5.90 carats per 100 tons. Working costs per ton treated and per carat recovered decreased slightly.

Kahama Mines operations continued at a loss and were expected to do so until the ore reserves are exhausted in 1971. Tonnage treated amounted to 268,488 with a recovery of 14,115 carats; averaging about 5.26 carats recovered per ton treated.

Williamson Diamonds continued prospecting within its mining lease at Mwadui and elsewhere in the country. Two kimberlite occurrences were located near the Nyahua River and west of Tinde in the Tabora District, but proved uneconomical. Prospecting for diamond was started in the Old Shinyanga area. The company also prospected for base metals in the Nguala River in Chunya District. The prospecting program in Masailand was unrewarding.

Fertilizer Materials.—The fertilizer plant at Raskazone, within the boundaries of Tanga Municipality, was ahead of construction schedule by yearend.[10] The plant is jointly owned by NDC (60 percent) and Klockner Industries Anglagen of Duisberg, West Germany (40 percent). Klockner will offer technical advice, participate in the management, and purchase all fertilizer surplus that cannot be sold in East Africa.

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[9] Jenga. Rail Loan. No. 7, 1970, p. 2.
——. Studies . . . Giant Iron and Coal Project. No. 7, 1970, p. 11.

[10] Malijsulla, M. S. Tanzania's Fertilizer Plant Ready Next Year. Tanzania Maelezo Feature Service. Dec. 22, 1970, 4 pp.

Raw materials include phosphates, sulfates, potassium compounds, and liquid ammonia. Finished products will be ammonium sulfate, triple superphosphate, diammonium phosphate, and mixed fertilizers. The plant capacity is rated at 105,000 tons combined products.

Other Gem Stones.—The export of gem stones, other than diamond, increased 10 percent in weight, but the value decreased 4 percent compared with 1969. Tanzanite continued to receive great publicity. In October 1970, the German Jewel Association exhibited tanzanite in Frankfurt as the "Jewel of the Year." The Government owned Tanzania Gemstone Industries, Ltd., began operations in 1970. In August 1970, restrictions were imposed on the issue and renewal of prospecting rights that permitted prospectors to mine for all other minerals but restricted prospecting for diamond and gem stones. The measure involved the Government directly in the gem stone mining industry. Prospecting for gem stones was mainly in the northern half of the country on the "Mozambique Belt" of rocks.

Mica.—In 1970 exports of sheet mica decreased 48 percent in quantity (to 45 tons) and 26 percent in value. The mica industry of Tanzania could not secure markets because of severe competition from Indian mica and to the emergence of artificial materials that are now used as insulants.

Salt.—In terms of total mineral production value, salt ranked second in 1970. Although salt production increased 27 percent in quantity over that of 1969, some salt was imported to meet local demands in some areas. Exports of salt were entirely from the Uvinza Brine Springs plant of Nyanza Salt Mines Ltd. NDC, principal owners of Nyanza Salt Co. has contracted for the construction of new salt works to be in production by 1973. The new plant will have a capacity of 80,000 tons and will be operated on the principle of solar evaporation. Production from the Uvinza plant in 1970 was 23,075 tons, which was 1,755 tons below that for 1969.

Coastal salt works and inland salt works of other companies increased their production over that of 1969 because the rains stopped earlier in May, which made it possible to crop salt in July.

Mineral Fuels.—*Coal.*—Production of coal increased 7 percent over that of 1969. All coal was used by the tea estates. A vast increase in coal production and consumption was projected based on development of a Tanzanian steel industry for which coal would be used in both ironmaking and energy production at a thermal electric generating plant.

Petroleum.—Agip S.p.A., a subsidiary of Italy's Ente Nazionale Idrocarburi (ENI) continued exploratory seismic surveys for the Tanzania Petroleum Development Corporation. Progress was reported as good, and interpretation of the seismic surveys progressed.

UGANDA

In 1970 copper mining and smelting continued to dominate Uganda's mineral industry. Production of blister copper in 1970, was 2.4 percent higher than that of 1969. However, owing to the decline in world prices for copper in 1970, the value of Uganda output declined 5.6 percent. The effect on the value of total mineral production was a decline of 2.5 percent.

The Uganda Geological Survey and Mines Department continued its own exploration program which was supplemented by private interests.[11] For example, during 1970, Oil Ventures International Inc. surveyed by airborne methods for radioactive and associated minerals approximately 30,000 square miles in southern Uganda. The airborne results warranted more intensive ground surveys. Mineral Prospecting (Uganda) Ltd. continued prospecting over large areas primarily directed to kimberlite and diamond. Comoro Exploration Ltd. negotiated an oil and gas concession agreement with the Uganda Government over the Lake Albert section of the Rift Valley.

Exploration in the Kilembe region was continued in order to check possible extensions in the main mine area by means of induced polarization equipment to pinpoint drilling targets.

Brine deposits at Katwe in western Uganda were investigated by drilling, which indicated 20 million tons of mixed salts.

In May 1970, the Uganda Government announced its decision to purchase a ma-

[11] Central and East Africa. Uganda. Mining Annual Review. June 1971, p. 356.

jority shareholding in banks and in various industrial concerns. Since that time the policy was changed, and full details have not yet been released. New mining laws were drafted, and publication of the new laws will probably be late in 1971.

COMMODITY REVIEW

Metals.—*Beryllium.*—Beryl production increased from 286 tons in 1969 to 367 tons in 1970. The bulk of the production comes from southwest Uganda contiguous to the Rwanda beryl field and is mostly by 80 small operators.

Bismuth.—In 1970 a new area near Rwanzu opened up and bismuth production increased.

Copper and Cobalt.—Kilembe Mines Ltd. continued to be Uganda's only significant copper producer. The company treated a record tonnage of ore of 1,003,115 tons containing 1.91 percent copper and resulted in a blister copper production of 16,958 tons. Increased production was made possible by more mechanization and by improvements made to the underground backfill distribution system.

During the year, the sinking of both the 2,300- and the 2,000-foot shafts was completed and connections between the shafts were made on two levels. Ore- and waste-loading facilities, pumping arrangements, and spillage handling systems progressed.

The decision whether or not to proceed with the construction of the plant for the extraction of cobalt from pyrite residues as reported in the review for 1969, was deferred pending details of the Government policy announced in May 1970.

Table 7.—Uganda: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Beryllium, beryl concentrate, gross weight	361	286	367
Bismuth mine output, metal content ... kilograms	713	e 770	e 770
Columbium and tantalum ore and concentrate, gross weight ... do	9,144	1,900	3,000
Copper:			
Mine output, metal content	18,907	19,439	19,159
Metal, blister, primary	15,597	16,564	16,958
Gold mine output, metal content ... troy ounces	r 36	3	--
Iron and steel, steel ingots	21,416	20,551	19,521
Tin mine output, metal content ... long tons	r 169	163	123
Tungsten mine output, metal content	r 440	531	121
NONMETALS			
Cement, hydraulic	154,853	172,946	191,072
Fertilizer materials, phosphatic:			
Crude, apatite	142,240	e 145,000	218,312
Superphosphate	15,005	22,832	24,761
Lime (quicklime and hydrated)	19,890	e 20,000	21,279
Lithium minerals, amblygonite	r 49	--	--
Salt, evaporated	e 4,000	4,803	2,277

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	1968	1969
METALS		
Beryllium, beryl ore and concentrate	483	319
Copper blister and other unrefined unalloyed	15,632	16,637
Iron and steel, semimanufactures	4,634	4,487
Tin ore and concentrate ... long tons	291	232
Tungsten ore and concentrate	102	176
Other nonferrous, scrap	739	860
NONMETALS		
Cement	5,189	2,443
Fertilizer materials	r 175	8
Lime	4	5
Salt and brines	1,970	1,497

r Revised.
[1] Excludes reexports.

Table 9.—Uganda: Imports of major mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, semimanufactures	745	1,623
Copper metal including alloys, all forms	177	314
Gold ... troy ounces	1,173	2,865
Iron and steel:		
Metal:		
Scrap	1	1
Pig iron, ferroalloys and similar materials	552	529
Steel, primary forms, ingots and other	1,606	617
Semimanufactures:		
Bars, rods, angles, shapes, sections	12,579	13,113
Universals, plates, and sheets	490,870	715,820
Hoop and strip	826	1,294
Rails and accessories	431	1,663
Wire	2,849	1,986
Tubes, pipes, and fittings	4,615	5,582
Castings and forgings, rough	2	--
Lead metal including alloys, all forms	42	78
Tin metal including alloys, all forms ... long tons	121	221
Zinc metal including alloys, all forms	911	1,669
Other nonferrous, scrap	72	40
NONMETALS		
Asbestos	1,296	1,957
Cement	r 377	566
Clays and products (including all refractory brick):		
Crude n.e.s.	r 325	473
Products	r 2,978	2,268
Feldspar, fluorspar, cryolite and chiolite	1,544	2,215
Fertilizer materials:		
Manufactured:		
Nitrogenous	2,252	2,059
Phosphatic	945	635
Potassic	3,805	2,694
Other including mixed	8,588	9,712
Ammonia	25	10
Graphite, natural	4	5
Lime	5	1
Mica, all forms	1	7
Salt and brines	40,083	22,539
Stone, sand and gravel:		
Dimension stone	136	321
Dolomite	246	303
Limestone [1]	585	305
Gravel and crushed rock	300	213
Sand	19	26
Sulfur, elemental, all forms	1,614	4,532
MINERAL FUELS AND RELATED MATERIALS		
Coal including briquets all grades	86	47
Coke and semicoke	354	417
Petroleum:		
Refinery products:		
Gasoline ... thousand 42-gallon barrels	26	28
Kerosine and jet fuel ... do	4	6
Lubricants ... do	43	48
Other ... do	7	8

r Revised.
[1] Includes gypsum, plasters, and similar stone used for the manufacture of lime or cement.

Tungsten.—Continental Ore Ltd. assumed the managing partnership of one of the leading wolfram producers. The entrance of Continental Ore into the industry is expected to result in continued increases in yields and revenue.

Nonmetals.—*Cement.*—Cement production was at a record-level of 191,072 tons in 1970, compared with 172,946 tons in 1969. Uganda Cement Industry Ltd. completed construction of its second cement factory at Hima near Kasese in western Uganda, convenient to a good source of limestone. The Hima plant, after further extensions will raise Uganda production capacity to 900 tons per day. Reserves of limestone at Hima are estimated at more than 100 million tons.

Fertilizer Materials.—Production of apatite for single superphosphate production was 218,312 tons in 1970. A feasibility study for a plant to produce triple superphosphate from apatite produced at Tororo in eastern Uganda was made, and the financial requirements were considered.

Vermiculite.—The Minister of Mineral and Water Resources reported to the National Assembly the discovery of a rich deposit of high-quality vermiculite in the area around Namekara and Bukusa in the eastern region.[12]

[12] Standard Bank. Uganda. Annual Economic Review, July 1971, p. 7.

The Mineral Industry of North Korea

By Frank B. Fulkerson [1]

North Korea continued to be more important than South Korea as a mineral and metal producer, ranking about third in the Far East, behind Japan and mainland China. The country has been traditionally noted for tungsten, graphite, and magnesite, and its output of coal, lead, zinc, pyrite, and barite has also been of consequence by world standards. In addition, sizeable quantities of iron ore, cement, gold, copper, bismuth, cadmium, fluorspar, phosphate rock, salt, and talc were produced. North Korea's moderate-sized, integrated iron and steel industry was expanded somewhat in 1970. Although North Korea is endowed with a great variety of mineral resources, ores are often low grade; oil and natural gas have not yet been discovered.

At the end of 1970 it was officially claimed that the main goals of the 7-year plan had been attained. The plan, originally scheduled to end in 1967, had been extended 3 years for failure to meet objectives on schedule, owing in part to heavy military spending. It was alleged, however, that gross industrial output was 3.3 times as great in 1970 as in 1960. Also, production of capital goods increased 3.7 times and production of consumer goods, 2.8 times. During this 10-year period, the metallurgical, chemical, machine-building, fuel, power, and building materials industries in particular were greatly expanded. Electric power generating capacity was said to have been raised 1.8 times. Shortages of power and reliance on hydroelectric power were lessened due to an elevenfold increase in thermal-power generating capacity. Output of coal, iron ore, steel, cement, and numerous other mineral commodities showed significant increases. Due to greater use of scrap, dependence on local pig iron was lessened, thus relieving the shortage of coke. Cement production capacity reportedly was raised to 5 million tons per year. Facilities were completed to recover industrial ammonia by gasification of anthracite.

Large expenditures were made in 1970 to expand existing facilities and build new plants. State budgetary expenditures were put at 6 billion won, an increase of 19 percent over those of the previous year. In order to implement the heavy industry program of the initially proposed 7-year plan, the 1970 state budget allocated funds amounting to nearly 90 percent of total industrial investments for large-scale basic projects. Most of these projects were mineral-industry oriented, involving mining facilities, ore dressing and sintering plants, steel works, building materials plants, chemical industries and electric powerplants.

The new 6-year plan for 1971–76 adopted at the Fifth Korean Workers Party Congress in November 1970 envisaged that gross industrial output would jump 2.2 times in value. Specifically, capital goods production would advance 2.3 times and consumer goods production 2.0 times. During 1971–76 highest priority would be given to the development of mining and power industries. Exploration for new domestic resources would be stepped up with a view towards reducing imports. The goal is to make all industrial sectors at least 60 to 70 percent self sufficient in raw materials.

In metal mining during 1971–76, output would be increased as follows: 1.8 times for iron ore, 1.7 times for copper, 2.8 times for lead and zinc, and 1.9 times for tungsten. While placing emphasis on exploration

[1] Industry economist, Division of Nonmetallic Minerals.

for iron ore and other known minerals, geological work would also be done on mineral commodities hitherto not produced, such as mercury, and bauxite.

Other forecasts under the new 6-year plan for 1976 were pig iron and granulated iron, 3.5 to 3.8 million tons; steel ingots and castings, 3.8 to 4.0 million tons; rolled steel, 2.8 to 3.0 million tons; chemical fertilizers, 2.8 to 3.0 million tons; cement, 7.5 to 8.0 million tons; magnesite clinker, 1.6 million tons; coal, 50 to 53 million tons; and electricity, 28 to 30 billion kilowatt-hours.

Again, quoting the 6-year plan, projected output increases are as follows: Electric power, 2.1 times; mining industry, 2.0 times; metallurgical industry, 1.8 times, and the chemical industry, 2.5 times.

Specifically, the 1971–76 plan calls for increasing coal production at existing collieries and developing new coal mines in Tŏkch'ŏn, Kangŝo, Anju, and other areas. Modern preparation plants will be installed at the Anju, Kogŏnwŏn, and Chŏnch'ŏn collieries in order to produce high-quality coal. In bituminous coal mines, directives call for complete mechanization in coal faces by introducing high-performance coal-cutting equipment. In anthracite coal mines, where the level of mechanization is low, research will be conducted to devise the optimum cutting methods.

In ferrous metals, annual capacity of the Musan iron mine in the northeast would be expanded to 6.5 million tons in 1976, along with the smaller increases for lesser iron mines. Also, because North Korea has no coking coal, pig iron would be produced with the least possible consumption of coke through the preliminary treatment of iron ore before smelting in blast furnaces. Domestic fuel would be increasingly used in iron smelting, research work would be continued in electric ironmaking practice, and oxygen injection would be widely introduced in steelmaking.

Also during the 6-year plan, a steel shop with annual capacity of 1 million tons of ingot would be completed at the Kimchaek steel works on the east coast. The rolling mill at the Hwanghae steel mill south of P'ongyang would be expanded. Additional rolling mills would be installed at the Kimchaek and Kangson steel mills. A new iron works to make metal using domestic fuel would be completed. It was also planned to install small rolling mills at factories that use a great deal of steel.

In nonferrous metals, capacity of existing smelters will be increased, a new copper smelter will be built on the east coast, and an additional lead and zinc smelter will be completed on the west coast. It was also planned to build a 20,000-ton-capacity aluminum reduction plant, which presumably would be based on local nephelite.

Improved refractories would be developed. The refractory industry is one of the weak links of the country's mineral industry.

In power, new thermal facilities will be built to bring the share of output by thermal powerplants from one-third of total power to one-half by 1976.

PRODUCTION

Evidently 1970 was a year of rapid economic growth. Industrial production value was claimed to have increased 30 percent for the year compared with 15 percent in 1969. The greatly increased economic activity resulted in several mineral-related sectors finally attaining their 7-year plan goals. Production targets allegedly fulfilled in 1970 were as follows: Steel ingots, 2.2 million tons; cement, 4.0 million tons; chemical fertilizers, 1.5 million tons; and electric power, 16.5 billion kilowatt-hours. The coal industry had been previously declared as having met its objective of 23 to 25 million tons in 1968 and 1969. Iron ore and pig iron apparently reached and exceeded the goal of 7.2 million tons and 2.2 million tons, respectively, in 1969, although there was no formal announcement. In 1970 the key Hwanghae steel plant reportedly met its individual 7-year plan goal for steel ingot. Other mines and plants that were stated to have met their 7-year targets were the Songhung gold-silver-copper mine, the Nampo electrolytic zinc plant, and the Munpyong lead smelter.

Table 1.—North Korea: Estimated production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970
METALS			
Cadmium ... metric tons	105	110	110
Copper:			
Mine output, metal content	12	12	13
Metal refined, primary	12	12	13
Gold, mine output, metal content ... thousand troy ounces	160	160	160
Iron and steel:			
Iron ore and concentrate	7,000	7,500	8,000
Pig iron and ferroalloys [2]	r 2,000	2,250	2,400
Steel ingots and castings	1,750	2,000	2,200
Steel semimanufactures	1,500	1,750	1,900
Lead:			
Mine output, metal content	70	70	70
Metal, primary	55	55	55
Nickel, primary	1	1	1
Silver, mine output, metal content ... thousand troy ounces	700	700	700
Tungsten, mine output, metal content ... metric tons	r 2,150	r 2,150	2,150
Zinc:			
Mine output, metal content	120	125	130
Metal, primary	80	60	90
NONMETALS			
Barite	120	120	120
Cement, hydraulic	2,700	3,000	4,000
Fertilizer materials, crude, natural phosphates (apatite)	300	300	300
Fluorspar	30	30	30
Graphite	75	75	75
Magnesite:			
Crude	1,400	1,500	1,600
Clinker	700	700	700
Pyrite and pyrrhotite (including cupreous):			
Gross weight	500	500	500
Sulfur content	200	200	200
Salt, all types	550	550	550
Talc, soapstone, steatite, and pyrophyllite	60	70	80
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite	18,500	20,100	21,800
Bituminous [3]	4,300	4,700	5,500
Other	200	200	200
Total	23,000	25,000	27,500
Coke	2,000	2,000	2,200

r Revised.
[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, silicon, 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

As North Korea's official trade statistics are not available, data on the country's foreign trade are based upon reports from other countries.

North Korea's principal exports include iron ore, pig iron, and steel semimanufactures in the ferrous category; copper, lead, zinc, and silver in nonferrous metals; and barite, cement, magnesite, and talc in nonmetallics. Exports of zinc concentrates and metal continued to be key items in North Korea's foreign trade. Approximately 70,000 to 80,000 metric tons of zinc (half each in concentrates and metal) were exported in 1970, with all of the concentrates going to Japan and most of the metal going to Europe, primarily the Soviet Union. All of the exports of lead (perhaps 30,000 tons in 1970) was in the metal form and went predominantly to Europe. Iron ore exports in 1970 were just over one-half million tons, all to Japan.

North Korea was endeavoring to expand trade with European countries but made little inroads into these markets in 1970. Poland and Austria absorbed some magnesite, while West Germany, Belgium-Luxembourg, and the Netherlands purchased slightly greater quantities of nonferrous metals. Small shipments of mineral commodities probably were made to Hungary and Czechoslovakia. In 1970 North Korea established a trade office in Vienna as a step towards expanding commercial contacts in Europe.

Figures on mineral trade between North Korea and mainland China were not available, but tonnages probably were relatively small as compared with the trade with the U.S.S.R. and Japan—North Korea's two principal trading partners. The bulk of the country's oil requirements were met by shipments from the U.S.S.R.

Table 2.—North Korea: Apparent exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Cadmium	151	96	U.S.S.R. 43; Belgium-Luxembourg 29; West Germany 20.
Copper and alloys, all forms	1,477	1,231	Belgium-Luxembourg 991; Japan 230.
Iron and steel:			
Iron ore and concentrate	571,050	543,962	All to Japan.
Pig iron and cast iron	330,677	162,748	Japan 114,748; U.S.S.R. 48,000.
Sponge iron	31,313	30,203	All to Japan.
Iron and steel powders	--	4,079	All to U.S.S.R.
Ferroalloys	2,297	1,300	Do.
Steel:			
Primary forms	26,508	11,663	All to Japan.
Semimanufactures	85,194	84,967	U.S.S.R. 83,700; Poland 1,267.
Lead:			
Ore and concentrate	3,290	--	
Metal and alloys, all forms	29,753	26,007	West Germany 13,541; U.S.S.R. 3,400; Netherlands 3,285.
Nickel and alloys, all forms	197	--	
Silver unworked and partly worked value, thousand dollars	$2,884	$2,039	Japan $1,851; West Germany $188.
Tungsten ore and concentrate	38	28	All to United Kingdom.
Zinc:			
Ore and concentrate	7,164	73,110	All to Japan.
Metal and alloys, all forms	29,932	40,477	U.S.S.R. 15,700; Belgium-Luxembourg 5,871; Netherlands 5,670; Japan 5,078.
Other metals and alloys, all forms	32	14	Japan 9; United Kingdom 5.
NONMETALS			
Barite	88,900	46,015	All to Japan.
Cement	295,000	375,000	All to U.S.S.R.
Graphite	12,600	6,179	All to Japan.
Feldspar	101	--	
Fluorspar	14,041	4,302	All to Japan.
Magnesite	307,265	387,591	U.S.S.R. 276,200; Poland 61,250; West Germany 19,674.
Quartz and quartzite	4,308	4,586	All to Japan.
Stone, crushed including gravel	625	--	
Talc, soapstone, and steatite	45,216	70,410	U.S.S.R. 37,000; Japan 25,066; Poland 8,344.
Other, slag and similar materials from steel manufacture	16,914	--	All to U.S.S.R.
MINERAL FUELS AND RELATED MATERIALS			
Coal, anthracite and bituminous	104,025	56,440	All to Japan.

[1] Compiled from import data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the U.S.S.R., the United Kingdom, the United States, and Yugoslavia.

Source: For Poland and the U.S.S.R.: Official foreign trade statistics of the respective countries; for all other countries: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual, v. 5, (the Far East), Walker and Company, New York, 1970, pp. 68–69; 1969 Supplement to the World Trade Annual, v. 5 (the Far East), Walker and Company, New York, 1971, pp. 47–48.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum and alloys, unwrought and semimanufactures	3,183	4,362
Chromium, chromite ore and concentrates	10,000	22,000
Copper ore and concentrate	4,913	--
Iron and steel:		
Pig iron and cast iron	--	4,064
Ferroalloys	7,029	7,000
Semimanufactures	14,308	14,878
Manganese ore	19,000	21,000
Mercury ... 76-pound flasks	1,073	290
Other nonferrous and alloy semimanufactures, not further described	91	111
NONMETALS		
Asbestos	3,300	4,300
Sulfur, elemental	8,000	5,900
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades ... thousand tons	692	606
Coke ... do	195	203
Petroleum, crude and refinery products ... do	722	772
Petroleum, coal and gas-derived crude chemicals ... do	27	19

[1] Compiled from export data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, the U.S.S.R., the United Kingdom, the United States, and Yugoslavia.

Source: For Poland and the U.S.S.R.: Official foreign trade statistics of the respective countries; for all other countries: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual, v. 5 (the Far East), Walker and Company, New York, 1970, pp. 70–72; 1969 Supplement to the World Trade Annual, v. 5 (the Far East), Walker and Company, New York, 1971, pp. 49–50.

COMMODITY REVIEW

METALS

Iron Ore and Steel.—There were no specific references to North Korea's iron ore production in 1970, but the apparent increase in steel output indicates a corresponding rise in iron ore output. Exports of iron ore to Japan from Musan, by far the largest iron ore mine in North Korea, totaled 535,000 tons in 1970, about the same as in 1969.

At yearend 1970 it was declared that the 2.2-million-ton steel production target envisaged in the 7-year plan had been achieved. It was also announced that expansion and modernization projects were underway or completed at all of the major steel plants—Hwanghae, Kimchaek, Kangson, and Songjin.

Additional furnaces and auxiliary equipment were being constructed at Hwanghae, North Korea's largest steelworks. This new shop, which boasts mechanized and automated processes, was placed into operation in October 1970. An ore sintering plant was also being installed. At the Kimchaek steelworks, known projects included a furnace and a rolling shop. The nature of the projects at the Kangson and Songjin steelworks was not revealed.

Concerning output and performance at the different plants, the Hwanghae works assertedly achieved its 7-year plan targets for both steel and pig iron during 1970.

At the Kangson works all output goals for the first 6 months of 1970 were declared to have been met. Crude steel output was increased 2.2 times over that during the first 6 months of 1969, and production of slab steel, rolled steel, seamless steel pipe, welded steel pipe, and wire rope also showed sharp increases. Comparing the January-June periods of 1969 and 1970, output of seamless steel pipe and welded steel pipe reportedly rose by 2.5 times and 4.3 times, respectively. All this would imply that Kangson steelworks has been greatly expanded in recent years.

The Songjin steelworks was credited with raising steel production in its electric furnaces through cutting down raw material charging time and average heat time. It was also claimed that rolled steel production more than doubled as compared with 1969 production. The scrap iron supply for the plant was increased as a result of a province-wide scrap collecting campaign.

At Kimchaek, where no production gains were claimed in 1969, indicating progress was not entirely satisfactory, it was asserted that pig iron production had been normalized in 1970 through more automated furnace controls. The increased pig iron output made possible a significant gain in steel output also. There was no information on oxygen converters, which supposedly had been installed.

Nonferrous Metals.—Little information was available on the status of North Korea's nonferrous mines and smelters although emphasis was known to have been placed on rock tunneling, open pit mining, and improved ore beneficiation. Apparently, the country produced more than 200,000 metric tons of lead and zinc in ores in 1970 and about 13,000 tons of mine copper. The Songhung mine, the country's largest gold-silver-copper mine, was said to have fulfilled its 7-year plan targets in 1970. During 1960–70, the mine doubled its labor productivity and introduced various technical innovations, including automatic drills, high-performance ore crushers, and automated ore dressing systems. The Nampo electrolytic zinc plant and copper smelter on the west coast also achieved its 7-year plan goals, as did the Munpyong lead smelter and electrolytic zinc plant on the east coast. During the year no mention was made of North Korea's third nonferrous smelter, the Hungnam copper smelter, also on the east coast. In 1970, Japan imported 62,480 metric tons of zinc concentrates from North Korea.

NONMETALS

Cement.—It was announced that cement production reached 4.0 million tons in 1970, a substantial increase over 1969 output. As a result, the lower limit of the 7-year plan goal was achieved. It was also stated that annual capacity stood at 5.0 million tons at yearend. North Korea increased construction funds for the building materials industry by 80 percent in 1970; most of the funds were allocated for expansion and modernization of existing facilities, rather than for constructing new plants. As an example of the programs that were carried out, a new large-size two-cylinder calcining furnace was put into operation at one cement plant in 1970.

Fertilizer Materials.—In 1970 emphasis was placed on expanding the chemical industry. Construction funds allocated were increased 60 percent as compared with those in 1969. As a result of the special effort, the 7-year plan goal for chemical fertilizers was achieved, and production of other chemicals also showed significant gains. Favorable mention was made of the important Hungnam chemical complex on the east coast. There was no news on North Korea's efforts to increase the supply of apatite used to produce superphosphates.

Magnesite.—Production at the Yongyang magnesite mine, located in the Machon Mountain Range in the northeast, was substantially greater than in 1969. Other magnesite mines probably did well also. Exports of calcined magnesite to the U.S.S.R., other European countries, mainland China, and Japan continued to be an important item of foreign trade, although substantial quantities were also consumed domestically.

MINERAL FUELS

North Korea's requirements for refined petroleum products were met by imports from the U.S.S.R. The lack of references in 1970 to a planned oil refinery (the country's first) that was to be constructed with U.S.S.R. technical assistance at Sinŭiju in North Pyongan Province might mean that the project was shelved.

To develop the electric power industry more rapidly, the 1970 state budget provided 30 percent more in funds than in 1969. Because of increased expenditures, the 7-year plan output goal of 16 to 17 billion kilowatt-hours assertedly was achieved. Work on large projects like the Puch'ang thermal powerplant and the Sŏdu-su hydroelectric powerplant made significant headway, and indications are that some facilities were even placed in operation.

Coal.—The coal sector, which achieved its 7-year plan production goal of 23 to 25 million metric tons in 1968 and 1969 continued to increase output. It was announced that production in 1970 had reached 27.5 million tons, predominantly in anthracite. The mines in the northern field (Aoji, Hakp'o, and Koch'am for example), which supply the best of the country's bituminous coal, however, were especially commended for raising production through successful introduction of metal props, new coal-cutting machines, automatic loading machines, and conveyors; by carrying out intensive geological prospecting work around existing operations; and for expanding tunneling work so as to prove up new coal reserves. The need for bituminous coal as an industrial raw material was accentuated.

Emphasis was placed on large-scale strip mining in the belief that this is the best method to increase coal production in a short period of time. Land clearing and choice of stripping sites would be expedited in preparation for mining. In implementing these plans, equipment such as rotary drills and large trucks would be introduced. To streamline operation of the medium- and small-scale underground coal mines, it was planned to have the large mines provide technical assistance and take the responsibility for directing mine shaft construction and selecting the plan for mining.

The Mineral Industry of the Republic of Korea

By Harold J. Drake [1]

In recent years, growth of the Republic of Korea's mineral industry has lagged behind that of the economy as a whole, as well as that of the principal markets to which it supplies mineral raw materials. As shown in the tabulation below, the index for gross national product (GNP) in 1970 stood at 178; that for manufacturing, 265; that for building construction, 277; whereas the index for mine production stood at 153. Indexes based on the value of manufactured products imports of which mineral raw materials are an important component, stood in 1970 at 386 for chemicals and 554 for metal and nonmetal manufactures. In terms of value, about half of the mineral commodities consumed in 1970 came from foreign sources as nearly a third of domestic output was exported.

In 1970, the GNP of the Republic of Korea, at current prices, amounted to 2,562 billion won ($8.2 billion) [2] a level approximately 25 percent above that of 1969. At constant 1965 prices, the GNP amounted to 1,434 billion won ($4.6 billion), compared with 1,306 billion won ($4.5 billion) in 1969. The value of mine production (about 3 percent of GNP) at current prices rose from 40.2 billion won ($140 million) in 1969 to 47.5 billion won ($153 million) in 1970.

Trends in production since 1965, in terms of quantity, of the principal types of products of mining and petroleum refinery operations are shown as indexes in the following tabulation. Mine production in 1970 was 53 percent above that in 1965 and 20 percent above that in 1969. All of the indexes in 1970, except that of metal concentrates, were well above the levels of 1965 and 1969. Mine production of iron concentrates, constituting the great bulk of metal concentrates, was 20 percent below that of 1969.

Virtually all of the growth goals of the

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[2] Where necessary, values have been converted from Korea won (Kw) to U.S. dollars at the rate of Kw 288.1=US$1.00 (1969) and Kw 310.6=US$1.00 (1970).

(1965=100)

Year	Gross national product [1]	Manufacturing production [1]	Construction [2]	Imports [3]: Chemicals [4]	Imports [3]: Metals and nonmetals	Mine production [5]
1965	100	100	100	100	100	100
1966	113	116	116	123	209	106
1967	123	144	151	194	354	120
1968	140	184	198	268	547	118
1969	162	225	246	329	597	127
1970	178	265	277	386	554	153

[1] Based on constant 1965 prices.
[2] Based on building construction permits in square meters of floor area.
[3] Based on the value in constant 1965 dollars of products made from minerals exclusive of petroleum products.
[4] Excludes manufactured fertilizers.
[5] Based on quantity.

	(1965=100)					
	1965	1966	1967	1968	1969	1970
Petroleum refinery:						
Production index	100	126	169	369	544	732
Total mine production:						
Thousand tons	15,379	16,327	18,377	18,084	19,568	23,492
Index	100	106	120	118	127	153
Percent of total production	100	100	100	100	100	100
Nonmetals:						
Coal (anthracite):						
Index	100	113	121	100	100	121
Percent of total production	67	71	68	57	52	53
Other:						
Index	100	89	119	159	196	240
Percent of total production	28	24	28	38	43	44
Metals:						
Concentrates:						
Index	100	108	97	117	103	87
Percent of total production	5	5	4	5	5	3
Refined metal: [1] [2]						
Index	100	113	131	141	193	311

[1] Gold and silver.
[2] Less than 1 percent of total production.

second 5 year plan, 1967–71, were achieved in 1970 but inflation during the period continued at an unacceptable rate. The third 5 year plan, 1972–76, will attempt to establish price stability and a balanced self-sustaining economic structure that emphasizes controlled growth in the agricultural and chemical industries and in heavy manufacturing industries, such as steel, shipbuilding, machinery, and petrochemicals. The plan calls for the maximum development of mineral resources and those industries consuming the products of the mineral industry.

The Asian Development Bank approved funds for a feasibility study of the Andong Dam Multi-Purpose Development Project. The dam and reservoir will supply water and generate hydroelectricity for industrial production facilities and shipyards planned for the area. The Asian Development Bank also approved a U.S.$10 million loan to the Government-owned Korea Developement Bank for relending to private industrial enterprises to finance the foreign exchange cost of machinery, equipment, supplies, and services needed to establish, modernize, or expand capital facilities.

PRODUCTION

Mineral production in 1970, at current prices, was valued at an estimated 47.5 billion won ($153 million). Nonmetallic minerals, including coal, accounted for about 97 percent and metal concentrates and refined metal for the remainder.

Production of coal (anthracite) in 1970 amounted to an estimated 12.4 million tons valued at 27.9 billion won ($90 million), compared with 10.3 million tons valued at 22.5 billion won ($78 million) in 1969. Production of other nonmetallic minerals rose 23 percent in quantity and 49 percent in value, to 10.4 million tons valued at 11.5 billion won ($37 million). Kaolin, fluorite, pyrophyllite, limestone, silica sand and stone, and salt registered significant production gains in 1970; output of amorphous and crystalline graphite and asbestos declined.

Production of metal concentrates declined about 16 percent to 685,875 tons valued at 8.1 billion won ($26 million), while that of refined gold and silver was up 62 percent as output of silver soared to 1.5 million troy ounces. Output of iron concentrate, which normally accounts for about nine-tenths of concentrate production, was off about a fifth, principally because of a decline in exports, the principal market for metal concentrates.

Additions to petroleum refining capacity in recent years have led to sharply increased output of refinery products. Overall output in 1970 was about double that of 1968 and 35 percent over that of 1969. Most of the increased output was accounted for by residual fuel oil, production of which nearly doubled in 1969 and increased again by 39 percent in 1970.

Production of hydraulic cement, steel ingot, and flat glass increased as did most chemicals and chemical products containing, as a major constituent, one or more mineral commodities.

Table 1.—Republic of Korea: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum, primary	--	6,600	15,450
Antimony mine output, metal content	31	NA	NA
Bismuth	104	r 111	106
Copper:			
Mine output, metal content	1,201	1,330	1,639
Metal refined including secondary	4,556	6,220	5,080
Gold [1] ... troy ounces	62,405	50,734	51,345
Iron and steel:			
Iron ore and concentrate ... thousand tons	830	710	571
Pig iron	r 16,767	41,000	47,736
Ferroalloys	5,891	11,000	13,310
Crude steel excluding castings ... thousand tons	372	374	479
Lead:			
Mine output, metal content	r 15,695	16,477	16,016
Metal	3,119	3,478	3,600
Manganese ore and concentrate, gross weight	4,221	2,902	3,401
Molybdenum mine output, metal content	192	130	115
Silver ... thousand troy ounces	r 637	906	1,494
Tin mine output, metal content ... long tons	r 35	--	--
Tungsten mine output, metal content	r 2,093	1,971	2,070
Zinc:			
Mine output, metal content	r 19,339	22,082	23,980
Metal, primary	2,454	2,310	2,300
NONMETALS			
Asbestos	3,311	5,910	1,373
Barite	5	--	--
Cement, hydraulic ... thousand tons	3,572	4,865	5,812
Clays, kaolin ... do	121	136	195
Diatomite	2,214	2,916	2,584
Feldspar	20,993	23,435	28,021
Fluorspar, all grades	46,604	39,173	47,780
Graphite:			
Crystalline	1,788	920	218
Amorphous	127,942	73,414	59,312
Kyanite and related materials, andalusite	113	54	NA
Salt, marine ... thousand tons	561	289	405
Stone, sand and gravel, n.e.s.:			
Crushed and broken limestone ... do	5,653	7,415	9,104
Stone, not further described (quartzite) ... do	r 179	226	259
Sand including glass sand ... do	49	87	105
Talc and related materials:			
Pyrophyllite	77,765	101,170	120,124
Talc	71,643	r 79,118	83,939
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	--	454	3,345
Coal, anthracite ... thousand tons	10,242	10,273	12,394
Fuel briquets, anthracite briquets ... do	6,891	9,194	10,000
Peat ... do	8	NA	NA
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	r 3,937	r 4,774	5,623
Kerosine ... do	1,975	2,220	3,252
Jet fuel ... do	r 2,063	3,126	4,623
Distillate fuel oil ... do	10,082	r 9,605	11,240
Residual fuel oil ... do	13,861	r 26,739	37,116
Other ... do	r 3,672	5,422	6,447
Refinery fuel and losses ... do	1,744	3,126	5,743
Total ... do	37,334	55,012	74,044

p Preliminary. r Revised. NA Not available.
[1] Officially reported production only.

TRADE

In 1969, as in previous years, the Republic of Korea was a net importer of mineral commodities. Exports were valued at 14 billion won ($45 million), whereas imports amounted to 29 billion won ($94 million). Nearly three-fourths of the value of exports and imports consisted of metal ores, concentrates, and scrap. If scrap metal was not included in trade data, Korea would be a net exporter of mineral commodities.

The principal export commodities in 1969 were metal ores and concentrates that amounted to 579,595 metric tons valued at 8.6 billion won ($28 million), all of which went to Japan. Tungsten concentrate accounted for 14 percent of the quantity and 62 percent of the value of these exports. Exports of anthracite were valued at 1.2 billion won ($3.9 million); natural quartz and quartzite, 496 million won ($1.6 million); and kaolin, 392 million won ($1.3 million). Japan was the recipient of these exports.

Imports of nonmetallic minerals in 1969 amounted to 1 million tons valued at 7.3 billion won ($24 million) and those of metallic ores, concentrates, and scrap amounted to 958,080 metric tons valued at 22 billion won ($70 million). Imports of sulfur and crude phosphate rock for use in the manufacture of fertilizers accounted for nearly half the quantity and value of nonmetallic minerals. Asbestos and salt accounted for 25 and 12 percent, respectively, of the value of imported nonmetallic minerals.

Iron scrap accounted for 88 percent of the value of imported metal ores, concentrates, and scrap. Nearly all of the remainder was copper ore (8 percent) and iron ore (2 percent).

Imports of crude and partly refined petroleum were valued at 41 billion won ($133 million), up about 24 percent, while imports of cement and manufactured fertilizers continued the rapid declines of recent years engendered by greater utilization of productive facilities within the Republic of Korea.

Table 2.—Republic of Korea: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Bismuth including alloys, all forms	75	NA
Iron and steel:		
Iron ore and concentrate thousand tons	772	673
Metal powders	6,580	NA
Semimanufactures thousand tons	NA	NA
Lead ore and concentrate	19,930	17,873
Manganese ore and concentrate	500	NA
Molybdenum ore and concentrate	509	368
Silver including alloys, all forms thousand troy ounces	418	NA
Tin ore and concentrate long tons	2	NA
Tungsten ore and concentrate	3,619	3,712
Zinc ore and concentrate	34,075	39,873
NONMETALS		
Abrasives, flint pebbles	8,227	NA
Cement	17,500	290,970
Clays and products:		
Crude, kaolin	39,608	41,003
Products, refractory	59,860	NA
Diatomite and other infusorial earths	60	NA
Feldspar and related materials:		
Feldspar	6,767	NA
Leucite, nepheline, and nepheline syenite	r 25,801	NA
Fluorspar	49,733	37,157
Graphite, natural	48,037	43,025
Mica, all forms	3,461	NA
Stone, sand and gravel:		
Dolomite, chiefly refractory grade thousand tons	11	16
Gravel and crushed rock do	1	NA
Quartz and quartzite do	72	NA
Talc and soapstone do	49	131
MINERAL FUELS AND RELATED MATERIALS		
Coal and briquets, anthracite do	226	234
Petroleum refinery products:		
Gasoline, motor do	--	467
Kerosine, white spirit do	--	54
Distillate fuel oil do	--	113
Residual fuel oil do	--	142

r Revised. NA Not available.
Source: Foreign Trade of Korea, 1968. Customs Bureau, Ministry of Finance.

Table 3.—Republic of Korea: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	15,404	14,196
Copper:		
Ore and concentrate	6,786	14,905
Metal and alloys, all forms	3,475	3,322
Iron and steel:		
Scrap ... thousand tons	391	701
Pig iron ... do	79	60
Spiegeleisen	14	NA
Steel, primary forms ... thousand tons	r 357	316
Semimanufactures ... do	232	255
Lead including alloys, all forms	2,706	2,565
Manganese:		
Ore and concentrate	521	11,307
Oxides	242	NA
Mercury ... 76-pound flasks	2	NA
Tin including alloys, all forms ... long tons	280	374
Titanium, oxides	3,157	4,216
Zinc including alloys, all forms	6,780	8,326
NONMETALS		
Asbestos ... thousand tons	25	28
Cement ... do	142	16
Diatomite and other infusorial earths	157	NA
Fertilizer materials:		
Crude, phosphatic ... thousand tons	371	509
Manufactured:		
Nitrogenous ... do	420	111
Phosphatic ... do	140	NA
Potassic ... do	68	224
Others ... do	15	8
Gypsum ... do	101	110
Sodium and potassium compounds, soda ash ... do	23	NA
Sulfur, elemental, all forms ... do	55	138
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	4,875	NA
Coal, all grades including briquets	53	28
Coke and semicoke	51	64
Petroleum:		
Crude and partly refined ... thousand 42-gallon barrels	37,199	55,300
Refinery products:		
Gasoline ... do	r 159	19
Kerosine ... do	r 98	--
Distillate fuel oil ... do	r 139	284
Residual fuel oil ... do	r 3,176	509
Lubricants ... do	39	68
Other ... do	99	240

r Revised. NA Not available.
Source: Foreign Trade of Korea, 1968. Customs Bureau, Ministry of Finance.

COMMODITY REVIEW

A number of technical assistance and licensing agreements with foreign manufacturers were made in 1970 as the Government continued its drive to introduce advanced technology into the operations of domestic industries.

Agreements relating to the mineral industry include processing licenses covering asbestos, gypsum, phosphoric acid, silica sand, and crude steel from Japanese manufacturers and technical assistance at Pohang steel mill from an Australian company. Naphtha-cracking licenses were granted by two U.S. companies and another company agreed to provide construction and plant testing supervision and other assistance and to rent equipment for the construction of a naphtha-cracking plant.

METALS

Copper, Lead, Zinc, Silver and Gold.—Output of copper at the Kunbuk mine exceeded by 78 percent that of 1969. The Kooryong, Dalsung, and Daeduk mines also contributed substantial tonnages to the total copper output of 27,312 metric tons. The Korean Government was studying the feasibility of constructing a copper smelter in Masan, Kyungsangnamdo, an area noted for its concentration of copper mines. An anticipated near-doubling of demand for electrolytic copper by 1976 and a production capacity of about one-quarter of that at the copper refinery in Changhang led to the study.

The new Bupyong silver-lead mine added significantly to domestic output of silver and in 1970 accounted for about half of the quantity produced. The Yeong Hwa mine continued to dominate mining of lead and zinc and accounted for 63 percent of the lead ore and 55 percent of the zinc ore produced.

Iron Ore.—Production of iron was well below that of 1969, notwithstanding that output at the Yangyang mine, the largest domestic producer, was up in 1970. Sharp declines in production occurred again at Mulkum and Chungju to offset the increase at Yangyang.

Iron and Steel.—Production of steel ingot in 1970 rose to 480,669 metric tons, a level nearly 30 percent above that of 1969. Domestic producers of basic iron and steel products depend principally on imports for their raw materials needs. Imports of iron and steel scrap rose 16 percent in 1970, to 839,938 metric tons; only one-tenth of domestic output of iron ore was used within the Republic of Korea.

Tungsten.—The Sangdong mine recorded only a modest gain in production over that of 1969. Nearly all of the 3,110 metric tons of scheelite concentrate was exported to Japan.

NONMETALS

Cement.—The Samchok cement plant was undergoing expansion that will add 2.2 million metric tons to its rated capacity of 1.7 million metric tons. Anticipated increased demand has led to other plant expansions and current plans call for an increase in total capacity from 6.6 million metric tons in 1970 to 10.6 million metric tons in 1972.

Tong Yang Cement Manufacturing Company, Ltd., Seoul, plans to establish a concrete and asbestos-cement products plant and a refractory plant at a total investment of about $8 million. Output of both plants is for both domestic and foreign markets.

Graphite.—Production of amorphous graphite in 1970 was dominated by the Wolmyung and the Mano mines which, in the aggregate, accounted for two-thirds of the 59,312 metric tons produced. Of the 15 mines operating in 1970, four were closed by yearend.

MINERAL FUELS

Petroleum.—Gulf Oil Corporation, Pittsburgh, Pa., and Korea Oil Corporation announced a new joint project to manufacture and market in Korea a complete line of high-quality and economy-grade lubricating oils. Construction of the facility, which will have a 3,000-barrel-per-day capacity, was to begin in 1971.

The Mineral Industry of Kuwait and Saudi Arabia

By David A. Carleton [1]

CONTENTS

On December 18, 1969, officials of the Kingdom of Saudi Arabia and the State of Kuwait signed a document formally dividing the Kuwait-Saudi Arabia Neutral Zone into equal administrative parts—the northern part to be administered by Kuwait and the southern part to be administered by Saudi Arabia. Existing arrangements for the equal sharing of natural resources will continue. Petroleum is the only major mineral activity in the former Neutral Zone, including its offshore area. Offshore petroleum is produced by Arabian Oil Co. Ltd. (AOC), the concessionaire for both Kuwait and Saudi Arabia. Onshore, petroleum is produced jointly by two companies, Getty Oil Co., the concessionaire for Saudi Arabia, and American Independent Oil Co. (Aminoil), the concessionaire for Kuwait. Many of the facilities belonging to the Getty Oil Co., are in the Kuwait-administered section; however, for the purpose of this report all Getty operations will be discussed under Saudi Arabia and all Aminoil operations will be discussed under Kuwait. Activities of AOC will also be reviewed under Kuwait.

KUWAIT

Kuwait's petroleum-based economy continued to undergo another year of retrenchment even though petroleum revenues increased 6 percent, a rate essentially unchanged for several years. The country's rising oil revenues have traditionally supported increasing expenditures for social services and economic development and still produced budgetary surpluses. These surpluses go into the Government's general reserve fund, most of which is held in the form of foreign assists. In recent years, Kuwait has been extending increasing amounts of aid and grant money to other Arab Governments. During the past 3 years these have averaged $150 million annually. This together with direct aid to the United Arab Republic (U.A.R.) and Jordan following the June 1967 conflict with Israel, economic and technical aid to developing countries, and special financial assistance to Yemen and the Trucial States have diverted financial resources which could have otherwise been spent to stimulate domestic activity or to earn additional income.

Despite fiscal restraints, Kuwait's national income during the fiscal year ending March 31, 1970, was $2.2 million, up slightly from the previous year. The country's gross national product (GNP) during this fiscal year ending March 31, 1970, was $2.7 billion. Oil and natural gas continue to account for more than half of the GNP. This condition concerns government officials and efforts to diversify the economy are being implemented.

On December 24, 1970, a protocol for industrial development was signed in Cairo between Kuwait and the U.A.R. The protocol provides, *interalia,* for the U.A.R. to

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assist Kuwait in conducting geological surveys and appraising their results, undertaking economic feasibility studies on industrial projects contemplated, and providing Kuwait with the services of Egyptian experts. It also calls for the coordination of plans for the production and marketing of fertilizers in both countries.[2]

Although discussions concerning Kuwait's offshore boundary with Iran have been going on for many years, no final solution has been reached. There have been agreements in principal; however, the main problem in adopting a demarcation line is the other unresolved offshore boundary disputes with Saudi Arabia (in the Neutral Zone) and Iraq. Settlement of a boundary line would permit further development of the Marjan-Fereidoon oilfield, which lies astride the Kuwait-Saudi Arabia (in the former Neutral Zone) and the Iran boundary junction point.

PRODUCTION

Crude oil and the refined petroleum products derived therefrom are the only major items of mineral production in Kuwait. The 1.09 billion barrels (2,986,410 barrels per day) of crude oil produced in 1970 was 6.6 percent more than that produced in 1969. Kuwait Oil Co., Ltd. (KOC), the only crude oil producer in Kuwait proper accounted for 91 percent of the 1970 total. The remainder came from Kuwait's one-half share of production from the former Neutral Zone, including offshore areas; Aminoil accounted for 3 percent and AOC for 6 percent. After experiencing 2 years of production declines, Aminoil recorded a substantial gain of 26 percent during 1970. This gain reflects the improved marketability of fuel oil from Aminoil's Mina Abdullah refinery following the completion of a desulfurization unit.

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

Commodity	1968	1969	1970 p
NONMETALS			
Fertilizer materials ... metric tons	199,169	229,419	NA
Lime, hydrated and quick ... do	893	694	e 700
Salt ... do	4,211	4,000	e 4,000
Sulfur ... do	NA	14,786	20,786
MINERAL FUELS AND RELATED MATERIALS			
Natural gas, marketed ... million cubic feet	118,750	132,973	NA
Petroleum:			
Crude ... thousand 42-gallon barrels	964,069	1,021,615	1,090,040
Refinery products:			
Motor gasoline ... do	4,209	7,053	10,132
Jet fuel ... do	411	635	883
Kerosine ... do	1,287	3,674	4,762
Distillate fuel oil ... do	48,460	46,989	54,090
Residual fuel oil ... do	50,360	52,284	72,280
Liquefied petroleum gas [2] ... do	16,829	17,163	e 20,000
Other [3] ... do	7,119	5,966	9,019
Total ... do	128,675	133,764	171,166

e Estimate. p Preliminary. NA Not available.

[1] Includes Kuwait's one-half share of crude oil production in the former Kuwait-Saudi Arabia Neutral Zone and Kuwait's share of refinery output by its concessionaires in that area.

[2] Includes production from natural gas processing plants.

[3] Mostly naphtha and topped crude for blending.

TRADE

Kuwait's mineral trade is dominated by exports of petroleum and imports of iron and steel materials and cement. Exports of crude oil increased 5 percent in 1970, reflecting the rising world demand. Exports of refined products, however, increased a sizable 38 percent, reflecting the salability of Aminoil and Kuwait National Petroleum Co. (KNPC) residual fuel oils produced from new desulfurization facilities.

Kuwait continued to maintain its rank as the world's fifth largest crude oil exporter. The 944 billion barrels exported in 1970 amounted to 11 percent of the world's total, unchanged from 1969.

[2] Middle East Economic Survey. V. 14, No. 10, Jan. 1, 1971, p. 8.

Table 2.—Kuwait: Exports of mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1968	1969	1970
METALS			
Aluminum and alloys, all forms	13	11	NA
Copper and alloys, all forms	(2)	259	NA
Iron and steel:			
Scrap and unwrought	34,753	27,724	NA
Semimanufactures	3,573	19,815	NA
Lead and alloys, all forms	2	17	NA
Other n.e.s	(2)	2	NA
NONMETALS			
Asbestos, crude	-------	(2)	NA
Cement	4,078	14,976	NA
Clay products:			
Refractory brick	20	86	NA
Nonrefractory brick	452	117	NA
Fertilizers, natural	24	60	NA
Gypsum, plasters, and limestone	247	62	NA
Lime	15	-------	NA
Precious and semiprecious stone, except diamond ---- kilograms	125	-------	NA
Salt	236	129	NA
Stone, sand and gravel:			
Dimension, crude	-------	263	NA
Gravel and crushed rock	-------	540	NA
Sand	15	-------	NA
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke, and briquets	1	10	NA
Petroleum and refinery products:			
Crude petroleum ---- thousand 42-gallon barrels	847,853	896,967	943,833
Refinery products:			
Gasoline ---- do	-------	4,232	7,354
Kerosine and jet fuel ---- do	60	3,157	4,562
Distillate fuel oil ---- do	37,365	34,798	41,409
Residual fuel oil ---- do	19,348	24,364	43,833
Liquefied petroleum gas ---- do	11,948	12,097	12,816
Other ---- do	[3] 14,694	6,274	7,163
Total ---- do	83,415	84,922	117,137

NA Not available.
[1] Includes Kuwait's share of former Neutral Zone exports.
[2] Less than ½ unit.
[3] Includes total refinery products exports of Kuwait National Petroleum Co. (KNPC).

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

Commodity	1968	1969
METALS		
Aluminum and alloys, all forms	643	723
Copper and alloys, all forms	197	273
Iron and steel:		
Scrap and unwrought	762	2,069
Semimanufactures	186,165	201,880
Lead and alloys, all forms	459	123
Tin including alloys, all forms	5	9
Other n.e.s	68	49
NONMETALS		
Asbestos, crude	3,926	1,624
Cement	905,363	811,280
Clay products:		
Refractory brick	1,864	1,271
Nonrefractory brick	409	9,860
Diamond ---- carats	1,880	1,145
Fertilizers, natural	846	69
Gypsum, plasters, and limestone	9,543	5,897
Lime	-------	25
Precious and semiprecious stone except diamond ---- kilograms	95	26
Salt	1,963	2,995
Stone, sand and gravel:		
Dimension:		
Crude	4,901	8,004
Worked	1,380	3,647
Gravel and crushed rock	-------	47,059
Sand	-------	53
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke, and briquets	362	167
Crude petroleum ---- thousand 42-gallon barrels	(1)	-------
Petroleum refinery products:		
Gasoline ---- do	16	8
Kerosine and jet fuels ---- do	(1)	6
Distillate fuel oil ---- do	(1)	-------
Lubricants ---- do	119	164
Asphalt ---- do	84	20
Total ---- do	219	198

[1] Less than ½ unit.

COMMODITY REVIEW

Nonmetals.—*Fertilizer Materials.*—Debate continued during the year 1970 on the condition of Kuwait's fertilizer industry. During 1969 sundry startup problems of the new Shuaiba plant were corrected, and total production increased 15 percent over that of 1968. Production in 1970 was also up; however, data are available only for the first quarter. During that period production amounted to 60,000 tons essentially unchanged from the corresponding period in 1969. The plant is run by Kuwait Chemical Fertilizer Co. (KCFC), owned 60 percent by Petrochemical Industries Co. (PIC) and 40 percent by subsidiaries of British Petroleum Co., Ltd. (BP), and Gulf Oil Corp., in equal shares. Like other fertilizer companies, KCFC suffered from a worldwide decline in prices. PIC, however, in 1970 succeeded in gaining a foothold in the mainland China market. This company is now over 90 percent owned by the Government.

Banking on the support of BP and Gulf, PIC decided to build another petrochemical-fertilizer plant adjacent to the Shuaiba plant; however, both BP and Gulf decided not to participate financially. The new plant, being built by PIC, is nearing completion. Its initial annual production capacity will be 68,000 tons of ammonia and 180,000 tons of urea reaching 280,000 tons and 500,000 tons, respectively, by 1973. Both plants will be managed by KCFC who will be responsible for marketing the combined output. Much of the ammonia will be exported to Turkey where PIC has a 40-percent interest in a fertilizer plant at Mersin.

Mineral Fuels and Related Materials. *Petroleum and Natural Gas.*—During November 1970, the Government of Kuwait and KOC, (owned equally by BP and Gulf) negotiated new price and payment arrangements effective November 14, 1970. The new arrangements are as follows: (1) a $0.01 per barrel higher royalty resulting from the posted price increase; (2) a $0.04 per barrel higher tax; (3) a $0.065 per barrel increase resulting from the tax rate rising from 50 to 55 percent. The total $0.115 per barrel increase will augment the Government's income by $120 million annually.

KNPC in which the Government holds 60 percent and local nationals 40 percent has experienced technical problems at its Shuaiba refinery and marketing difficulties abroad. Although crude throughput was an estimated 90,000 barrels per day in 1970, slightly under the 95,000-barrel-per-day capacity, problems in the H-oil unit had an adverse effect on profits. The latter is a hydrotreating unit which reduces fuel oil yields and desulfurizes the input. KNPC has contracted with a Japanese company to run the unit at capacity. In addition, higher cost oil from the Burgan oilfield had to be used at the refinery instead of the less expensive, low-quality Umm Gudair crude for which the refinery was designed. Closure of the Suez Canal continues to adversely affect the marketing of Shuaiba products in Europe. KNPC has leased its bulk terminal in Denmark to Mobil Oil Co. and is concentrating on sales east of the Suez Canal.

The Kuwait-Spanish Petroleum Co. (KSPC), a joint venture between KNPC (51 percent) and Hispanica de Petroleos, S.A. (Hispanoil) (49 percent), and the Spanish national company, found oil with its first wildcat well in its 3,500-square-mile concession. Dirah No. 1 was drilled in western Kuwait, northwest of Minagish field during July and August 1970. Based on initial flows, the well, which encountered oil at 12,500 feet, was promising. Early in May, the company completed a seismic survey of its concession area.

Reportedly, Kuwait and the U.S.S.R. signed two separate contracts for exchanges of petroleum products. Under the agreements the Soviets will receive refined petroleum products in the Persian Gulf to supply their markets in Ceylon and India while KNPC will receive products in northern Europe for distribution to their customers in Europe. Although details were not made available, reliable sources described the deals as amounting to more than 35,000 barrels per day for a period exceeding 3 years.

Major increases in AOC's production in 1970 (6.3 percent over that of 1969) resulted from the increased marketability of crude oil from the Hout field, which lies offshore from the former Neutral Zone. Its low sulfur content relative to the rest of AOC's production is particularly useful in that air pollution regulations are becoming stringent in Japan, the destination of most AOC exports. AOC, by expending $300 million in its concession area in 1969, was responsible for 71 percent of total Japanese overseas expenditures on petroleum exploration and development. Production averaged 368,408 barrels per day in 1970. The company averaged 380,862 barrels daily during October–December 1970, which indicates that the company is approaching its current goal of 400,000 barrels per day.

Onshore the joint production of Getty and Aminoil averaged 157,316 barrels daily, up 26 percent from that of 1969. During the year Aminoil was the principal offtaker, accounting for 52 percent of the joint production in 1970. The Aminoil "overdraw" of 950 barrels per day compares with an "underdraw" of 9,835 barrels per day in 1969.

SAUDI ARABIA

The Saudi Arabian economy during 1970 was relatively stagnate in spite of a spectacular growth in petroleum production. This situation reflected heavy aid obligations to Jordan and the United Arab Republic (U.A.R.), a peaking of deferred payments for various defense programs, and the Government's desire to improve its cash position.

The country's first development plan, originally approved in 1969, was revised prior to its official issuance in the fall of 1970. In its final form the plan made no reference to any time period but rather refers to those objectives that should be completed in the first, second, or third year and those that should be achieved by the end of the plan. The document identifies goals and objectives and reaffirms the Kingdom's commitment to a free economy guided by private enterprise. It recognizes that Saudi Arabia's potential for development will largely depend on manpower changes and occupational redistribution of the labor force. The plan calls for additions to physical infrastructure, i.e. roads, airports, telecommunications, housing, powerplants, and water and sewerage systems, as well as encouraging diversification of agriculture and industry.

During Saudi Arabia's fiscal year covering the period September 12, 1969, through September 1, 1970, government income from oil amounted to $1,063 million or 80 percent of total government revenue. The petroleum sector continued to account for about one-half of the gross national product (GNP) and the bulk of the nation's foreign exchange earnings. These oil industry payments represent a 14-percent increase over the $932 million in the previous fiscal year. The following tabulation presents payments and unit income during 1969 from Saudi Arabia's three oil producing concessionaires, Arabian American Oil Co. (Aramco), Arabian Oil Co. Ltd. (AOC), and Getty Oil Co. (Getty):

Company	Payments (million US dollars)	Unit income (US cents per barrel)
Aramco	895.2	82.0
AOC	37.1	63.1
Getty	15.2	67.0
Total	947.5	80.7

Payments by nonproducing oil companies provided an additional $1.5 million. Payments by Aramco to the Government from oil production during 1970 amounted to US$1,148.4 million, a 28-percent increase over those in 1969. Government receipts from AOC and Getty were an estimated $60 million in 1970. Taking into account the 3-month time lag in tax receipts and assuming a not unreasonable 10-percent increase in production and in consideration of the new tax rates, revenue could reach $2.4 billion in 1971.

Saudi Arabia has few developed mineral resources except for petroleum and natural gas. Geological and geophysical surveys are being conducted as a first means toward the discovery and exploitation of other mineral resources. The Directorate General of Mineral Resources has completed its aerial geophysical survey of the "Arab Shield," an area which comprises most of the western half of the country. A detailed geophysical survey of areas with mineral potential has also been initiated under the supervision of a French geological mission.

During the year, three foreign agencies under contract with the Ministry of Petroleum and Mineral Resources, the U.S. Geological Survey (USGS), the French Bureau de Recherches Géologiques et Minières (BRGM), and the Geological Survey of Japan continued their search for minerals. At yearend, BRGM renewed its contract with the Ministry for an additional 2½ years, effective January 1, 1971. Mineral resources found by BRGM since 1964 reportedly have a potential value of $7.5 billion.[3] Important among these discoveries are iron, silver, copper, pyrite, phosphate, clay, and gypsum.

PRODUCTION

Saudi Arabia crude oil production increased a substantial 18 percent in 1970, occasioned by a world demand that increased 9 percent compared with a 7-percent annual increase during the past decade. Demand for petroleum in Western Europe, traditionally the destination of about half of the country's petroleum exports, increased 11 percent. Production by Aramco, the country's largest producer rose 19 percent while that of Saudi Arabia's one-half share in the former Neutral Zone rose 13 percent.

Natural gas output, all of which is produced in association with crude oil production, also increased. Gross production of Aramco increased to 700 billion cubic feet in 1970 compared with 613 billion cubic feet in 1969. Only 14 percent or about 100 billion cubic feet were marketed, the remainder being either flared or injected back into the producing field.

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

Commodity	1968	1969	1970 [p]
METALS			
Steel semimanufactures (hot rolled) metric tons	NA	NA	8,498
NONMETALS			
Cement [2] do	510,813	[e] 550,000	651,455
Gypsum [2] do	[r] 13,000	[e r] 15,000	17,231
Lime [2] do	10,870	[e r] 15,000	21,620
Marble do	NA	NA	2,000
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, marketed million cubic feet	[e] 54,000	97,520	NA
Petroleum:			
Crude thousand 42-gallon barrels	1,113,717	1,173,896	1,387,266
Refinery products:			
Aviation gasoline do	145	176	38
Motor gasoline do	24,446	25,408	[3] 35,038
Jet fuel do	13,177	13,962	13,668
Kerosine do	3,081	3,190	6,876
Distillate fuel oil do	18,818	18,346	22,088
Residual fuel oil do	85,242	90,256	124,325
Liquefied petroleum gas [4] do	10,635	13,251	18,240
Other do	3,434	2,414	2,774
Total do	158,978	167,003	223,047

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] Includes Saudi Arabia's one-half share of crude oil production in the former Kuwait-Saudi Arabia Neutral Zone and Saudi Arabia's share of refinery output by its concessionaires in that area. Figures for 1968 and 1969 therefore differ from those appearing in previous editions, which did not include production from the Neutral Zone.
[2] Data presented are for Hejira calendar years as follows: 1968—Hejira year 1388 (Mar. 29, 1968–Mar. 18, 1969); 1969—Hejira year 1389 (Mar. 19, 1969–Mar. 8, 1970); 1970—Hejira year 1390 (Mar. 9, 1970–Feb. 27, 1971).
[3] Includes naphtha.
[4] Includes natural gas liquids.

TRADE

Crude oil and petroleum refinery products, which are essentially the only mineral commodities exported by Saudi Arabia were valued at about $1.8 billion in 1970. Major mineral imports are iron and steel semimanufactures, gold, and cement. Imports of cement have declined in recent years, the result of domestic cement plant expansion. The total value of mineral imports during the Hejira calendar year 1387 (Apr. 11, 1967–Mar. 29, 1968) was $43 million.

[3] Bureau des Informations du Pétrole. No. 1773, Feb. 12, 1971, p. 5.

Table 5.—Saudi Arabia: Exports of crude petroleum and petroleum refinery products [1]

(Thousand 42-gallon barrels)

Commodity	1968	1969	1970
Crude petroleum	966,496	1,020,055	1,175,329
Petroleum refinery products: [2]			
Motor gasoline	21,179	21,522	27,011
Jet fuel	13,298	14,100	13,436
Kerosine	1,430	1,366	4,476
Distillate fuel oil	15,397	17,157	23,160
Residual fuel oil	50,762	48,508	68,450
Other	11,167	14,552	15,344
Total	113,233	117,205	152,377

[1] Includes Saudi Arabia's share of exports from the former Kuwait-Saudi Arabia Neutral Zone.
[2] Excludes exports by General Petroleum and Mineral Organization (Petromin).

Table 6.—Saudi Arabia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966–67 [1]	1967–68 [2]	1969 [3]
METALS			
Aluminum semimanufactures, plates and sheets	-------	283	577
Copper semimanufactures, wire	-------	510	NA
Gold ---thousand troy ounces	4,115	4,437	385
Iron and steel:			
Primary forms	-------	462	6,026
Semimanufactures:			
Bars and rods	103,028	60,726	94,265
Angles, shapes, and sections	8,989	5,156	16,784
Sheets and plates	15,453	17,293	23,729
Pipes, tubes, and fittings	34,745	30,307	70,182
NONMETALS			
Cement	465,114	279,516	623,305
Diatomite and other infusorial earths	-------	9,609	NA
Fertilizer materials, mineral	4,675	-------	5,865
Lime	11,050	-------	9,302
Stone, dimension and calcareous	9,959	5,372	5,761
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	-------	10,752	NA
Petroleum refinery products:			
Lubricants ---thousand 42-gallon barrels	144	140	245
Paraffin and vaseline oil ---do	11	-------	54
Other ---do	4	5	
Total ---do	159	145	299

NA Not available.
[1] The Hejira calendar year 1386: Apr. 21, 1966–Apr. 10, 1967.
[2] The Hejira calendar year 1387: Apr. 11, 1967–Mar. 29, 1968.
[3] Gregorian calendar year.

COMMODITY REVIEW

Although no commercial exploitation of any nonfuel mineral found from recent exploration in Saudi Arabia has yet begun, there are good chances that exploitation will soon begin as a result of favorable findings.

One of the most interesting occurrences found during recent exploration was a lead-zinc-copper prospect in the Jabal Dhaylan area along the northern Red Sea coast. Studies carried out by BRGM will continue in order to determine the economic significance of the find.

The gold-silver-zinc-copper prospects at Jabal Shayban about 80 miles northeast of Jidda has so far yielded three small possible areas of mineralization, but there are good chances for extensions. At Samrah mineralization has been established to a depth of 220 meters and diamond drilling has indicated reserves of approximately 204,000 tons of silver, lead, and zinc.

Several other prospects are in various stages of economic evaluation and appraisal while the Directorate General of Mineral Resources initiated efforts to interest foreign investors to conclude exploitation contracts with the Saudi Arabian Government. Proposed projects include Wadi Fatimah iron ore deposits, Wadi Sawadin iron ore, Thaniyat-Turaif phosphate, and the Jabal Sayid copper-zinc-silver-gold deposit. In 1970, the Director General of Mineral Resources published its first list of mineral resources (other than petroleum), which is shown in the following tabulation:

Area	Minerals	Possible reserves [1] (million tons)	Potential reserves [2] (million tons, unless otherwise specified)
Wadi Fatimah	Iron (hematite), 45 percent	----	50
Wadi Sawain	Iron (hematite, magnetite)	350	----
Idsas	Iron (magnetite), 25 percent	80 to 110	----
Samrah	Silver (3 kilogram per ton)	----	800,000 tons
Jabal Sayid	Copper, 2.2 percent, zinc 1.4 percent	----	8
Al Amar	Zinc, copper, gold, lead	----	5
Wadi Wassat	Pyrite, 80 percent	800	300
Jizan	Salt, 96 percent	1,000	33.5
Thaniyat and Turaif	Phosphate	1,000	----
Umm-Jarad	Barite	----	100,000 tons
Khashm Rida	Clay	56	----
Al-Kharj	Gypsum	3	----
Al-Hith	----do	10 to 15	----

[1] Quantities of ore estimated to exist on the basis of geological and geophysical surveys.
[2] Quantity of ore estimated to exist on the basis of drilling results.

Nonmetals.—*Fertilizer Materials.*—Because of construction delays and startup problems, the Dammam fertilizer complex of the Saudi Arabian Fertilizer Co. (Safco) did not begin continuous production until early 1971. Technical operational difficulties plagued the plant during much of 1970. It is estimated that the plant, an ammonia-urea facility, operated only 50 percent of the time from startup through yearend 1970 and even then at sharply reduced rates. Total 1970 urea production was only 24,397 tons, compared with a capacity of more than 300,000 annually. Plant technicians hope during 1971 to reach and maintain design production levels. The most important units in the plant are a 35-ton-per-day sulfur recovery unit, a 600-ton-per-day ammonia unit, and a 1,100-ton-per-day urea unit. This latter facility is one of the largest urea plants in operation.

At yearend 1970, status of the planned sulfur plant at Abqaiq was pending. The continuing drop in world sulfur prices is the principal reason for delaying the project. The original plans called for the $22 million plant to have a capacity of about 200,000 tons per year and for the output of liquid sulfur to be processed into flaked sulfur and to be transported by railroad to Dammam for export. Feedstock will be 500 million cubic feet per day of natural gas from Abqaiq oilfield.

A small sulfuric acid plant, due to begin production in mid-1971, was being built at Dammam. The unit has a designed capacity of 50 tons per day, using 35 tons of sulfur per day from the nearby Safco fertilizer plant. The $1 million facility will market production in the Kingdom to existing industries, such as oil refining and the manufactures of fertilizers and soap.

Mineral Fuels and Related Materials.—*Petroleum and Natural Gas.*—During 1970, Saudi Arabia moved closer to becoming the world's third largest petroleum producer, having an average daily offtake of 3,801,100 barrels. This amount represented an 18.6-percent increase over 1969 production and was only 50,000 barrels per day less than that of Iran. Production by company during the year was as follows:

	Barrels per day
Aramco	3,548.9
AOC	[1] 173.5
Getty	78.7
Total	3,801.1

[1] This amount is one-half of the former Neutral Zone's onshore production.

Studies of the Kingdom's oil reserves were completed in 1969 by two U.S. geological firms in accordance with agreements signed in 1965 and 1966. According to the report submitted, oil reserves in the fields studied are estimated at 126.4 billion barrels. Most important of these fields were Ghawar, 80.0 billion barrels; Safaniyah, 15.4 billion barrels; Abqaiq, 8.0 billion barrels; Khurais, 7.5 billion barrels. Estimates prepared by Aramco, Getty, and AOC for reserves of fields not included in the study, place their reserves at 20.2 billion barrels. The total reserves of 146.6 billion barrels constitute more than 30 percent of total world proved reserves. According to conservative estimates, proved petroleum reserves were 88.1 billion barrels at yearend, a gross increase of 3.4 billion barrels over those of 1969.

Two Aramco seismographic crews operated throughout the year. One explored near the Persian Gulf coast and the other worked in the sand mountains of eastern Rub al-Khali.

No exploration wells were drilled in 1970 by Aramco; however, 10 development wells were completed and about 25 wells were drilled for water injection and observation. At yearend Aramco had completed 778 wells and had an additional 17 listed as temporarily suspended. Of those completed, 420 produced oil and two produced associated natural gas.

Although Saudi Arabia's fields, together with other Middle East oilfields, are known for their high production rates, Aramco has been injecting water into the Ghawar and Abqaiq fields since 1955. At the end of January 1970, Aramco had 109 water injection wells, of which 102 were gravity injection and seven were pumping wells. Because of the successful results in maintaining the reservoir pressure, more water injection wells are planned. The total injection rate was 3,593,000 barrels of water per day. Individual well rates are as high as 86,000 barrels of water per day, and the average is 32,000 barrels per day. In addition, natural gas (methane) from the Abqaiq natural gas process plant was injected at a daily rate of 329,735,000 cubic feet into the Abqaiq field and the Ain Dar section of the Ghawar field.

Ghawar field continued as the country's largest field, producing 1,575,637 barrels per day or 49 percent of the Aramco total in 1970. The field showing the most significant gain during the year was the offshore Safaniyah field. The 771,311 barrels per day produced in 1970 was 82 percent more than in 1969 and enabled the field to replace Abqaiq as the country's second largest field.

The offshore portion of Berri field was brought on stream in October. The onshore section which produced about 30,000 barrels per day came on stream in 1967. Project production of 150,000 per day in 1971 will rank this field fourth in the country. Facilities completed during the year for handling Berri crude include a stabilizer and the company's first million-barrel crude oil storage tank at Ras Tanura, gas-oil separators at Jubail and Ras Tanura, and 26 miles of pipeline. A 36-mile pipeline between Berri and Ras Tanura and another million-barrel oil storage tank were under construction at yearend.

Production increases during the year were sustained despite the closure of the Trans-Arabian Pipeline (Tapline)—Persian Gulf to Mediterranean pipeline—from May through December. During 1968, the last full year of Tapline operations, this line handled 17 percent of Aramco's crude oil production. Closures during the following 2 years reduced the pipeline's share of output to 12 and 5 percent, respectively.

Aramco announced during the year production plans for the Marjan and Zuluf offshore oilfields. A loading tanker will be permanently placed 50 to 75 miles offshore to receive and store crude from the offshore gas-oil separators and later to transfer the crude to ocean-going tankers. The scheme should be in operation late in 1971.

The Ras Tanura refinery of Aramco processed crude oil, unfinished products, raw liquefied petroleum gas, and natural gasoline. These runs averaged 584,939 barrels per day, up 32 percent from the previous year. Maintenance and construction crews modified a crude oil topping unit to increase its capacity, and the Merox plant, which is engaged in removing noxious sulfur compounds from naphthas, went on stream in February 1970 with a throughput capacity of 32,000 barrels per day.

Shipments of crude oil and products from the new Ras Tanura Marine Terminal started during the year. Cargo loaded on 3,170 tankers totaled 1,166 million barrels, 28 percent more than in 1969.

General Petroleum and Mineral Organization (Petromin) continued to expand its petroleum operations by becoming a fully integrated company in Saudi Arabia. The company's 12,000-barrel-per-day refinery operated at capacity and plans were firmed up for expanding the plant to 27,000 barrels per day and building a new 15,000-barrel-per-day plant at Riyadh. Plans were worked out under which a subsidiary of Universal Oil Products, Co., will be the major contractor for the dual refinery contract. No final contract had been signed at yearend.

The Jidda plant for manufacturing lubricating oils was under construction at yearend and should be completed late in 1971. The plant is owned 71 percent by Petromin and 29 percent by Mobil Oil Investments, a company incorporated in Panama. The plant will be able to produce 75,000 barrels annually.

Petromin's tanker company purchased its first vessel, a 35,000-deadweight-ton vessel which will ply the Ras Tanura-Jidda route. Purchase of another tanker of similar size was being negotiated.

Plans for the construction of a 14-inch, 180-mile natural gas pipeline from Uthmaniyah (Ghawar field) to Riyadh have been finalized. The line is designed to supply 70 million cubic feet per day to private and industrial consumers in Riyadh. Estimated cost is $20 to $30 million.

During 1970 Atlantic Richfield Co. assigned its rights under an exploration contract to Sun Oil Co. Partners in the new contract are Sun Oil Co., 60 percent; the Natomas group, 30 percent; and the Pakistan state agency, Oil and Gas Development Corp., 10 percent. The Natomas group share is held by Natomas Co., 9.85 percent; Dellingham Corp., 9.85 percent; Texas International Petroleum Corp., 5.0 percent; and Sante Fe International Corp., 5.3 percent. It is believed that this approximate 9.000-square-mile offshore/onshore Red Sea concession has been finally defined. In the event of a commercial discovery, a 30-year exploitation concession will be granted in which Petromin may opt up to 50 percent participation. A drilling rig is being mobilized, and the first well, Gawwas No. 1, is scheduled to begin in April 1971. The well will be located in the Red Sea, 10 miles offshore approximately 125 miles south of Jidda. The water depth at the well location is 75 feet, and the well is expected to be drilled to 15,000 feet.

During 1970 the partnership of Tenneco Oil Co., and Société Auxiliaire de la Régie Autonome du Pétroles (Auxirap), a member of the Elf/ERAP group, relinquished approximately two-thirds of its license area but retained two offshore/onshore Red Sea blocks totaling 3,000 square miles. The partnership had a gas discovery well in 1969 in one of these areas, both of which are located at the northern end of the Red Sea. During the year seismographic work was undertaken and a dry well was abandoned. Certain operational problems developed during the year, the result of proximity to the Sinai Peninsula.

In the Eastern Province, exploration continued in the license area belonging to Petromin but assigned to Agip Saudi Arabia, S.p.A., an affiliate of the Italian State Petroleum agency, Ente Nazionale Idrocarburi (ENI). Agip transferred one-half of their interest to Phillips Petroleum Co. The two-parcel concession covers 77,382 square kilometers in the Rub al-Khali and 9,107 square kilometers in al-Hasa. During 1970 two wells were drilled in each of the areas with disappointing results. Two crews are continuing seismic work, and a well is planned for the Rub al-Khali in 1971.

The Mineral Industry of Liberia

By E. Shekarchi [1]

The mineral industry of Liberia again registered substantial gains in 1970, with large increases reflected in iron ore, diamond, and petroleum refinery products. Offsetting the high level of activity in these sectors was the decline in gold production, as more marginal mines suspended or cut back operation. Liberia retained its position as Africa's leading iron ore producer and the world's third largest exporter of iron ore.

Estimated value of iron ore shipments in 1970 was $151 million,[2] an increase of 18 percent when compared with 1969 values. Other mineral industry contributors to the gross national product (GNP) of $270 million in 1970 were: Diamond, $48 million; petroleum refinery products, estimated at $12.8 million; cement, $2.2 million; and gold, $20 million.

The Bureau of Natural Resources and Surveys conducted geological investigations by detailed mapping in the Monrovia area and Cape Palmas in its search for clays, kyanite, and silica sand deposits.

An airborne geological survey of the Continental Shelf and field studies of the coastal area by the U.S. Geological Survey suggested potential deposits of petroleum. The study found two sedimentary basins on shore, and indications of similar basins with identical rock units in the offshore areas.

PRODUCTION

The total value of mineral production increased to an estimated $183 million in 1970 compared with $178 million in 1969. Although output of most major mineral commodities with the exception of gold increased in 1970, lower prices for diamond on the world market resulted in a lower total production value than might have been anticipated. Statistics on production are contained in table 1.

[1] Physical scientist, Division of Ferrous Metals.
[2] Liberia uses U.S. dollar currency.

Table 1.—Liberia: Production of mineral commodities

Commodity [1]	1968	1969	1970 [p]
METALS			
Gold [2] ____ troy ounces	3,216	1,136	[e] 1,100
Iron ore ____ thousand metric tons	19,571	22,866	23,658
NONMETALS			
Cement, hydraulic ____ do	50	70	[e] 70
Diamond: [3]			
Gem ____ thousand carats	537	562	620
Industrial ____ do	[r] 212	184	206
Total ____ do	[r] 749	746	826
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline, motor ____ thousand 42-gallon barrels	[r] 13	[r] 383	464
Jet fuel ____ do } Kerosine ____ do }	[r] 1	[r] 76 / [r] 91	170
Distillate fuel oil ____ do	[r] 45	[r] 639	917
Residual fuel oil ____ do	[r] 97	[r] 638	1,201
Other ____ do	--	[r] 4	16
Refinery fuel ____ do	16	203	48
Total ____ do	[r] 172	2,034	2,816

[e] Estimate. [p] Preliminary. [r] Revised.
[1] In addition to the commodities listed, a variety of crude construction materials such as clays, stone, 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: Apparent exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
Copper scrap	237	456	Italy 241; West Germany 117; Japan 51.
Diamond:			
Gem ----value, thousands	$14,286	$21,154	Belgium-Luxembourg $15,026; United Kingdom $3,151; United States $2,976.
Industrial ----do	$3,239	$1,624	Belgium-Luxembourg $1,499; United States $125.
Iron and steel:			
Ore and concentrate--thousand tons	18,309	20,043	West Germany 6,666; United States 3,195; Japan 2,300; Italy 2,197; United Kingdom 1,527; Netherlands 1,342.
Scrap	9,581	12,970	Italy 11,594; Japan 1,376.
Nonferrous metal scrap n.e.s	18	94	West Germany 72; Italy 22.
Petroleum:			
Crude----thousand 42-gallon barrels	933	227	All to Belgium-Luxembourg.
Refinery products:			
Gasoline ----do	--	99	All to Canada.
Residual fuel oil ----do	150	--	

[1] Compiled from import data of Australia, 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, the United States, and Yugoslavia.

Source: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 739–740; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 525–526.

Table 3.—Liberia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	3	35
Metals including alloys, semimanufactures	120	124
Arsenic:		
Trioxide, pentoxide, and acids	1	(1)
Metal including alloys	1	3
Copper including alloys, semimanufactures	34	26
Gold ----troy ounces	2,241	4,406
Iron and steel:		
Scrap	r 152	6
Pig iron and ferroalloys	207	17
Ingots and other primary forms	210	331
Semimanufactures	11,364	17,343
Lead including alloys, all forms	33	29
Platinum group including alloys, all forms ----troy ounces	2	2
Silver:		
Silver and platinum ore ----value	$32	$657
Metal including alloys, all forms ----troy ounces	118	260
Zinc including alloys, all forms	34	42
Metallic oxides n.e.s	99	51
Alkali rare earth	31	40
Nonferrous n.e.s	6	5
NONMETALS		
Abrasive materials, natural:		
Pumice, emery, etc	223	310
Grinding and polishing wheels and stones	57	653
Asbestos, crude	--	87
Cement	36,211	4,383
Clay products, refractory and nonrefractory including nonclay brick	226	663
Diamond, industrial ----value	$899	--
Diatomite	6	--
Fertilizer materials:		
Natural:		
Nitrogenous	243	157
Phosphatic	5	36
Potassic, salts	365	5
Manufactured:		
Nitrogenous	12,280	4,597
Phosphatic, basic slag	696	619
Potassic	152	185
Mixed	1,240	217
Ammonia	943	1,028
Gypsum and plaster	166	45
Lime	1,505	1,077

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Salt	3,372	1,916
Sodium and potassium compounds:		
Caustic soda	820	1,155
Caustic potash	11	10
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked mainly calcareous	495	2,339
Worked	65	80
Gravel and crushed rock	5,458	3,608
Limestone, except dimension	5,721	17,779
Sand	625	--
Sulfur:		
Elemental	1	114
Sulfur dioxide	(1)	1
Sulfuric acid	197	42
Other:		
Refractory minerals, clay, graphite, dolomite and magnesite	31,266	13,996
Building materials of asphalt, asbestos and fiber, cement and unfired materials value	$294,272	$155,355
Other crude minerals	49	10
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	16	325
Carbon black, and gas carbon	21	13
Coal, coke and briquets	--	671
Gas, hydrocarbon manufactured value	$124,418	$21,495
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	661	917
Refinery products:		
Gasoline do	412	491
Kerosine and jet fuel do	99	131
Distillate fuel oil do	r 278	144
Gas oil do	369	206
Residual fuel oil do	347	127
Lubricants do	42	34
Asphalt do	19	973
Other do	(1)	(1)
Mineral tar and other crude chemicals derived from the distillation of coal, petroleum, or gas	203	41

r Revised.
1 Less than ½ unit.

Source: Republic of Liberia, External Trade, Imports 1968 and 1969.

COMMODITY REVIEW

METALS

Iron Ore.—Liberia iron ore production and export tonnage reached new highs in 1970. Production for the year totaled 23.6 million metric tons while exports totaled 24.1 million metric tons. Output at three major mines, Liberia Mining Co. (LMC), Bong Mining Co., and Liberian American-Swedish Mining Co. (LAMCO) exceeded 1969 levels and showed only a slight decrease at National Iron Ore Co., Ltd. (NIOC). Quantity and type of production from all four companies is presented in the following tabulation (thousand metric tons).

	1969	1970
Bong Mining Co.: Concentrates	4,463	5,267
Liberia Mining Co. (LMC):		
Lump ore	996	1,064
Fines	928	916
Concentrates	908	847
Liberian American-Swedish Mining Co. (LAMCO):		
Run-of-mine ore	537	769
Lump ore	4,183	4,118
Fines	4,549	5,046
Pellets	1,526	1,848
National Iron Ore Co. Ltd. (NIOC):		
Lump ore	1,545	1,509
Fines	3,231	2,274

In 1970 export of Liberian iron ore reached the new high of 24.1 million metric tons, which was 4.1 million metric tons above the previous year. West Germany, as in the past 3 years, remained the leading importer of Liberian iron ore with imports in 1970 totaling 5.6 million metric tons. The following tabulation shows 1970 exports from all four companies by type of product and recipient countries (thousand metric tons).

	LMC	NIOC	Bong	LAMCO	Total
Belgium-Luxembourg	--	81	--	1,546	1,627
France	124	485	--	719	1,328
Germany, West	279	1,064	3,543	748	5,634
Italy	--	386	1,397	1,286	3,069
Japan	--	--	220	2,286	2,506
Netherlands	1,630	1,360	--	2,404	5,394
United Kingdom	518	1,132	296	60	2,006
United States	85	167	--	1,758	2,010
Other countries	85	--	--	469	554

Expansion programs were underway at all four major iron mining companies, and output was expected to reach 24.7 million metric tons in 1971.

LAMCO, the leading producer in 1970, continued exploration and development work on the extension of the Nimba deposit adjacent to Guinea border. An agreement between the Liberian and Guinean Governments, to ship the iron ore from Guinea, on a joint venture basis, through LAMCO's railroad to Buchanan Port, was still under consideration.

Near the end of 1970 Bong Mining Co. had a trial run at its newly erected iron ore pelletizing plant, a joint German-Italian operation. Shipment of pellets was expected to begin early in 1971. The pelletizing plant, which cost $45 million will employ the Allis-Chalmers grate-kiln process and has an expected annual output of 5 million metric tons.

During the year NIOC was seeking a $5.3 million loan to be used for expansion of facilities at its Mano River mine. The company intends to construct a concentrating plant in which all low-grade mined ores, plus old tailings, will be used as feed. In addition substantial new loading and stockpiling facilities at the port of Monrovia have been envisaged.

Exploration and development work on the iron deposit at Wologisi range, 230 kilometers northeast of Monrovia, was completed in 1970. Liberia Iron and Steel Corp. (LISCO), which holds a concession from the Liberian Government on the Wologisi deposits, was actively negotiating with three major Japanese companies to enter into a joint venture for exploration of the deposits. The three Japanese companies involved are Kawasaki Steel Corp. and two trading concerns: C. Itoh and Co., Ltd., and Nissho-Iwai Co. Ltd. LISCO's development and exploitation of the Wologisi iron ore deposits envisages an investment of about $400 million and includes mining and concentrating facilities, a pelletizing plant, a 130-mile railroad and port facilities near Roberts port on the northern coast of Liberia. The anticipated output for the first 20 years, according to the local press, would be 10 million metric tons per year.

NONMETALS

Barite.—The barite concession in Grand Bassa County held by the U.S. firm, Dresser Industries Inc., was not opened for exploitation during the year. Dresser has had its geologists exploring the area at intervals over the past 2 years, but by yearend it was not known when the company would begin extraction.

Diamond.—Depressed world diamond market conditions had repercussions in the Liberian market as well. Exploration work on the new deposit in the Kakata area, 55 kilometers from Monrovia, was reduced to a minimum. Details of this new discovery, such as size, importance and reserves were not available.

Diamond mining continued in various parts of the country. A new management has taken over the Liberia Swiss Mining Corp. (LISWIMCO), whose president resigned when a large dam was carried away, before completion, during an abnormally high rise of the Lofa River. This company has the only mechanized operation for diamond mining in Liberia.

MINERAL FUELS

Petroleum.—Union Carbide Petroleum Co., a subsidiary of Union Carbide Corp., carried out seismic studies during the year on the offshore oil concession of Block A. This block, covering approximately 3,000 square kilometers, extends from Cape Mount, near the Sierra Leone border to Monrovia. Union Carbide anticipated drilling the first test well during the early part of 1971.

Frontier Liberian Oil Co., the successful bidder on Block B which extends from South of Buchanan to Bafu Bay and covers approximately 3,500 square kilometers, undertook an extensive seismic survey during the year. The seismic work was done primarily by Royal Resource Corp. and its parent company, Colorado Corp. The companies hold a 65-percent interest purchased from Frontier Liberian Oil Co. No drilling date was set in the concession.

Chevron Overseas Petroleum Co., a subsidiary of Standard Oil Co. of California which had obtained the concession right for Block C of the offshore oil, ran several hundred miles of seismic profiles in 1970. Block C extends from Monrovia to a little south of Buchanan. No results of the seismic work or date for the first test well were available by the end of the year.

Contract terms of these offshore agreements were believed to include a 50-percent income tax, based on posted prices, cash bonuses on production of 100,000 and 200,000 barrels per day, 2½-percent expensed royalty, 50-50 profit split, rentals, periodic 25-percent relinquishment of acreage, a 6-year exploration program, and 25-year development program.

The second year of successful operation of the only refinery in the country, 9 kilometers from the port of Monrovia, was marked by a 38-percent increase in total refinery products in 1970. The refinery produced regular and premium gasoline, kerosine, jet fuel, residual fuel oil, liquefied petroleum gas and asphalt; however, it is not equipped to produce lubricants, waxes, and base stocks for the petrochemical industry.

The Mineral Industry of Libya

By Roman V. Sondermayer [1]

During 1970 Libya remained a one-mineral-commodity country, with crude oil production dominating its economy. Although the Government made efforts to develop other mineral resources, at yearend only petroleum and, to a certain extent, natural gas were of world significance. Moreover, the new military Government continued to tighten supervision of oil operations and control of oil production, and to obtain increased revenues from petroleum operations. Petroleum marketing companies were nationalized, and production quotas were imposed on oilfields and companies. Following a lengthy period of negotiations, agreement was reached on new posted prices and tax rates. Crude oil prices increased from $2.23 [2] to $2.57 per barrel and tax rates advanced from 50 percent to a range of 55 to 58 percent.

Since the Suez Canal closing in 1967 and the subsequent elimination by the Organization of Petroleum Exporting Countries (OPEC) of allowances and adjustments for Libyan crude oils, the differential in tax reference prices for crude oil of similar gravity produced in the Persian Gulf and in Libya has been 40 cents per barrel. As a result of 1970 settlements with Libya, this differential will increase to about 73 cents per barrel over the next 5 years.

The Council of Ministers issued a law creating the Libyan National Oil Corporation (Linoco) to increase Libyan participation in the country's oil industry. Linoco replaced the former Libyan General Petroleum Company (Lipetco). The new company is authorized to participate in joint ventures and service contracts. In 1970 Linoco produced its first domestic crude oil. Linoco acquired the Umm Farud oilfield when Phillips Petroleum relinquished the concession rather than accept the Government's new posted crude oil prices.

New agreements with Yugoslavia and the U.S.S.R. were reached, whereby these nations would assist Libya in developing its oil transportation and reservoir engineering capabilities.

Drilling activities both exploration and development slowed considerably in 1970. Production increased in the first half of the year, but output dropped sharply in the third quarter of the year after the Government imposed production restrictions. At yearend, production reached a level of about 3.2 million barrels per day.

Although the liquefied natural gas (LNG) facilities begun in 1969 were completed they remained idle during 1970. Libyan authorities refuse to allow Esso Standard Libya, Inc., to fulfill its export commitments until a new agreement is reached on the tax base.

Two natural gas processing plants were completed and a third was under construction at the close of the year. The total design capacity of the completed plants amounted to 20,000 barrels daily throughput, The reported design capacity of the third plant was 68,000 barrels daily.

PRODUCTION

The new Government restrictions on crude oil production during the second half of the year somewhat curtailed 1970 production. Crude oil output averaged 3.2 million barrels per day compared with 3.1 million barrels per day in 1969. The following tabulation shows monthly crude oil production in 1970.[3]

[1] Petroleum engineer, Division of Fossil Fuels.
[2] Where necessary, values have been converted from Libyan pounds (£1) to U.S. dollars at the rate of £1=US$2.80.
[3] Petroleum Press Service. V. 38, No. 2, February 1971, p. 80.

Month	*Thousand barrels*
January	111,513
February	101,086
March	100,934
April	110,193
May	110,704
June	97,812
July	98,884
August	93,009
September	89,856
October	93,859
November	95,334
December	98,865

Table 1.—Libya: Production of mineral commodities

Commodity [1]	1968	1969	1970 [p]
NONMETALS			
Cement [e] thousand metric tons	-----	50	100
Gypsum do	14	[e] 15	[e] 15
Salt [e] do	16	16	16
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, gross production [2] million cubic feet	620,000	666,525	[e] 710,000
Petroleum:			
Crude thousand 42-gallon barrels	948,519	1,134,452	1,215,340
Refinery products:			
Gasoline do	494	762	NA
Kerosine do	215	364	
Distillate fuel oil do	666	861	
Residual fuel oil do	972	1,160	
Other (naphtha) do	122	-----	
Refinery fuel and losses do	182	166	
Total do	2,651	3,313	NA

[e] Estimate. [p] Preliminary. 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.

[2] Virtually all flared or reinjected.

TRADE

U.S. imports of Libyan crude oil decreased 65 percent from 134,000 to 47,000 barrels per day between 1969 and 1970.

Supplies and equipment used by oil companies represented the largest single import trade category.

Table 2.—Libya: Crude oil exports, by countries

(Million 42-gallon barrels)

Country	1967	1968	1969
Belgium	33.3	30.3	44.6
Canada	5.9	-----	3.8
Denmark	13.2	8.9	9.1
France	80.6	[r] 75.1	121.8
Germany, West	[r] 148.2	[r] 259.5	274.3
Italy	129.2	[r] 182.7	241.8
Netherlands	58.1	[r] 68.2	113.1
Norway	6.7	10.4	7.7
Romania	-----	[r] 1.1	3.9
Spain	27.9	[r] 57.1	59.4
Switzerland	6.3	[r] 8.0	11.0
Trinidad and Tobago	7.2	6.3	8.3
Tunisia	-----	-----	1.2
Turkey	3.7	4.0	1.9
United Kingdom	75.7	[r] 171.5	152.9
United States	18.3	[r] 53.1	56.8
Yugoslavia	4.3	2.0	1.5
Other	8.2	4.5	7.3
Total	[r] 626.8	[r] 942.7	1,120.4

[r] Revised.

Source: Statistics Unit of the Organization of Petroleum Exporting Countries (OPEC). Annual Statistical Bulletin, 1969. Vienna, 1970, p. 64.

COMMODITY REVIEW

NONMETALS

Cement.—Construction of a 340,000-ton-per-year cement plant continued at a site near Benghazi. The project was largely financed by the Ministry of Industry. The plant will be operated by the Libyan Cement Co., when completed in 1971.

Fertilizer Materials.—The 272,000-ton-nitrogen-per-year ammonia plant of Occidental Chemical and Linoco at Zuetina is scheduled for production in 1972.

A consortium formed by the Libyan Government, Ashland Oil Refining Co., and AGIP Mineraria, Inc., plans to build an ammonia plant near Benghazi as a part of a new Government-controlled petrochemical complex.

Other Nonmetals.—The Ministry of Industry continued to promote the development of Libyan mineral resources. The following resources development projects were stressed: Bentonite and clay deposits near Holms, silica deposits at Abu Ghelan, marble quarries near Tarhuna and Ben Wadi, gypsum deposits near the Bir Ghenim Jeffren and Garian areas. Pertinent capacities and economic aspects of these projects were not available at yearend 1970.

MINERAL FUELS

Natural Gas.—Following more than a year of difficulty with technical problems and pipeline explosions and fires, the Esso Standard LNG plant at Marsa-el-Brega was completed in 1970 but not placed in operation. Exportation of the LNG to Spain and Italy was denied by the new Government because no agreement had been reached on the price of the LNG for tax purposes. The 15 and 20-year contracts with these two countries involve the supply of 345 million cubic feet per day of natural gas.

Esso has invested about $350 million in the project which includes two compression plants, one In Raguba and one in Zelten; a pipeline that connects the oilfields with the LNG plant at Marsa el-Brega; the LNG plant itself; and LNG storage and loading facilities at the port of Marsa el-Brega.[4]

Two natural gas processing plants with a combined output capacity of approximately 20,000 barrels per day of LNG were completed in 1970. One, owned by Occidental of Libya, Inc., can produce up to 5,000 barrels per day of liquids that are blended with crude oil prior to shipment. The dry gases (methane) are reinjected into reservoirs for pressure maintenance. The British Petroleum Co. Ltd., and Nelson Bunker Hunt plant processes associated gas from the Sarir oilfield. The recovered liquids are blended with Sarir crude oil, raising gravity from 30° to 37° API gravity oil.[5]

In late 1970, Occidental was building a larger natural gas processing unit that will have a 68,000-barrel daily capacity.

Petroleum.—During 1970 the Libyan Government increased control over the foreign-operated oil industry.

The Government nationalized facilities for distribution of petroleum products. Esso, Shell Co. of Libya. Ltd., and Ente Nazionale Idrocarburi (ENI) were the companies affected. Including 310 retail outlets, the nationalized assets were valued at $30 million. The Esso refinery at Marsa el-Brega and the Oasis topping plant at the Bahra field were not affected.[6]

During July and August the Libyan Government imposed production controls which reduced output of crude oil by about 665,000 barrels per day. Toward yearend the Government permitted some increases in production, but the overall production remained below the May level. Maximum allowable production rates were set for each field, thus introducing a state-imposed proration system as a conservation measure. Following the September settlement of the posted price dispute, the Government restored some of the cutbacks in production. The tabulation below shows, in thousand barrels per day, the extent of cutbacks at yearend 1970:

[4] World Oil. V. 169, No. 16, Aug. 1, 1969, p. 55.

[5] Petroleum Intelligence Weekly. V. 9, No. 28, July 13, 1970, p. 1.

[6] Petroleum Intelligence Weekly. V. 9, No. 29, July 20, 1970, p. 3.

Company	Government imposed allowable production	Extent of cutbacks
American Overseas Petroleum, Ltd. (Amoseas)	260	100
British Petroleum Co. Ltd.-Nelson Bunker Hunt	405	---
Esso Standard Libya, Inc	620	110
Mobil Oil Libya Ltd./Gelsenberg Benzin, A. G	222	50
Oasis Oil Co. of Libya, Inc	895	150
Occidental of Libya, Inc	745	100
Other	43	---
Total	3,190	510

During 1970, the Libyan Government obtained, after long and difficult negotiations, a substantial increase in posted prices as well as increased tax rates. The negotiations ended in early September when Occidental reached a settlement with the Government. By yearend all companies had concluded agreements with the Libyan Government along the lines established by Occidental except Phillips, which preferred to relinquish its concession rather than accept the new terms. The terms of the announced settlements were as follow:

1. The posted price for all Libyan crude oil effective September 1 was $2.53 per barrel f.o.b. loading for 40° API gravity oil, with 2 cents per barrel more for every full degree above 40° API, and 1½ cents per barrel less for every full degree below 40° API gravity. The new posting applied to all crude oils irrespective of loading port and quality other than gravity. Changes in prices are presented in the following table:

Gravity type	Old posting (value per barrel)	New posting (value per barrel)	Difference (value per barrel)
42° API gravity Libyan light	$2.23	$2.57	$0.34
40° API gravity Libyan light	2.23	2.53	.30
37° API gravity Libyan high pour, Marsa Hariga	2.10	2.48-½	.38-½
36° API gravity Libyan high pour	2.10	2.48	.38

Posted prices for all crude oils will increase by 2 cents per barrel each year from 1970 through 1975; thus, in 1975 the posted price for 40° API gravity crude oil will increase to $2.63 per barrel f.o.b. loading port with the same variations based on gravity as applicable in 1970.

2. The tax rates to be paid by the companies on any crude oil were also increased effective September 6, 1970. The new tax rates to be paid by the various companies are as follows: Occidental, 58 percent; Mobil-Gelsenberg, 55 ½ percent; Texaco-Chevron-BP, Bunker, Hunt-Esso-Atlantic-Richfield-Grace 55 percent; the Oasis group-Continental-Marthon-Amerada-Shell, 54 percent. The tax rates for Standard of Indiana (Amoco) and the Elf Snpa Hispanoil Murphy consortium remain unchanged. Instead of higher taxes these companies have agreed to cash settlements with the Libyan Government.

The increase in revenue to the Government resulting from the settlements with the oil companies was estimated to range from 25 to 35 cents per barrel; it is expected to increase by about 1 cent per barrel per year over the next 5 years. About 30 percent of the increase resulted from the higher tax rates, and the balance was from increased prices.[7]

Drilling activity declined, and the number of active drilling rigs dropped from 41 to 12 by yearend 1970. To encourage drilling the Government issued an edict late in 1970 requiring the oil companies to set aside a percentage of their profits for exploration.[8]

In the first half of 1970 (latest available data), extension and development well footage declined, whereas the number of completions rose slightly. The success ratio was 88.5 percent. The most active companies were Oasis (Bahi field); Esso (Zelten field); and Amoseas (Nafoora field). The extension and development drilling for first half of 1970 were as follows:

Company	*Footage*	*Completions*
Agip Minararia, Inc	28,000	2
American Oil Co. (Amoco)	1,500	---
American Overseas Petroleum, Ltd. (Amoseas)	154,300	19
Aquitaine Libya	11,000	1
British Petroleum Co., Ltd. Nelson Bunker Hunt	500	1
Esso Standard Libya, Inc	273,800	43
Esso Sirte, Inc	40,300	7
Mobil Oil Libya, Ltd./Gelsenberg Benzin, A. G	78,300	12
Oasis Oil Co. of Libya, Inc	178,200	45
Occidental of Libya, Inc	71,100	9
Shell Co. of Libya, Ltd	800	---
Total	837,800	139

[7] Petroleum Press Service. V. 38, No. 10, October 1970, p. 379.
[8] Petroleum Intelligence Weekly. V. 10, No. 1, Jan. 4, 1970, p. 7.

As a result of exploration activities the following fields were discovered:

Company and field	Average initial production rate (barrels per day)
Amoco:	
Sahabi—B	414
Sahabi—D	3,079
Aquitaine: Mansour	5,290
Oasis: Bahi	102,783
Occidental: Intisar—C	31,053

The French company Société National des Pétroles d'Aquitaine (SNPA) announed Libya's first offshore oil discovery. The well, located northwest of Tripoli, tested 1,102 barrels per day of 34° API gravity oil on a ¼-inch choke.

The principal oilfields in production during the first half of 1970 were as follows:

Company and field	Average production for the first half of 1970 (barrels per day)
Amoco:	
Sahabi—B	412
Sahabi—D	3,079
Amoseas:	
Beda	14,617
Dor	7,460
Kotla	13,995
Nafoora	332,156
Aquitaine:	
Magid	16,212
Mansour	5,290
BP-Hunt:	
Sarir Main	323,261
Sarir North	6,084
L-65	72,760
Esso Libya:	
Arshad	3,747
Jebel	22,211
Lahib	12,851
Ralah	3,302
Zelten	578,940
FFF-6	873
Esso Sirte: Raguba	130,287
Mobil:	
Amal (A, N, and U)	212,985
Bu Mras	490
Dor Marada	15,043
Ed Dib	1,816
Farigh	4,557
Farrud	4,777
Hofra	9,238
Ora	13,846
Rakb-D	13,189
Rakb-Y	890
Fakb-GG	540
Oasis:	
Bahi	102,783
Bel Hedan	7,565
Dahra	75,173
Defa	186,468
Gialo	392,178
Samah	82,958
Waha	146,244
Zaggut	3,264
Occidental:	
Augila	87,846
Intisar-A	263,297
Intisar-C	31,053
Intisar-D	334,553
Phillips: Umm Farud	4,761

The Libyan Government has a number of widely scattered small fields (130,000 square kilometers) with a combined theoretical capacity of 45,000 barrels per day (2.25 million tons per year). Development of these fields would necessitate the construction of a main trunk pipeline and gathering system.

Plans to build a 40,000-barrel-per-day refinery at Tripoli collapsed when Shell withdrew from a project it held jointly with Linoco. At yearend Linoco was seeking new bids.

There was no major pipeline construction in 1970 in Libya; however, a 68-mile-long, 14-inch pipeline to connect with the present pipeline system of Mobil-Gelsenberg and Amoseas was planned.

Several Japanese firms have shown interest in obtaining exploration rights in Libya. A general agreement in principal has been signed, but at yearend no information was available on the status of contract negotiations.

An assistance agreement has been signed with the U.S.S.R. calling for Soviet specialists to make a detailed survey of the country's oil reserves.

A preliminary cooperation accord was reached between Libya and Yugoslavia in the field of petrochemicals and petroleum refining. Moreover, Yugoslav authorities have offered to assist the Libyan Government in establishing a tanker fleet.

Occidental, continued construction of a $30 million methanol plant. The plant, to be completed during 1973, will be a joint venture with Linoco and part of a large State-sponsored petrochemical complex near Benghazi. The complex will include a 1,000-ton-per-day ammonia plant and possibly a 50,000-barrel-per-day refinery. Total cost for the project was reported to be $150 million.

Preliminary talks between a German concern and Linoco for a $50-million petrochemical installation were underway during 1970. The installation will have an annual capacity of 550,000 tons of benzene.

The Mineral Industry of Malaysia

By John R. Lewis [1]

In 1970 Malaysia was a country with a relatively sound economy, a mildly favorable balance of trade, an attractive investment climate, and a comparatively high standard of living. Much of this state of affairs was a result of the nation's natural resource position.

Although the economy slowed somewhat in 1970, the direction was upward. Exports rose 2.1 percent in value during the year, but imports jumped 15.7 percent. A smaller trade surplus than usual at yearend totaled M$1,034 million.[2] The gross national product (GNP) rose 6.3 percent during 1970, against 9.8 percent in 1969 and 4 to 5 percent in 1968.

Second in importance only to rubber among Malaysia's exports, tin metal shipped to world markets in 1970 showed a 0.6-percent increase in value over tin shipments in 1969. Valuewise, and not including rubber, these tin exports outstripped the combined worth of all other Malaysian commodity exports in 1970—wood, palm products (mostly oils), bauxite, titanium, and iron ore. Metallic tin accounted for 23 percent of the value of all 1970 commodity exports, whereas iron ore shipments, reflecting dwindling reserves, generated only 3 percent of the commodity export values.

Malaysia continued to be far in the lead among the world's tin mining and smelting nations during 1970. This century-long leadership has steadily widened since 1948, when post World War II recovery began to gather momentum. Malaysia's tin mining sector employed 46,000 men in 1970, who mined the Nation's extensive alluvial deposits with gravel pumps, hydraulicing, or with giant dredges. The two tin smelters, which process all domestic ores plus those of several neighboring countries and others, turned out 41 percent of the world's tin metal in 1970; most of it ranked as the world's highest quality.

The United States maintained its position as Malaysia's largest customer, buying mostly tin and rubber. Japan, as a buyer of tin, was second, and Eastern Europe more than doubled its imports of Malaysian tin during 1970 and overtook the Netherlands for third place among Malaysia's tin customers. Earnings from sawn logs, iron ore, palm oil, and other agricultural items also showed considerable increases.

Wider interest in control of the environment developed during the year. Water and air pollution, caused by installations processing items such as rubber, pine oil, chemical fertilizers, etc., and by the slimes of tin mining and by tin smelting, were recognized as problems but although pollution control measures were under consideration during the year, environmental control did not assume the proportions of a major issue. Past performance indicates that Malaysia will probably be able to take advantage of progressive developments abroad.

The First Malaysia Plan (1966–70) ended at the close of 1970. An outlay of M$10.5 billion, in both public and private sectors, had been used to encourage development. Records of 5-year growth were termed satisfactory by Malaysian sources despite wide fluctuations in prices of major export commodities (including tin) and an uncertain international demand situation. Satisfactory completion of the Fourth International Tin Agreement was expected to

[1] Physical scientist, Division of Nonferrous Metals.

[2] Where necessary, values have been converted from Malaysian dollars (M$) to U.S. dollars at the rate of M$3.04=US$1.00.

have a stabilizing effect upon Malaysia's fluctuating tin mining and marketing situation.

The Government's Second Malaysia Plan (1971–76) had five priorities: (1) a stronger economic, social, and security foundation for overall economic expansion; (2) rapid economic growth to raise the national income level and steadily increase the number of employment opportunities; (3) more equitable distribution of wealth and sharing of facilities among the different races; (4) promotion of economic and social integration and an increase in the productive capacity of the disadvantaged groups; and (5) a dynamic and direct role by the Government in selected commercial and industrial ventures to promote greater involvement and participation by the less favored groups.

PRODUCTION

Malaysia's tin production is located in West Malaysia and its surrounding waters. The metal content of mine output for 1970 was 76,632 long tons, up 4,465 tons from 1969 and a post-World War II record high, exceeding the previous post-war peak of 75,069 tons achieved in 1968. Approximately 55 percent of Malaysia's tin came from the gravel pump mines, 979 of which were operating at yearend; only 955 were

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

(Metric tons unless otherwise specified)

Commodity [2]	1968	1969	1970 [p]
METALS			
Aluminum, bauxite, gross weight ... thousand tons	799	1,073	1,139
Antimony mine output, metal content (Sarawak)	23	39	[e] 35
Columbium and tantalum concentrates, gross weight	52	64	23
Copper mine output, metal content [e 3]	319	250	305
Gold mine output, metal content:			
West Malaysia ... troy ounces	1,454	3,153	3,912
Sarawak ... do	2,718	2,271	1,265
Total ... do	4,172	5,424	5,177
Iron and steel:			
Iron ore and concentrate ... thousand tons	5,167	5,234	4,491
Pig iron and blast furnace ferroalloys [e] ... do	60	60	60
Crude steel [e] ... do	60	60	60
Manganese ore and concentrate, gross weight	45,121	10,334	--
Rare earth minerals:			
Monazite, gross weight [4]	2,138	2,054	1,657
Xenotime (yttrium mineral) gross weight [4]	70	153	394
Tin:			
Mine output, metal content ... long tons	75,069	72,167	76,632
Smelter output ... do	[r] 88,185	87,089	90,652
Titanium, ilmenite concentrate, gross weight [4]	125,825	132,628	192,455
Tungsten mine output, metal content	65	138	136
Zirconium, zircon concentrates, gross weight [4]	1,126	1,417	860
NONMETALS			
Cement, hydraulic ... thousand tons	[r] 937	973	1,030
Clays, kaolin	1,521	2,048	3,327
Lime (Sarawak only)	21	NA	NA
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude (Sarawak) ... thousand 42-gallon barrels	[r] 1,557	3,278	6,299
Refinery products (Sarawak and West Malaysia):			
Gasoline ... do	9,628	5,950	[e] 3,984
Jet fuel ... do	7,431	5,475	[e] 7,290
Kerosine ... do		3,285	[e] 2,423
Distillate fuel oil ... do	15,521	6,096	[e] 6,746
Residual fuel oil ... do	15,619	20,002	[e] 17,186
Other ... do	1,672	1,096	[e] 2,062
Refinery fuel and losses ... do	2,271	2,117	[e] 2,427
Total ... do	52,142	44,021	[e] 42,118

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

[1] All recorded production is from West Malaysia unless otherwise indicated parenthetically in commodity column.

[2] In addition to the commodities listed, a variety of crude construction materials, such as clays, sand and gravel, and stone, are also produced, but output is unreported and available information is inadequate to make reliable estimates of output levels.

[3] Estimate based on exports of copper concentrates.

[4] Exports.

operating a year earlier. Price improvement was given credit for the increased mine activity. There were also 61 dredges running at yearend; four less than at yearend 1969. Dredging supplied 32.43 percent of Malaysia's tin in 1970. The balance came from underground mines, hydraulicing mines, opencast mines and others.

Iron ore production, all of which took place in West Malaysia, was curtailed when economic reserves were finally exhausted at one large mine on the East Coast. Production dropped 14.2 percent in 1970.

Malaysia's petroleum comes from three fields in Sarawak, of which the offshore W. Lutong field is the largest. Repeating the performances of recent years, crude production almost doubled in 1970 over 1969 and reached an annual total of 6.3 million barrels.

Bauxite production rose somewhat in 1970 as a new mine, making three in all, opened in West Malaysia. Production had ceased in Sarawak in 1965.

Gold, from West Malaysia and Sarawak, at 5,177 troy ounces, was only slightly below output of 1969.

Two additional kaolin mines went into operation in 1970, whereupon total production rose 62 percent to 3,327 tons.

Other minerals produced mostly as byproducts of tin mining included ilmenite, zircon, xenotime, scheelite, monazite, and columbite. Ilmenite (an ore of titanium), totaling 132,628 tons, was exported in 1969.

TRADE

Second only to rubber among all of Malaysia's products, tin is the export leader among the mineral commodities. Tin leaves the country only as metal, some of which is mined in Indonesia and elsewhere and brought to Malaysia for smelting. In 1970 exports of tin metal were up very slightly from 89,830 long tons in 1969 to 90,432 tons. Tin exports amounted to about 125 percent of the total mined in the country. Buyers of 82 percent of Malaysia's exported tin were the United States (32,862 long tons), Japan (24,074), the Netherlands (8,258), Italy (6,229), and Canada (2,958).

In January 1970, the Governments of Malaysia and Poland initialed a draft trade agreement under which each country would establish trade offices in the other's capital. Poland was reported also to be exploring possibilities of setting up joint venture trading firms in Malaysia. Malaysia was making plans to send an official trade and industrial mission to the Soviet Union, Bulgaria, Romania, Poland, Yugoslavia, and Hungary.

Table 2.—West Malaysia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite	r 789,450	876,854
Metal including alloys:		
Unwrought	13	34
Semimanufactures	195	245
Copper:		
Ore	1,276	1,016
Metal:		
Scrap	--	2,371
Unwrought and semimanufactures	292	301
Iron and steel:		
Iron ore thousand tons	r 5,189	5,347
Metal:		
Iron and steel scrap	26,116	25,906
Pig iron, ferroalloys and similar materials	545	1,198
Steel, primary forms	74	221
Semimanufactures:		
Bars, rods, angles, shapes, and sections	2,936	24,907
Universals, plates and sheets	8,819	10,163
Hoop and strip	31	45
Rails and accessories	172	1,231
Wire	163	102
Tubes, pipes and fittings	4,254	13,452
Castings and forgings, rough	59	80

See footnotes at end of table.

Table 2.—West Malaysia: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS—Continued		
Lead:		
Ore	10	361
Oxides	2	53
Metal including alloys, all forms	35	432
Magnesium including alloys, all forms	--	11
Manganese ore	40,745	45,670
Mercury ... 76-pound flasks	77	3
Monazite	NA	1,605
Thorium ore	2,207	164
Tin:		
Ore ... long tons	r 1,002	741
Metal including alloys:		
Scrap ... do	--	542
Unwrought ... do	r 86,019	89,830
Semimanufactures ... do	27	6
Titanium ore and concentrate	r 126,389	132,628
Tungsten ore and concentrate	229	44
Zinc including alloys:		
Scrap	--	417
Blue powder	--	3
Unwrought	--	6
Semimanufactures	58	102
Other:		
Ash and residue containing nonferrous metals	4,111	3,484
Oxides, hydroxides and peroxides of metals n.e.s	38	145
Metals including alloys, all forms:		
Alkali, alkaline earth and rare earth	104	51
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	1	10
Asbestos	133	33
Barite and witherite	--	15
Boron materials, crude	--	10
Cement	r 292,404	405,485
Clays and products (including refractory brick):		
Crude:		
China (kaolin)	140	573
Fuller's earth	--	56
Other	283	247
Products:		
Refractory	53	69
Nonrefractory	1,902	2,271
Diamond, gem not set or strung ... value	NA	$153,913
Diatomite and other infusorial earths	3	29
Fertilizer materials:		
Crude, phosphatic	705	1,156
Manufactured:		
Nitrogenous	114	2,036
Phosphatic	--	136
Potassic	75	99
Other including mixed	15,311	23,794
Ammonia	441	374
Gypsum and plasters	544	77
Lime	4,635	5,841
Pigments, mineral, natural, crude	3	18
Precious and semiprecious stones, except diamond, natural	NA	13,197
Salt and brines	479	3,734
Sodium and potassium compounds, n.e.s.:		
Caustic soda	11	203
Caustic potash, sodic and potassic peroxides	--	3
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	820	1,036
Worked	248	290
Dolomite, chiefly refractory grade	2,629	1,313
Gravel and crushed rock	107,743	101,604
Limestone (except dimension)	1,113	5,862
Quartz and quartzite	34	34
Sand excluding metal bearing	38,219	11,940
Talc, steatite, soapstone, and pyrophyllite	41	10
Other nonmetals, n.e.s.:		
Crude	21	215
Slag, dross and similar waste, not metal bearing	12	520
Building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals, n.e.s	8,961	19,971
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	1	493
Carbon black and gas carbon	1	24
Coke and semicoke	199	139

See footnotes at end of table.

Table 2.—West Malaysia: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS—Continued		
Petroleum:		
Crude thousand 42-gallon barrels	9	(1)
Partly refined do	r 3,860	3,402
Refinery products:		
Aviation gasoline do	1	9
Motor gasoline do	4	744
Kerosine do	1,339	749
Jet fuel do	160	1
Distillate fuel oil do	944	1,073
Residual fuel oil do	1,475	1,211
Lubricants do	6,578	3,409
Other, bitumen and other residues do	98	37
Total do	10,599	7,233

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

Table 3.—West Malaysia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	2,464	2,712
Metal and alloys, all forms	r 4,502	4,723
Chrome, oxide and hydroxides	2	16
Cobalt, oxide and hydroxides	38	22
Copper:		
Ore and concentrate	--	56
Metal and alloys, all forms	r 2,785	2,834
Iron and steel:		
Iron and steel scrap	814	4,001
Pig iron including cast iron	3,143	10
Sponge iron, powder and shot	42	95
Ferroalloys:		
Ferromanganese	700	509
Other	35	300
Steel, primary forms	19,156	198
Semimanufactures:		
Bars, rods, angles, shapes and sections	r 69,772	43,885
Universals, plates and sheets	r 130,812	139,642
Hoop and strip	14,308	20,525
Rails and accessories	5,189	1,082
Wire	30,470	29,270
Tubes, pipes, and fittings	31,952	22,853
Castings and forgings, rough	2,714	2,006
Lead:		
Ore and concentrate	1	48
Oxides	518	727
Metal including alloys, all forms	694	1,354
Magnesium including alloys, unwrought	--	69
Manganese:		
Ore and concentrates	1,866	2,288
Oxides	354	334
Mercury 76-pound flasks	105	63
Molybdenum including alloys, all forms	--	28
Nickel including alloys, unwrought and semimanufactures	34	36
Platinum group including alloys troy ounces	15	394
Silver do	14	2,581
Tin:		
Ore long tons	23,504	18,387
Metal including alloys, all forms do	173	18,736
Titanium oxides	1,541	1,590
Zinc:		
Ore	2,684	2,105
Oxide	1,404	1,538
Metal including alloys, all forms	2,569	4,128
Other:		
Ash and residue containing nonferrous metals	1,293	1,030
Metals including alloys, all forms:		
Metalloids	107	67
Alkali, alkaline earth and rare earth	937	27
Pyrophoric alloys	1,703	24

See footnote at end of table.

Table 3.—West Malaysia: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS		
Abrasives, natural, n.e.s.: Pumice, emery, corundum, etc	106	106
Asbestos	10,354	8,790
Barite and witherite	--	108
Boron materials:		
Crude natural borates	--	99
Oxide and acid	--	67
Cement	3,321	7,099
Chalk	--	333
Clays and products:		
Crude:		
Bentonite	--	114
China (kaolin)	1,196	1,435
Fuller's earth	431	1,707
Mullite, charmotte, and dinas earths	--	123
Other	1,470	1,228
Products:		
Refractory	12,162	9,483
Nonrefractory	6,705	8,227
Diamond, gem not set or strung value, thousands	$1,270	$1,496
Diatomite and other infusorial earths	300	319
Feldspar	582	3,040
Fertilizer materials:		
Crude:		
Nitrogenous	33	56
Phosphatic	r 86,312	81,648
Potassic	158	375
Other	26,477	26,446
Manufactured:		
Nitrogenous	r 57,773	72,020
Phosphatic:		
Thomas (basic) slag	3,927	385
Other		6,370
Potassic	r 54,094	74,212
Other including mixed	25,389	43,091
Ammonia	2,143	8,247
Graphite, natural	182	105
Gypsum and plasters	36,551	30,618
Lime	6,511	1,570
Magnesite	204	324
Pigments, mineral:		
Natural, crude	145	232
Iron oxides	617	759
Precious and semiprecious stones, except diamond:		
Natural value	$33,949	$43,976
Manufactured do	$3,678	$3,730
Pyrite	--	31
Salt and brines	r 86,134	109,460
Sodium and potassium compounds, n.e.s.:		
Caustic soda	4,643	3,709
Caustic potash, sodic and potassic peroxides	381	453
Stone, sand and gravel:		
Dimension stone crude and worked	913	1,760
Dolomite, chiefly refractory grade	115	78
Gravel and crushed rock	1,801	2,565
Limestone (except dimension)	1,520	1,484
Quartz and quartzite	477	44
Sand excluding metal	2,498	2,778
Sulfur:		
Elemental, all forms	5,847	5,607
Sulfur dioxide	150	345
Sulfuric acid	203	561
Talc, steatite, soapstone, and pyrophyllite	2,933	3,147
Other nonmetals, n.e.s.:		
Crude	17,343	23,520
Slag, dross, and similar waste, not metal bearing	78	108
Oxides and hydroxides of magnesium, strontium, and barium	57	19
Building materials of asphalt, asbestos, and fiber, cement, and unfired metals, n.e.s	1,665	4,516
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	411	1,182
Carbon black	4,033	4,331
Coal, coke, and briquets:		
Anthracite and bituminous coal	r 12,267	17,009
Lignite and lignite briquets	--	100
Coke and semicoke	5,814	6,573
Petroleum:		
Crude thousand 42-gallon barrels	r 22,231	22,690
Partly refined do	1,917	2,133

See footnote at end of table

Table 3.—West Malaysia: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS—Continued		
Petroleum—Continued		
Refinery products:		
Aviation gasoline ---- thousand 42-gallon barrels	1	3
Motor gasoline ---- do	829	766
Kerosine ---- do	389	610
Jet fuel ---- do	100	23
Distillate fuel oil ---- do	3,340	3,472
Residual fuel oil ---- do	366	255
Lubricants ---- do	211	192
Mineral jelly and wax ---- do	26,172	40,048
Other:		
Nonlubricating oils ---- do	18	53
Petroleum coke ---- do	218	941
Bitumen and other residues ---- do	78	67
Total ---- do	31,722	46,430

r Revised.

Table 4.—Sarawak: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Iron and steel scrap	1,259	925
Platinum and silver waste and sweepings ---- value	$1,761	$34,418
Silver including alloys ---- do	$1,098	--
Other, ore and concentrate	122	36
NONMETALS		
Clay products	462	54
Fertilizers, crude	170	174
Stone, sand and gravel:		
Dimension crude and partly worked	--	3,794
Gravel and crushed rock	3,546	23,553
Sand excluding metal bearing	10	74
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude oil ---- thousand 42-gallon barrels	r 16,511	22,335
Partly refined ---- do	r 4,763	5,177
Refinery products:		
Gasoline:		
Aviation ---- do	77	49
Motor ---- do	670	773
Kerosine ---- do	2	2
Jet fuel ---- do	3,743	4,539
Distillate fuel oil ---- do	1,188	1,125
Residual fuel oil ---- do	10,401	10,967
Lubricants ---- do	1,184	(1)
Total ---- do	17,265	17,455

r Revised.
[1] Less than ½ unit.

Table 5.—Sarawak: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum semimanufactures	182	302
Copper unwrought and semimanufactures	65	39
Iron and steel:		
Metal, pig iron, ferroalloys and similar materials	613	760
Steel semimanufactures	21,359	26,458
Lead unwrought and semimanufactures ... long tons	41	38
Tin unwrought and semimanufactures	109	135
Zinc unwrought and semimanufactures	68	73
NONMETALS		
Cement	r 55,335	54,612
Clays, crude	62	65
Fertilizers:		
Crude	r 9,735	4,683
Manufactured	r 17,284	21,010
Ammonia	21	25
Gypsum and plasters	19	33
Lime	47	314
Pigments, mineral including processed iron oxides	13	12
Salt	6,487	6,662
Sodium and potassic compounds, n.e.s	155	102
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	48	56
Worked	98	39
Dolomite, chiefly refractory grade	464	251
Gravel and crushed rock	2,453	3,413
Limestone	1,718	232
Sand excluding metal bearing	544	--
Sulfur:		
Elemental, all forms	5	4
Sulfuric acid	34	44
Talc, steatite, soapstone, and pyrophyllite	49	54
Other nonmetals, n.e.s.:		
Crude	895	558
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s	4,516	5,779
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	36
Coke	11	10
Petroleum:		
Crude ... thousand 42-gallon barrels	r 38,571	45,183
Partly refined ... do	r 411	388
Refinery products:		
Gasoline:		
Aviation ... do	4	4
Motor ... do	188	237
Kerosine ... do	79	137
Jet fuel ... do	104	56
Distillate fuel oil ... do	317	368
Residual fuel oil ... do	20	30
Lubricants ... do	31	32
Other:		
Bitumen and other residues ... do	12	7
Bituminous mixtures ... do	6	33
Total ... do	761	904

r Revised.

Table 6.—Sabah: Imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1968	1969
Gasoline	410	396
Kerosine and jet fuel	293	293
Distillate fuel oil	851	775
Residual fuel oil	121	116
Lubricants	52	51
Total	1,727	1,631

Source: Institute of Geological Sciences, Mineral Resources Division. Statistical Summary of the Mineral Industry 1964–69. Her Majesty's Stationery Office, London, 1971. p. 272.

COMMODITY REVIEW

METALS

Copper.—Earlier reports of a 1972 target for completion of development work and full-scale operation of the Mamut copper mine near Mount Kinabalu, on Sabah, were confirmed during 1970. Overseas Mineral Resources Development Co., Ltd., owned 51 percent by eight Japanese copper-smelting companies and 49 percent by Malaysian industrialists, was investing $67 million in developing the mine which will have a daily capacity of 20,000 to 40,000 tons of ore. After concentrating the ore nearby, the company hopes to ship 16,000 tons of copper to Japan every month. When in full operation, 1,000 people will be employed at the mine. The Mamut facilities, estimated to contain 90 million tons of copper ore, will be Southeast Asia's largest and will take 10 years to deplete.

Tin.—The crowded navigational dangers in the Straits of Malacca tended to perturb the newer tin-dredge operators. Some of Malaysia's new vessels are capable of working in up to 100 feet of water.

There were 24 more gravel pump mines in operation in Malaysia in 1970 than during the previous 2 years. Spokesmen for the tin-mining industry indicated that the previous reverse trend was the result of restrictions placed upon tin production owing to tin export controls of the International Tin Council during late 1968 and throughout 1969. The correction in tin prices, which was the result of the restrictions, created the incentive for reopening some mines, the startup of several new operations, and larger, newer equipment in others. Total horsepower employed in the gravel pump mines, for example, rose 6.8 percent from January to December 1970, from 725,263 in January to 774,454 by December.

During 1970 seven operating dredges were shut down because payable reserves were exhausted. Their combined digging capacity was 1,512,000 cubic yards per month. There were three startups, two of which were new, large dredges. Total digging capacity of the three newcomers was 1,410,000 cubic yards per month; the net loss of digging capability was minimal.

The total tin mining labor force was 46,457 men in 1970, one less than in 1969.

Because of dwindling reserves, the Perak State Government launched a survey for new mining areas early in 1970. It is in Perak that most of Malaysia's onshore tin is mined. All over the country, however, experts insisted that new fields for exploitation must be developed if tin is to maintain its present position in the Malaysian economy.

On July 18, 1970, the newly built Petaling Tin Ltd. dredge No. 7 was commissioned by the Sultan of Selangor. It has a rated capability to treat 6 million cubic yards of gravel per year. Cost of this single dredge was 30 percent more than the combined costs of seven Petaling dredges built prior to World War II.

The volume of tin concentrates treated at the Butterworth Smelter of The Straits Trading Co., Ltd., was the highest of any post-World War II year. A significant volume of imported concentrates contributed to this showing. Management pointed out that costs increased in 1970, principally for labor and reductants, and that smelting, at present rates charged, could continue only under a continuous and full-capacity operation.

Titanium.—Substantial tonnages of ilmenite are produced in Malaysia as a by-product of tin mining. Usually it is a constituent of a rough concentrate and requires further separation. Japanese pigment producers have been able to use the low-chrome Malaysian ilmenite for some years, because raw material costs are low, outweighing possible quality disadvantages.

In 1970, the National Lead Co., through its West German subsidiary, Titangesellschaft, M.b.H., and the West German engineering firm, Ferrostaal A.G., proposed to join with Malaysian interests, represented by Sharikat Gula Perak Berhad, in establishing a titanium dioxide plant in Perak, the main tin-mining area of Malaysia. Feasibility studies were well underway by midyear. A 20,000-ton-per-year plant is contemplated that probably will employ the conventional sulfate process. Local ilmenite, mostly from Perak, will be digested in sulfuric acid manufactured at the site from brimstone imported from Japan and Iran. Since the Malaysian market uses only about 3,000 tons of TiO_2 annually, most of the plant's output will be exported, mainly to Japan.

NONMETALS

Cement.—Ytong Malaysia Berhad, formerly known as the Basset Rubber Co. Berhad, obtained an exclusive license to manufacture and market a lightweight concrete which, it was expected, could revolutionize the building industry in Malaysia and Singapore. Source of the patented process is Intong Aktibolag of Sweden. Ytong concrete weighs less than one-third as much as ordinary concrete and costs 20 percent less.

Clays.—*Kaolin.*—In 1970, Sanyo Pulp of Japan, with a group of Malaysian investors, arranged a joint venture to mine and refine kaolin at a location near Tapah in Perak. The pioneer firm, Kaolin (Malaysia), was to start production in September. Output was destined for use in paper, pharmaceuticals, plastics, paint, ceramics, rubber, and fertilizer products. The company expected about $6–7 million in foreign exchange earnings when the operation was fully developed. It will be the largest project of its kind in the Far East and plans to employ 500 persons.

Fertilizer Materials.—The first fertilizer plant in East Malaysia was to open in early 1971. Located at Kuching in western Sarawak, the facility was owned by Wee Kheng Chiang Sdn. Bhd. and constituted a rather large investment for the firm. Fertilizers, at a rate of up to 5 tons per hour, were to be prepared for use in the growing of rubber, pepper, oil palm, coconuts, and vegetables. Initially, sixty workers were to be employed on a single shift. Output was to be sold throughout Sarawak and later, in Sabah. Presumably the plant would obtain its raw materials from new fertilizer chemical plants recently set up within the country or from other Far Eastern sources.

MINERAL FUELS

Petroleum.—Increased use of the Malacca Straits by ocean-borne commerce, particularly crude oil tankers, was giving rise to growing concern by Malaysian and other officials in 1970. The threat to fishing, owing to a collision and subsequent possible oil spills, was growing as traffic through the narrow, shallow Straits grew more dense. A survey to determine some sort of international traffic separation and control was agreed upon, and initial work begun.

Petroleum exploration accelerated during 1970, especially in the offshore areas, nearly all of which were under concession to Esso, Continental, and two consortiums—Agip, Phillips, Tenneco, and Agip, Phillips, Tenneco, Frontier. Final negotiations on awards of licenses in principle, which were with Mobil, Amoco, and Gulf for the Malacca Straits, were continuing. Also, increased onshore drilling indicated an even greater number of wells were to be drilled in 1970 than the 24 drilled in 1969.

Sarawak's Miri field, opened in 1911, showed a heavy decline and was down to about 800 barrels per day from 500 wells.

The Mineral Industry of Mexico

By Burton E. Ashley [1]

During the period 1966–70, the value of mineral production contributed an average of 1.86 percent of the gross national product, varying between 1.83 and 1.89 percent. Preliminary figures for 1970 indicate that the value of mineral imports amounted to 4.73 percent of total imports, and value of mineral exports were 14.26 percent of total exports. Imports showed a rising trend from 1966, and mineral exports declined during the period from 20 percent of total exports in 1966 to 14 percent in 1970. The mining labor force in 1970 was estimated at 108,000 persons, an increase of 18,000 over the 1966 figure. While the actual number employed in 1970 was greater than in 1969, the percentage of mining employees in the total labor force declined from 4.33 to 3.10.[2]

New investment in the mining industry during 1970 totaled about $80 million, supplied primarily by Asarco Mexicana, S.A., and Industrias Peñoles, S.A. (Peñoles). Thirty-five new mining companies were formed in 1970 with capital amounting to a total of about $10 million.

No significant mining legislation was enacted during the year, but a decree published July 2 ruled that 51-percent Mexican capital will be required for new enterprises in the following industries: Iron and steel, cement, glass, fertilizers, aluminum, and cellulose.

Reserves of selected mineral commodities at yearend 1970 were as follows, in metric tons: iron ore, 300 million averaging 56 percent Fe; copper ore, 1.45 billion; zinc, 35 million; lead, 30 million; manganese, 16 million; uranium ore, 4.6 million; and sulfur, 84.6 million.

During 1968 and 1969 the Comisión de Fomento Minero released booklets dealing with pyrite, tungsten, molybdenum, tin, antimony, coal, and a single booklet on arsenic, bismuth, cadmium, and selenium. A short history of each commodity is given with background on its use. Mining methods and geological setting are outlined with a description of known occurrences in Mexico. In some cases, reserve estimates were published. In addition, consumption, production, and trade statistics are given as they apply to Mexico and selected areas of the rest of the world.

The Dirección General de Estadística published its Estadística Minerometalurgica-Produccion y Exportacion in early 1970. The volume gives mineral and metallurgical statistics for 1968 and 1969 covering quantity and value of production and exports by years and months. Sources of exports by customs area within Mexico, and the country destination of the exports, are listed.

The Consejo de Recursos Naturales No Renovables (CRNNR) published Anuario Estadístico de la Mineria Mexicana—1970, which appeared in early 1971. The volume contains various statistics relating to production, imports, and exports; in addition, the production source is listed by State and municipality for selected commodities. Tables spanning a 5-year period list economic indicators comparing the mineral industry with total national figures.

In 1970, CRNNR also published a four volume directory of mining companies. Two volumes each are devoted to nonmetallic and metallic mineral commodities. In each case, volume 1 lists producers by commodity, and principal importers and exporters by commodity. Volume 2 lists companies in alphabetical order giving main office addresses, plant locations, and mineral commodities produced; traders are also listed alphabetically with the commodities traded.

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[1] Physical scientist, Division of Nonferrous Metals.

[2] Anuario Estadístico de la Mineria Mexicana 1970. Consejo de Recursos Naturales No Renovables. Mexico, D. F., 1971. p. 25.

CRNNR also issued Bibliografía Geológico-Minera y Económico-Minera de Mexico, which is a primary reference to books in the CRNNR library. The bibliography lists many unpublished theses and reports written by CRNNR authors.

The U.S. Consulate General in Monterrey reported on the Monterrey industry as a market for American exports. In Airgram [3] form, part 1 describes the general business and industrial situation in Monterrey and touches on public utilities and transportation. Two appendixes list various kinds of economic information in table form. Part 2 gives the background of Monterrey industry, discusses the "industrial group" concept, and the growth and ramifications of 12 major groups. The appendix lists 272 firms with addresses and group affiliation. Because Monterrey is an important center for various mineral industries, the report was of particular pertinence to such U.S. interests. The two-part report is unclassified and is distributed by Commercial Intelligence Division, Bureau of International Commerce, U.S. Department of Commerce, Washington, D.C. 20230.

PRODUCTION

Mexico produces about 50 different mineral commodities. Excluding petroleum, the more important commodities are precious and base metals, iron ore, sulfur, coal, and fluorite. The following list of selected commodities shows the chief producing States, and their percent of the total output:

Gold	Durango 31; Zacatecas, 15.
Silver	Chihuahua, 31; Zacatecas 16.
Copper	Sonora, 57.
Lead	Chihuahua, 66.
Zinc	Chihuahua, 63.
Coal	Coahuila, 100.
Sulfur	Vera Cruz, 98.
Fluorite	San Luis Potosi, 35; Coahuila, 31.
Iron ore (Fe content)	Durango, 40; Chihuahua, 38.

Value of mineral output in 1966 was $404.3 million and rose to an estimated $552 million in 1970. Metallic mineral production usually contributes 70 to 77 percent of the total, and nonmetallics, not including petroleum, accounted for the remainder.

In 1970 cadmium and iron ore production gained 25 percent each over 1969 levels, gold gained 10 percent, and zinc and lead increased 5 and 3 percent, respectively. Output of silver and fluorspar declined slightly, but sulfur production was 21 percent below the 1969 figure. Steel production gained 11 percent and pig iron 8 percent; output of portland cement rose 7 percent.

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[3] U.S. Consulate, Monterrey, Mexico. Monterrey Industry as a Market for American Export. Part 1, Infrastructure and Indices. State Department Airgram A-7, Jan. 29, 1971, 8 pp., 2 appendixes.
———Monterrey Industry as a Market for American Export. Part 2, The Industrial Groups. State Department Airgram A-17, May 12, 1971, 32 pp., 1 appendix.

Table 1.—Mexico: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum, primary	22,518	32,383	33,955
Antimony:			
Mine output, metal content	3,464	3,225	4,468
Metal (in mixed bars)	1,090	1,028	818
Arsenic, white [2]	13,531	7,983	9,133
Bismuth, content of refined metal, bullion, and concentrates exported	525	606	571
Cadmium:			
Mine output, metal content	1,194	1,579	1,967
Metal, refined	202	210	268
Copper:			
Mine output, metal content	61,110	66,167	61,012
Matte, metal content [3]	79	75	92
Precipitate, metal content [3]	80	80	38
Metal:			
Blister	59,707	64,877	59,609
Refined	51,483	56,589	53,676
Gold:			
Mine output, metal content ... troy ounces	176,952	180,599	198,240
Metal, refined ... do	172,745	169,163	191,447
Iron and steel:			
Iron ore:			
Gross weight [4] ... thousand tons	3,202	3,495	4,355
Metal content ... do	1,921	2,097	2,612
Pig iron and sponge iron ... do	1,972	2,104	2,263
Ferroalloys ... do	48	53	70
Crude steel ... do	3,285	3,470	3,845
Steel semimanufactures ... do	4,590	5,110	5,242
Lead:			
Mine output, metal content	174,169	170,894	176,597
Smelter (in refined and mixed bars)	r 166,824	162,687	171,007
Manganese ore:			
Gross weight [5]	r 59,185	143,564	273,916
Metal content	26,706	60,136	98,609
Mercury mine output, metal content ... 76-pound flasks	r 17,195	22,500	30,256
Molybdenum mine output, metal content	80	202	141
Nickel mine output, metal content	26	35	44
Selenium:			
Mine output, metal content	1	198	126
Refined	1	30	e 19
Silver:			
Mine output, metal content ... thousand troy ounces	40,031	42,904	42,836
Metallurgical products, metal content ... do	38,962	41,699	41,493
Tin:			
Mine output, metal content ... long tons	r 520	490	525
Smelter, primary ... do	r 242	139	284
Tungsten mine output, metal content	266	289	288
Zinc:			
Mine output, metal content	240,021	253,375	266,400
Smelter, primary	80,038	80,265	80,662
NONMETALS			
Asbestos	NA	1	126
Barite	246,539	176,921	319,092
Cement, hydraulic ... thousand tons	6,126	6,787	7,267
Clays:			
Bentonite	40,073	46,017	62,950
Fuller's earth	11,281	21,401	24,197
Kaolin	75,715	89,732	78,548
Refractory	102,037	101,740	92,878
Diatomite	9,944	11,175	16,115
Feldspar	80,257	83,493	82,823
Fertilizer materials:			
Crude, phosphate rock	r 43,138	32,574	46,726
Manufactured:			
Nitrogenous, gross weight ... thousand tons	781	1,149	1,177
Phosphatic, gross weight ... do	209	389	368
Mixed, gross weight ... do	271	271	279
Fluorspar, all grades	926,000	988,304	978,485
Graphite, all grades	r 52,694	42,920	55,648
Gypsum and anhydrite, crude ... thousand tons	1,235	1,219	1,291
Magnesite	--	222	8,164
Mica, all grades	737	594	497
Perlite	9,929	10,130	12,365
Salt, all types ... thousand tons	3,598	3,889	4,153
Stone, sand and gravel:			
Calcite, common	NA	4,341	4,254
Dolomite	377,161	475,029	474,468
Limestone [6] ... thousand tons	2,006	1,938	2,364
Marble	3,658	12,036	17,126
Quartz, quartzite, and glass sand	r 321,155	281,881	355,862
Strontium minerals	3,453	18,077	25,600

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
NONMETALS—Continued			
Sulfur, elemental:			
Frasch process ____ thousand tons	1,608	1,631	1,296
Other native mined ____ do	24	27	24
Byproduct from natural gas ____ do	53	58	60
Sulfates, natural sodium	NA	111,838	132,221
Talc and related materials, talc	641	1,333	1,918
Wollastonite	69	4,567	6,562
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous ____ thousand tons	2,605	2,458	3,008
Coke:			
Metallurgical ____ do	r 1,153	1,141	1,300
Breeze ____ do	87	93	NA
Gas:			
Manufactured, all types ____ million cubic feet	6,852	6,457	NA
Natural:			
Gross production ____ thousand tons	576,871	609,056	665,026
Marketed production ____ do	r 370,687	417,085	481,106
Petroleum:			
Crude ____ thousand 42-gallon barrels	r 142,257	149,661	156,530
Refinery products:			
Gasoline:			
Aviation ____ do	520	551	493
Motor ____ do	r 43,701	46,078	51,183
Jet fuel ____ do	2,243	2,681	3,086
Kerosine ____ do	11,812	11,575	11,348
Distillate fuel oil ____ do	r 26,715	27,581	30,403
Residual fuel oil ____ do	43,057	43,135	47,640
Lubricants ____ do	1,370	1,423	1,977
Other products ____ do	21,931	23,829	25,440
Refinery fuel and losses ____ do	9,591	12,072	11,668
Total ____ do	160,940	168,925	183,238

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

1 In addition to the commodities listed, carbon black, lime, and a variety of crude construction materials are also produced, but output is not reported, and available information is inadequate to made 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 percent iron, from reported metal content of mine production.

5 Estimate calculated from reported metal content of mine production.

6 Excluding that for cement production.

TRADE

Mexico carries on foreign trade in about 40 mineral commodities. Value of exports in 1969 was about 4½ times greater than the value of imports. Chief mineral exports were cadmium, steel, lead, mercury, silver, zinc, fertilizers, and fluorspar, most of which were sent to the United States. Mineral imports were mainly of aluminum in various forms, chromite, iron and steel, asbestos, and fertilizer materials. Volume of exports and imports of petroleum products came close to balancing during 1968 and 1969; the bulk of exports consisted of residual fuel oil; imports were largely made up of lighter fuels and lubricants.

Of Mexico's total foreign trade in 1969, about 66 percent by volume was directed to the United States, and the United States supplied 62 percent of that country's imports.

Table 2.—Mexico: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Oxide (alumina)	(1)	14	Brazil 11.
Metal including alloys, all forms	164	609	Colombia 343; West Germany 134; United States 124.
Antimony:			
Ore and concentrate, metal content	8,160	8,528	United States 8,500.
Metal including alloys, all forms	313	265	United States 263.
Arsenic:			
Oxide, white	3,034	5,360	All to United States.
Oxide, black	3,348	1,182	Do.
Bismuth including alloys, all forms, bismuth content	571	697	United States 400; United Kingdom 139.
Cadmium:			
Concentrate and speiss, metal content	1	4	Brazil 3.
Flue dust, metal content	1,138	838	All to United States.
Metal	174	237	Netherlands 108; United States 59; Brazil 33.
Copper:			
Ore and concentrate, metal content	1,200	4,156	All to United States.
Copper sulfate	454	209	United States 194.
Metal including alloys, all forms	10,756	16,031	United States 5,179; Japan 4,919; West Germany 3,374.
Gold troy ounces	2,390	3,177	Mainly to United States.
Iron and steel:			
Ore and concentrate, metal content	138	24	West Germany 15; United States 9.
Metal:			
Scrap	499	950	All to United States.
Steel, primary forms, ingots	9,486	9	Do.
Semimanufactures	149,615	189,818	United States 167,506.
Lead:			
Ore and concentrate, metal content	1,305	1,302	United States 1,289.
Oxides:			
Litharge	32,304	39,976	United States 22,381; Italy 5,979.
Red lead	4,429	7,071	United States 3,783; Italy 1,454.
Metal including alloys:			
Antimonial and other bars	13,168	11,125	Netherlands 7,770; United States 1,024.
Refined bars	82,005	72,968	United States 48,849; Italy 12,151.
Semimanufactures	--	1,042	United States 1,021.
Manganese ore and concentrate, metal content	6,958	4,198	United States 3,916.
Mercury 76-pound flasks	14,124	32,141	United States 15,258; Japan 7,136.
Molybdenum concentrate, metal content	154	54	United States 32; Italy 22.
Nickel including alloys	--	12	All to United States.
Selenium, elemental	--	34	Netherlands 10; Panama 9; United Kingdom 6.
Silver thousand troy ounces	37,318	27,653	West Germany 10,400; United Kingdom 9,195.
Tin semimanufactures long tons	1	--	
Titanium ore and concentrate, metal content	--	3	All to United States.
Tungsten concentrate, metal content	419	503	United Kingdom 202; United States 153.
Zinc:			
Ore and concentrate, metal content	298,402	313,615	United States 279,292; Japan 33,242.
Oxide, white	7,520	5,825	United States 5,630.
Sulfate	2,107	5,476	United States 5,201.
Metal including alloys:			
Powder	451	1,052	Argentina 1,022.
Unwrought	r 42,169	41,265	Brazil 18,139; United States 10,334; Colombia 4,300.
Semimanufactures	r 3	--	
Other metals and metallic residues	325	875	All to United States.
NONMETALS			
Abrasives, natural:			
Emery	57	19	Venezuela 18.
Pumice	r 7,321	375	United States 374.
Asbestos	--	3	All to United States.
Barite and witherite thousand tons	99	114	Do.
Calcite, optical kilograms	--	7	All to Netherlands.
Cement	33,898	55,782	Brazil 43,900; United States 9,527.
Clays and products, crude n.e.s.:			
Bentonite	115	2,801	United States 2,786.
Fuller's and other earths	2,169	4,475	Brazil 1,066; Peru 969; Colombia 588; Guatemala 582.
Kaolin (china)	4	23	Japan 10; Venezuela 9.
Other clays including refractory	105	105	Peru 66; Colombia 29.
Diatomite, infusorial earth, tripoli, and chalk	6,103	6,371	Argentina 1,930; Peru 1,294; Venezuela 759.
Feldspar	5	1	All to United States.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude, phosphatic	28,794	22,486	All to United States.
Manufactured:			
Nitrogenous, including ammonia and urea	8,134	20,179	United States 9,681; Indonesia 7,388.
Phosphatic	r 435	61,036	United States 44,505; Spain 14,980.
Potassic	2,929	2,827	All to United States.
Other including mixed	3,100	6,037	Guatemala 5,059; United States 450.
Fluorspar:			
Acid grade	254,801	313,140	All to United States.
Metallurgical grade	677,959	662,205	United States 489,146; Canada 167,680.
Graphite, natural	50,619	39,309	United States 39,308.
Gypsum:			
Crude thousand tons	1,161	1,038	United States 772; Republic of Korea (South) 90; Taiwan 52.
Calcined	3	21	United States 18.
Lime	95	142	Mainly to United States.
Mica, all forms	10	48	All to United States.
Perlite	221	620	Colombia 247; Peru 211; Venezuela 107.
Precious and semiprecious stones except diamond kilograms	179	160	Mainly to Japan.
Salt thousand tons	2,993	3,582	Japan 2,458; United States 719; Canada 396.
Stone, sand and gravel:			
Dimension stone	5,954	25,087	United States 25,053.
Calcite, industrial	144	744	United States 486; Guatemala 256.
Crushed rock	158	162	Guatemala 107; United States 48.
Limestone and dolomite	245	181	All to United States.
Quartz	384	37	Do.
Sand and gravel	13,764	14,736	Guatemala 13,785.
Strontium minerals	3,615	18,066	All to United States.
Sulfur, elemental, all forms thousand tons	1,416	1,158	United States 757; Bahama Islands 158; France 74.
Talc, soapstone, and pyrophyllite	24	90	All to United States.
Wollastonite	131	1,677	United States 1,671.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and natural bitumen	238	223	United Kingdom 102; Guatemala 100.
Carbon black	6	36	Mainly to Costa Rica.
Coal and coke	1,182	2,411	Mainly to United States.
Gas, natural million cubic feet	49,338	48,754	All to United States.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	--	8	All to Trinidad and Tobago.
Distillate fuel oil do	21	221	United States 134; Japan 62.
Gas oil do	1	1	Mainly to United Kingdom.
Residual fuel oil do	14,157	18,398	Mainly to United States.
Lubricants do	99	600	United States 290; Guatemala 155.
Mineral jelly and wax do	11,354	5,656	Mainly to United States.

r Revised.
1 Less than ½ unit.

Source: Secretaría de Industria y Comercio Dirección General de Estadística. Anuario Estadística del Comercio Exterior de los Estados Unidos Mexicanos. 1969, 815 pp.; 1970, 824 pp.

Table 3.—Mexico: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	11,950	18,836	All from United States.
Oxide and hydroxide	44,682	72,931	United States 70,903.
Metal including alloys, all forms	9,150	9,963	United States 7,976.
Antimony and alloys, all forms kilograms	r 22	31	Italy 16; United States 15.
Arsenic:			
Trioxide, pentoxides, and acids	r 96	7	Japan 4; United States 2.
Metal including alloys, all forms	11	24	All from United States.
Natural sulfides	103	--	
Beryllium and alloys, all forms	3	44	Mainly from United States.
Bismuth and alloys, all forms kilograms	243	141	Netherlands 100; United States 41.
Cadmium and alloys, all forms do	79	18	All from United States.
Chromium:			
Chromite	23,464	34,002	United States 29,947.
Oxide and hydroxide	351	461	Belgium-Luxembourg 196; West Germany 150.
Cobalt oxide and hydroxide	102	76	Belgium-Luxembourg 56; United Kingdom 19.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Copper including alloys:			
Scrap	8	9	British Honduras 8.
Unwrought	21	22	United States 15; United Kingdom 6.
Semimanufactures	765	743	United States 362; West Germany 282.
Gold unworked or partly worked troy ounces	r 17,556	57,157	United States 44,129.
Iron and steel:			
Ore and concentrate	128,434	204,369	United States 138,492; Brazil 60,577.
Metal:			
Scrap	460,912	490,993	United States 490,647.
Pig iron, ferroalloys, and similar materials	7,882	5,987	United States 4,326; United Kingdom 1,258.
Steel, primary forms	139,691	93,049	United States 52,637; Switzerland 20,420.
Semimanufactures	164,119	197,390	United States 92,723; Canada 43,006; Japan 17,376.
Lead:			
Oxides	12	8	Mainly from United States.
Metal including alloys	979	101	United States 100.
Magnesium including alloys, all forms	859	674	United States 620.
Manganese oxides	1,542	2,442	Japan 1,264; United States 1,157.
Mercury 76-pound flasks	29	26	United States 18.
Molybdenum:			
Ore and concentrate	16	14	All from United States.
Metal including alloys, all forms	8	4	United States 3.
Nickel:			
Matte, speiss, and similar materials	183	151	United States 109; Canada 26.
Metal including alloys, all forms	1,358	858	United States 547; Canada 140; West Germany 85.
Platinum group including alloys, all forms troy ounces	9,430	5,705	United States 4,631; West Germany 551; United Kingdom 411.
Selenium, elemental kilograms	2,618	12	Italy 8.
Silver including alloys troy ounces	31,764	27,756	United States 24,410.
Tantalum, all forms kilograms	11	3	All from United States.
Tellurium, elemental do	199	579	Do.
Tin:			
Ore and concentrate long tons	1,984	2,218	United States 1,505; Bolivia 636.
Oxide do	73	76	United Kingdom 60; United States 14.
Metal including alloys, all forms do	853	654	United States 647.
Titanium:			
Ore and concentrate	896	763	Australia 422; United States 251.
Oxide	166	355	United States 313.
Slag and residues	26,063	20,978	All from Canada.
Tungsten including alloys, all forms	10	16	Mainly from United States.
Uranium	3	--	
Zinc including alloys, all forms	65	56	United States 21; West Germany 13; Belgium-Luxembourg 12.
Zirconium ore and concentrate	1,776	2,775	Austria 1,926; Belgium 572; United States 276.
Other:			
Ore and concentrate n.e.s	12,313	20	Mainly from United States.
Ash, cinder and other metallurgical residues containing nonferrous metals n.e.s	208	92	Do.
Metals and alloys, unwrought n.e.s	r 197	307	United States 250; Belgium-Luxembourg 42.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	749	929	United States 856.
Dust and powder of precious and semiprecious stones except diamond kilograms	r 2	7	Mainly from Belgium-Luxembourg.
Grinding and polishing wheels and stones	99	118	Mainly from United States.
Asbestos, crude	33,819	36,820	Canada 28,381; United States 4,795; Republic of South Africa 3,572.
Barite and witherite	819	99	West Germany 74; United States 25.
Boron materials, oxide and acid	1,292	1,194	United States 1,193.
Bromine	37	51	Mainly from United States.
Cement	2,594	3,076	United States 2,774.
Chalk	50	49	United States 48.
Clays, crude:			
Fuller's earth	323	278	All from United States.
Kaolin (china)	17,632	20,327	United States 20,175.
Refractory	75,037	108,213	United States 107,062.
Other	824	788	Mainly from United States.
Cryolite	96	79	United States 57; Denmark 22.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Diamond:			
Gem not set or strung .... carats..	12,160	6,785	United States 2,379; Belgium-Luxembourg 1,330; Netherlands 780.
Industrial stones .... do....	50,000	80,000	Mainly from United States.
Powder and dust .... do....	105,000	205,000	United States 200,000.
Diatomite	228	143	All from United States.
Feldspar and nepheline syenite	2,872	2,248	United States 2,104.
Fertilizer materials:			
Crude phosphatic rock	326,743	629,758	All from United States.
Manufactured:			
Nitrogenous	164,193	88,383	West Germany 24,586; Netherlands 19,223; United States 18,079.
Phosphatic	34,843	14,589	Mainly from United States.
Potassic	61,388	68,129	United States 52,602; West Germany 10,768; Spain 4,755.
Mixed	5,327	7,626	Chile 7,106.
Fluorspar	13	10	All from United States.
Graphite, natural	152	162	United States 95; Canada 50.
Gypsum	11,888	21,106	United States 17,858.
Iodine	62	105	Chile 100.
Lime	12,152	8,630	United States 8,619.
Magnesite	19,106	12,964	United States 12,944.
Mica, all forms	330	268	United States 183; Argentina 57; Brazil 24.
Pigments, mineral, including processed iron oxides	259	37	United States 30.
Precious and semiprecious stones except diamond .... kilograms..	1,629	1,496	Switzerland 628; United Kingdom 450; France 311.
Pyrite unroasted	70	12	West Germany 9; United States 3.
Salt	476	814	United States 788.
Sodium and potassium compounds:			
Caustic soda	8,039	1,866	United States 1,818.
Potassium hydroxide	2,162	777	West Germany 460; Belgium-Luxembourg 275.
Stone, sand and gravel:			
Dimension stone, roughly worked	r 5,541	6,227	Italy 6,088.
Dolomite, calcined	50	55	All from United States.
Gravel, crushed, and paving stone	2,450	2,606	United States 2,515.
Sand	121,669	157,795	United States 157,118.
Quartz	268	73	Mainly from West Germany.
Strontium minerals	--	1	All from United States.
Sulfur	428	831	United States 828.
Talc, soapstone, and pyrophyllite:			
Steatite	52,520	58,871	United States 57,016.
Talc	325	257	Italy 120; United States 85; France 50.
Pyrophyllite	58	176	All from United States.
Vermiculite	483	511	Do.
Other nonmetallic minerals	r 8	5	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt	528	535	United States 533.
Coal including lignite	69,863	115,232	United States 115,211.
Coke	303,714	541,977	United States 541,946.
Gas, hydrocarbon:			
Natural gas .... million cubic feet..	11,018	12,004	All from United States.
Natural gas liquids thousand 42-gallon barrels..	6,499	7,223	Do.
Petroleum:			
Crude .... do....	(1)	(1)	Mainly from United States.
Refinery products:			
Gasoline .... do....	608	2,031	Netherlands Antilles 1,427; United States 338.
Kerosine .... do....	209	207	Mainly from United States.
Distillate fuel oil .... do....	79	2,014	Venezuela 657; Netherlands Antilles 624; United States 518.
Residual fuel oil .... do....	1,239	1,074	All from United States.
Lubricants .... do....	602	546	Mainly from United States.
Mineral jelly and wax .... do....	204	250	Do.
Other .... do....	r 899	1,262	Do.
Mineral tar and other coal, petroleum or gas derived crude chemicals	22,630	15,610	Do.

r Revised.
[1] Less than ½ unit.

Source: Secretaría de Industria y Comercio Direccíon General de Estadística. Anuario Estadística del Comercio Exterior de los Estados Unidos Mexicanos, 1969, 815 pp; 1970, 824 pp.

COMMODITY REVIEW

METALS

Copper.—Asarco Mexicana, S.A., completed installations at its Inguarán copper mine in late 1970, and trial mill runs were expected to commence in early 1971. The mine is located 28 kilometers east of La Huacana, Michoacán.

The ore body is a barrel-shaped monzonite porphyry averaging 1.8 percent copper, chiefly as chalcopyrite. Reserves of 5 million tons were proven, and another 1 million tons were being explored.

The mine was designed for 2,500 tons per day capacity. Ore will be crushed underground in two stages, and a belt conveyor will transport it to the mill. The mill produces a clean concentrate of chalcopyrite, the chief impurity of which is one-half of 1 percent pyrite. Power is supplied by the Comisión Federal de Electricidad.

Concentrates were to be trucked to railhead at Patzcuaro and forwarded to the smelter at San Luis Potosí.

Cía. Mexicana de Cobre, S.A., which was developing the La Caridad Mine in Sonora,[4] awarded a contract to Parsons-Jurden Corp. of New York for a feasibility study of the property. It was reported that the Government also suggested that Parsons-Jurden consider the possibility of combining the concentrating and smelter operations of La Caridad with those of Cía. Minera de Nacozari, S.A. de C. V., an affiliate of The Anaconda Company. It was thought that such a plan would decrease the total investment in the two projects.

In order to provide adequate refining facilities, it was reported that the Mexican Government might designate the shallow water harbor at Guaymas, Sonora a free port and encourage the mining group to erect refining facilities there.

Iron and Steel.—In 1970, ingot steel output was 3.8 million tons, an increase of 11 percent over the preceding year's figure of 3.5 million tons. Mill products also showed substantial increases in most cases.

Expansion of the steel industry continued in 1970 with additional capacity installation at Altos Hornos de Mexico, S.A. (AHMSA), Hojalata y Lámina, S.A. (HYLSA), and Tubos de Acero de Mexico, S.A. (TAMSA).

AHMSA, Mexico's largest steel company, was completing its fourth blast furnace; the furnace has a capacity of 1,550 tons per day and is completely automated. A basic oxygen furnace with an annual capacity of 500,000 ingot tons of steel was also nearing completion. The furnace was reportedly the most modern steel facility in Latin America and incorporates German equipment exclusively. Coking capacity was also increased by about 50 percent with the addition of 69 coking ovens. Production of oxygen was raised to 380 tons per day and nitrogen, to 110 tons per day. AHMSA was to increase its tin plate capacity, which would decrease such imports considerably. HYSLA's new facilities at Puebla produced 769,395 ingot tons, a 17 percent increase over tonnage in 1969. TAMSA, said to be the largest producer of seamless pipe in Latin America, increased output by 11 percent, to 274,368 tons.

At yearend 1970, iron and steel sales began to decline and inventories increase.

Increased capacity for special items, now largely imported, is likely as Cía. Fundidora de Fierro y Acero de Monterrey, S.A., was reportedly negotiating with Ugine Kuhlman of France to start producing stainless steel. The first stage was to import rolled stainless stock for processing and cutting, and later, construction of furnaces to make the stock. Output was aimed at eliminating imports of stainless steel and shapes which cost around $10 million in foreign exchange annually.

Cía. Siderúrgica de Guadalajara, S.A., commenced operations in 1970. The plant was designed to produce 160,000 tons annually of structural steel for use in the construction and electrical industries. Initial capacity of 50,000 tons a year will eventually be increased. Raw material in the form of scrap metal was being imported from the United States at the rate of about 4,000 tons a month. All machinery in the plant is of German origin.[5]

Zinc.—Peñoles approved plans to invest about $50 million to build an electrolytic zinc refinery at Torreón, Coahuila. Construction commenced in October 1970, and the completion date was set for early 1973.

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[4] Bureau of Mines Minerals Yearbook. Area Reports: International. V. 4, 1969, p. 504.

[5] Skillings' Mining Review. V. 60, No. 20, May 15, 1971, p. 22.

Designed capacity was for output of 105,000 tons annually of refined zinc. Electrical energy will be supplied by the Comisión Federal de Electricidad at rates that were reportedly scaled to keep the zinc output competitive nationally and internationally.

Zincamex, S.A., the Government-owned zinc refinery near Saltillo, authorized investment of about $1.5 million for a new facility to produce zinc-based chemical products. Completion date was scheduled for mid-1973.

NONMETALS

Asbestos.—Peñoles started pilot plant operation at its asbestos prospect in Oaxaca during 1970. Small lots of fiber were recovered for analysis and further development will depend upon the resulting appraisal. Peñoles had a majority interest in the enterprise through its subsidiary Cía. Minera Pegaso, S.A., with the minority interest held by Freeport Sulphur Company.

Cement.—Cementos Tolteca, S.A., said to be Mexico's largest cement company, was Mexicanized in October 1970. Fifty-one percent of the shares constitute Series A, which can be held only by Mexicans; the remaining interest of 49 percent remained with Associated International Cement, Ltd., a British concern.

Fluorite.—In 1970 Peñoles took steps to become the largest producer of fluorite in the world with the acquisition of a 60-percent interest in properties belonging to Allied Chemical Corp. The mines were, Cía. Minera Rio Colorado, S.A., Cía. Metalúrgica de Parral, S.A., and Cía. Industrial de Fluorita, S.A. Investment of about $4.8 million was planned to bring the output of Rio Colorado to 100,000 tons of acid-grade fluorite annually by May 1972.

Plans were also initiated to acquire 60 percent of the equity in Fluorita de Rio Verde, S.A., from Continental Ore Corp.

Of added interest to the fluorite industry were reports that various companies were planning to manufacture significant quantities of anhydrous hydrofluoric acid (HF) and aluminum fluoride in Mexico. The HF plants would be located near the U.S. border for convenient export of the product to U.S. markets. It was not expected that any of the plants would be completed before 1973 or 1974.

Sulfur.—Cía Exploradora del Istmo, S.A., (CEDI) was readying its new Frasch sulfur mine, at Texistepec, southwest of Coatzacoalcos, for operation at yearend. Ownership in CEDI is shared by Texas Gulf Sulphur Co., 34 percent; Comisión de Fomento Minero and Mexican business interest, 33 percent each. Plant design was based on that used by Texas Gulf Sulphur at its Bully Camp, Louisiana operations. Rated capacity of the new mine is 750,000 tons of sulfur per year. Deep water shipments of liquid sulfur will be handled at new terminal facilities installed at Coatzacoalcos.[6]

Negociación Minera de Azufre, S.A. (NMA), began operating the extraction plant at its sulfur mine at Huaxcama, San Luis Potosí. The main ore body is an anhydrite breccia containing 20 to 25 percent native sulfur. Reserves were estimated at about 1 million tons of sulfur.

Ore is treated in three vertical jacketed autoclaves with steam under 2 kilograms of pressure. Sulfur recovery was between 87 to 90 percent but was expected to improve as operating experience was obtained. Initial capacity was expected to be about 40,000 tons of sulfur annually. The product (about 99.98-percent pure) is trucked to the railway at Cerritos and is sold entirely within Mexico, largely to fertilizer and sulfuric acid manufacturers.

The domestic price of sulfur is published monthly in the Diario Oficial for tax purposes and generally follows the range of the actual domestic f.o.b. mine selling price, which has been $22.40 for dark sulfur, $24.40 for bright, and $24.80 for sulfur not used for sulfuric acid manufacture. Export prices are usually negotiated under contract on the basis of the Engineering and Mining Journal quoted price.

MINERAL FUELS

Coal and Coke.—Hullera Mexicana, S.A., a subsidiary of Cía. Fundidora de Fierro y Acero de Monterrey, S.A., completed mechanization of its Four and a Half mine and began operations there during 1970. Installation of mechanized equipment was completed at mines Number Five and Don Evaristo. Equipment for coal handling at this project included continuous miners, automatic loading, and belt

[6] Skillings' Mining Review. V. 60, No. 11, Mar. 13, 1971, p. 23.

conveyors to the surface. Hullera plans to mine 120,000 tons of coal "ore" per month, which will yield 80,000 tons of washed coal. The washing plant was nearly completed and was being tested. Estimated reserves of coal amounted to 78 million tons, which is expected to afford 1.5 million tons annually for the expected 40-year life of the mines. Coking ovens, having a capacity of 60,000 tons of coke monthly, were nearly ready for operation.

Altos Hornos de Mexico, S.A. reopened its Barroterón coal mine, which had been shut down since early in 1969.

Petroleum.—Petróleos Mexicanos (Pemex) is the largest producer and employer (68,400 persons at the beginning of 1970) in Mexico and had an operating budget of $1,737 million. Of this amount, $1,129 million was provided by sales and the remainder by both long- and short-term loans. Pemex supplies about 90 percent of Mexico's energy requirements. Known reserves of petroleum were being depleted, and the Director of Pemex was of the opinion that nuclear energy sources should be developed in order to substitute, in part, for fossil fuels.

Pemex production of crude oil, condensate, and other liquids in 1970 amounted to 177.6 million barrels, an increase of 5.5 percent over 1969 output. Gross natural gas production was 665,026 million cubic feet, an increase of 9.2 percent over the 1969 level.

Net reserves of petroleum—crude oil, condensate, and gas (converted to barrels) —were 5,568 million barrels as of December 31, 1970; this was a net reserve loss of about 2.5 million barrels compared with the preceding year. In 1966 reserves were increased by 520 million barrels; net increases in 1967 amounted to 129 million barrels and to 44.5 and 39.7 million barrels in 1968 and 1969, respectively. The decrease in added reserves during the last few years were in condensate and gas (converted to barrels). Considerable effort to add to reserves will be necessary if the present 20 year reserve is to be maintained. In order to prove more reserves, efforts were to be directed toward greater domestic capability in prospecting techniques. It was expected that the Instituto Mexicano del Petróleo, the research organization of Pemex, would provide leadership in this program.

During 1970, Pemex had 70 exploration parties in the field. These parties included 23 devoted to seismograph work and 27 mapping surface geology; the remaining parties were made up of gravity, magnetometer, and subsurface teams. Exploration efforts were conducted both offshore and on land.

Pemex drilled 523 wells in 1970, of which 130 were classed as exploration wells and 393 as development wells. Of the exploration wells, 30 were completed for oil and gas production and the rest were unsuccessful; of the development wells, 315 were completed as oil or gas producers.

At the end of 1970, crude distillation capacity of Pemex refineries totaled 592,000 barrels a day, an increase of 40,000 barrels a day over the preceding year. The main increase in capacity was made at the Salamanca refinery where 25,000 barrels per day was added. Capacity under construction, and planned, amounted to 465,800 barrels a day. The new Tula refinery located 35 miles north of Mexico City, was expected to have a production rate of 150,000 barrels daily and, in time, may replace the present Azcapotzalco refinery, which contributes to Mexico City's air pollution problem.

Investment in pipeline facilities in 1970 amounted to $27.4 million. The most important works consisted of enlarging the capacity of the Reynosa-Monterrey-Torreón-Chihuahua gas pipeline, which parallels part of the Ciudad Pemex-Mexico City gas pipeline, and the repair and increase in size of the Tampico-Monterrey-Torreón-Chihuahua products line. In addition, a new products line was installed from Tuxpan and Poza Rica to Mexico City.

Capacity of the Pemex fleet rose to 2,741,079 barrels with the addition of the tanker Emiliano Zapata. The fleet now totals 22 vessels. For overland transport Pemex owned 442 tank trucks and 236 general trucks. Also, 755 privately owned trucks were available for distributing products. Pemex owned 1,190 railway tank cars and rented 2,069 others for its use.

For the first time in recent years, 1970 trade in products and petrochemicals showed an adverse balance, which amounted to $3.9 million. Product imports totaled 6 million barrels during the year and may be expected to rise. Imports were mostly of gasoline and diesel fuel from Aruba and Curaçao for delivery to ports in northwest Mexico. Some kerosine and liquid petroleum gases (LPG) were shipped to Vera Cruz.

The Brownsville Loop arrangement was terminated at the end of 1970, and unlicensed Mexican imports of asphalt and residuals no longer had to enter the United States by overland routes. The import level of 30,000 barrels daily was to be continued.

The Mineral Industry of Morocco

By Donald E. Eilertsen [1]

Minerals continued to be of great importance to the economy, both in terms of generating industrial activity within the country and earning foreign exchange abroad. It happens that most of the crude minerals produced by Morocco [2] are exported. The country's Gross National Product (GNP) in 1970 was about $3.32 billion or an increase of 6.8 percent over that of 1969. The mineral share for both years was about 5.5 percent in terms of mine output. This level is high by world standards, although mine output is small as compared with agricultural output, the principal component of Morocco's GNP. To attain stability and improve efficiency in mineral production, new deposits were vigorously sought through Government incentives, to supplement known reserves that were rapidly being depleted.

Dam construction forged ahead; this should greatly increase irrigation and the generation of electric power, which may well further influence the use of fertilizers and the development of mineral resources. The Moulay Youssef (Ait Aadel) Dam on the Tessaout River near Marrakech was dedicated in November and four other dams were under construction. The Hassan Dakhil Dam on the Zis River near Ksar es Souk is expected to be completed in 1971. The Mansour ed Dahbi Dam at Zaouia N'Ourbas on the Draa River should be finished in 1972. The Idris I Dam at Arabat on the Innouen River and the Youssef ben Tachfin Dam on the Messa River are scheduled for completion in 1973.[3]

In accordance with the provisions of the 5-year Plan (1968–72), the Moroccan Government, through the Bureau de Recherches et de Participations Minières (BRPM) and the Division of Mines and Geology of the Ministry of Commerce, Industry, and Mines, has been concentrating on the search for and development of lead, zinc, copper, and potash deposits.

The lead, zinc, and silver deposits at Bou Madine were studied by Soviet technicians in 1968, but to equip mines for a capacity of 530,000 tons of ore annually, as originally envisaged, was found to be uneconomical. Now, however, some consideration is being given to working the deposits on a smaller scale.[4]

Despite severe international competition, Morocco's phosphate rock industry increased exports substantially to more than 11 million metric tons. This had a significant impact on the world fertilizer market, because of the country's position as the second ranking producer and either the first or second ranking exporter of phosphate rock. To improve its competitive position, Morocco's State-controlled phosphate enterprise invested heavily in new equipment, with the help of loans from West Germany and the United States. Grand Douai within the Khouribga groups of deposits was being developed as a new modern mine.

PRODUCTION

Morocco's mineral industry showed sharp gains in output during 1970 for some sectors, and significant losses in others. Some of the commodities which increased in output were antimony concentrate (38.4 percent), copper concentrate (28.5 percent), iron ore (16.4 percent), cement (20.4 per-

[1] Physical scientist, Division of Nonmetallic Minerals.

[2] Kingdom of Morocco, Ministry of Commerce, Industry, Mines and Merchant Marine. Statement of Statistics of Production, of Exports and of Local Sales of Minerals, Year 1970. 44 pp.

[3] U.S. Embassy, Rabat. State Department Airgram A-27, Feb. 13, 1971, 10 pp.

[4] Bureau of Mines. Mineral Trade Notes. V. 67, No. 4, April 1970, pp. 19–21.

cent), bentonite (48.8 percent), phosphate rock (6.9 percent), and anthracite (9.1 percent). Commodities showing significant declines in output were cobalt concentrate (57.2 percent), manganese ore (13.9 percent), primary silver (20.9 percent), zinc concentrate (55.8 percent), pyrrhotite (25.7 percent), and crude oil (24.7 percent). Production of lead concentrate, barite, natural gas, and refined oil did not vary much from the previous year.

In terms of value in 1970, phosphate rock overshadowed everything else, with output valued at about $108 million [5] or perhaps three-fifths of Morocco's overall mine output value (including oil and gas). Lead concentrate contributed $19.3 million, whereas zinc concentrate was valued at only $2.1 million. Anthracite ($5.0 million), iron ore ($4.8 million), manganese ore ($4.0 million), copper concentrate ($2.9 million), antimony ore ($2.3 million), pyrrhotite ($1.8 million), and cobalt concentrate ($1.1 million) also were important. Silver was much more than the $1.2 million credited because at least twice that much was exported in the lead concentrate alone. Crude oil and natural gas production in 1970 were each less than $1 million. Morocco refined large tonnages of imported crude petroleum.

[5] Where necessary, values have been converted from Moroccan Dirhams (MD's) to U.S. dollars at the rate of MD's 5.06 = US$1.00.

Table 1.—Morocco: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Antimony concentrate:			
Gross weight	2,694	3,127	4,328
Metal content	1,212	1,407	1,973
Cobalt concentrate:			
Gross weight	15,179	14,097	6,039
Metal content	1,518	1,410	604
Copper:			
Concentrate:			
Gross weight	9,521	9,475	12,183
Metal content	3,047	[r] 2,274	2,873
Matte (byproduct of lead smelter)	NA	NA	201
Iron ore, direct shipping, gross weight ... thousand tons	807	749	872
Lead:			
Concentrate:			
Gross weight	120,570	117,680	120,911
Metal content	72,382	70,608	73,063
Smelter, primary	24,166	26,836	24,901
Manganese ore:			
Metallurgical grade	86,437	10,444	---
Chemical grade	73,774	120,132	112,376
Total	160,211	130,576	112,376
Nickel:			
Content of cobalt ore	[r] 304	[r] 282	121
Content of nickel ore	---	---	17
Total	[r] 304	[r] 282	138
Silver, primary [2] ... thousand troy ounces	920	861	681
Tin:			
Concentrate:			
Gross weight ... long tons	19	19	26
Metal content [e] ... do	10	10	14
Smelter, primary ... do	15	[e] 12	[e] 12
Zinc concentrate:			
Gross weight	67,620	72,079	31,871
Metal content	31,781	33,877	18,074
NONMETALS			
Barite	78,160	86,940	84,750
Cement ... thousand tons	[r] 1,010	[r] 1,165	1,403
Clays, crude:			
Bentonite	13,794	7,638	11,364
Smectite	29,965	13,567	NA
Other including Fuller's earth	4,380	[r] 5,020	8,200
Fertilizer materials, crude, natural, phosphate rock ... thousand tons	10,512	10,662	11,399
Goethite	24	36	36
Halloysite	77	30	---
Pigments, mineral, ocher	---	---	510
Pyrrhotite:			
Gross weight	417,851	391,528	291,041
Sulfur content	125,355	117,458	87,312
Salt, all types	[3] 41,000	66,720	57,075
Talc	---	136	226

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite ---- thousand tons	451	397	433
Briquets ---- do	18	17	20
Gas, natural, marketed ---- million cubic feet	382	1,484	1,539
Petroleum:			
Crude oil ---- thousand 42-gallon barrels	[r] 674	[r] 445	335
Refinery products:			
Gasoline ---- do	2,424	[r] 2,669	2,581
Jet fuel ---- do	40	269	21
Kerosine ---- do	573	631	589
Distillate fuel oil ---- do	3,079	3,493	3,352
Residual fuel oil ---- do	2,972	3,047	3,082
Other ---- do	540	[r] 601	880
Refinery fuel and losses ---- do	280	344	[e] 337
Total ---- do	9,908	11,054	[e] 10,842

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

[1] In addition to the commodities listed, Morocco also produces manufactured phosphatic fertilizers and various quarry products but production data are not available.

[2] Entirely produced from domestic lead concentrates smelted in Morocco. Inasmuch as only about one-third of total lead concentrate output is smelted indigenously, actual mine output of silver (in all lead concentrates) is probably much higher, but data on silver content of exported concentrates are not available.

[3] Rock salt only.

TRADE

The latest year for which complete export and import data are available is 1969.

Exports of mineral commodities in 1969, table 2, were $177 million compared with $168 million in 1968. Items which had values over $600,000 are as follows:

Item	Value (thousands)
Antimony ore and concentrate	$810
Cobalt ore and concentrate	2,510
Copper ore and concentrate	4,310
Copper scrap including alloys	1,240
Iron ore and concentrate	6,300
Pig iron, ferroalloys, and similar materials	1,250
Lead ore and concentrate	12,800
Crude lead unalloyed	3,720
Manganese ore and concentrate	5,990
Silver metal including alloys	1,400
Zinc ore and concentrate	12,800
Barite	1,120
Fertilizer materials:	
Crude, phosphatic	108,820
Manufactured, phosphatic	10,380
Coal and coke including briquets	1,050

Imports of mineral commodities in 1969, table 3, were valued at approximately $58 million, about the same as in 1968. Items which were valued over $600,000 are as follows:

Item	Value (thousands)
Aluminum metal including alloys, all forms	$3,050
Copper metal including alloys, all forms	4,000
Iron and steel semimanufactures	5,780
Nickel semimanufactures	710
Tin metal, all forms	1,340
Fertilizer materials:	
Nitrogenous	3,810
Potassic	1,270
Mixed	800
Coal and coke including briquets	1,340
Gas, hydrocarbon (LPG)	610
Petroleum, crude	20,080
Refinery products:	
Gasoline	690
Kerosine including jet fuel	2,050
Lubricants	4,920
Mineral jelly and wax	930

Table 2.—Morocco: Exports of mineral commodities
(Metric tons unless otherwise specified)

Commodities	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite and concentrate	400	120	All to France.
Metal including alloys, all forms	691	653	Italy 230; West Germany 195; France 185.
Antimony ore and concentrate	2,730	2,816	France 940; Belgium-Luxembourg 579; Spain 335.
Chromium, chromite	75	-----------	
Cobalt ore and concentrate	18,280	15,350	France 9,500; mainland China 4,000; Belgium-Luxembourg 1,850.
Copper:			
Ore and concentrate	6,521	14,688	West Germany 9,476; Taiwan 2,600; Sweden 1,100.
Matte	25	-----------	
Scrap including alloys	r 931	1,216	West Germany 741; Italy 185; France 172.
Sulfate	12	-----------	
Iron and steel:			
Ore and concentrate thousand tons	657	868	Spain 330; West Germany 229; Czechoslovakia 140.
Roasted pyrites	850	-----------	
Metal:			
Scrap	2,884	3,193	Italy 1,444; West Germany 748; Spain 598.
Pig iron, ferroalloys, and similar materials	22,556	35,373	Italy 11,549; Greece 9,850; United Kingdom 8,100.
Semimanufactures	2,432	2,405	Mainly to Italy.
Castings and forgings	10	17	France 8; Algeria 3; Netherlands 2.
Lead:			
Ore and concentrate	88,089	75,502	France 36,125; Italy 10,619; Greece 10,176; West Germany 10,055.
Crude unalloyed	22,747	25,080	All to France.
Magnesium including alloys, all forms	8	6	Mainly to France.
Manganese ore and concentrate	168,793	132,460	United States 30,940; France 30,591; Czechoslovakia 19,985.
Nickel including alloys, all forms	53	57	Mainly to Algeria.
Silver, all forms troy ounces	868	849	All to France.
Tin, all forms	20	1	Mainly to Algeria.
Tungsten, all forms	-----------	(1)	Do.
Zinc ore and concentrate	79,755	75,502	France 34,835; United States 15,460; United Kingdom 9,105.
Other:			
Ore and concentrate	1	1,997	France 1,197; West Germany 800.
Ash, slags, and residues	820	2,014	United Kingdom 673; Belgium-Luxembourg 603; France 540.
Oxides	2	5	Algeria 3; Libya 2.
NONMETALS			
Abrasives, grinding and polishing wheels and stones	-----------	1	All to Italy.
Barite	81,587	86,933	United States 48,768; United Kingdom 28,765.
Cement	9,345	11,816	Mainly to Spain.
Clays and products (including refractory brick):			
Bentonite	125	746	United Kingdom 455; Ships Stores 250; Spain 41.
Fuller's earth	2,532	2,880	Tunisia 1,950; Algeria 928; France 2.
Refractory	1,664	1,829	NA.
Smectic	15,306	12,380	Spain 8,350; France 3,700.
Fertilizer and materials:			
Crude, phosphatic	10,082,306	10,295,410	Spain 992,066; Poland 950,269; mainland China 566,568.
Manufactured:			
Phosphatic	239,415	182,789	Bulgaria 89,324; Cuba 51,982; Iran 16,355.
Potassic	1	-----------	
Other including mixed	175	307	Mainly to Canary Islands.
Fluorspar	5	11	All to France.
Gypsum and plasters	r 68,675	78,379	Japan 44,570; Portugal 22,680; Senegal 9,224.
Lime	92	202	Spain 186; Ships Stores 10.
Mica, all forms	(1)	-----------	
Pigments, mineral including processed iron oxides	89	30	All to France.
Salt and brines	1	106	NA.

See footnotes at end of table.

Table 2.—Morocco: Exports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodities	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Stone, sand and gravel:			
Dimension, crude and partly worked	9,702	13,512	Italy 4,333; Belgium-Luxembourg 1,170; West Germany 418.
Gravel and crushed rock	30	5,401	NA.
Sand excluding metal bearing	8,299	21,789	Spain 13,304.
Sulfur, elemental, all forms	2	130	NA.
Other nonmetals n.e.s., ash and slag	113	-----	
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke including briquets	57,925	52,371	Italy 20,225; Algeria 19,724; France 10,100.
Hydrogen, helium, and rare gases	8	21	Ships Stores 12; Gibraltar 8.
Petroleum refinery products:			
Gasoline (including natural) 42-gallon barrels	214,037	32,814	All to Ships Stores.
Kerosine and jet fuel do	130,228	2,516	Do.
Distillate fuel oils do	204,542	73,302	Do.
Residual fuel oils do	28,048	39,125	Do.
Lubricants do	692	177	Mainly to Ships Stores.
LPG gases do	24	-----	

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

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

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	1,600	-----
Hydroxide and oxide	749	732
Metal including alloys, all forms	2,395	3,083
Antimony including alloys, all forms	8	19
Arsenic:		
Natural sulfides	1	-----
Trioxides, pentoxides and acids	13	38
Metal including alloys, all forms	NA	1
Bismuth, crude	(1)	(1)
Cadmium including alloys, all forms	(1)	(1)
Chromium:		
Oxides and hydroxides	8	21
Metal including alloys, all forms	(1)	(1)
Copper:		
Matte	-----	(1)
Copper sulfate	(1)	(1)
Metal including alloys, all forms	2,528	2,705
Gold including alloys, all forms troy ounces	289	748
Iron and steel:		
Ore and concentrate	-----	(1)
Roasted pyrites	1,550	900
Metal:		
Scrap	(1)	-----
Pig iron, ferroalloys, and similar materials	1,728	2,151
Semimanufactures	18,444	31,720
Castings and forgings	14	29
Lead:		
Ore and concentrate	1,017	-----
Metal:		
Scrap	1	-----
Unwrought	5	5
Semimanufactures	59	61
Magnesium including alloys, all forms	1	(1)
Manganese, oxide and dioxide	52	146
Mercury 76-pound flasks	(1)	(1)
Molybdenum including alloys, all forms kilograms	447	103
Nickel:		
Scrap	7	4
Unwrought	10	2
Semimanufactures	406	335
Platinum-group metals including alloys, all forms troy ounces	-----	6
Silver including alloys, all forms do	5,400	13,512
Tin including alloys, all forms long tons	276	395
Titanium oxides	669	680
Zinc:		
Oxides	645	523
Metal:		
Unwrought	926	1,110
Blue powder	(1)	1
Metal including alloys, all forms	345	408

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS—Continued		
Others n.e.s.:		
Ore and concentrate	(1)	---------
Ash and residue of metals n.e.s	2	380
Oxides, hydroxides and peroxides of metals n.e.s	3	5
Metals including alloys, all forms [2]	(1)	(1)
Base metals n.e.s. [2]	(1)	(1)
NONMETALS		
Abrasives, natural n.e.s	9	24
Asbestos	2,224	2,545
Barite	---------	1
Boron materials:		
Crude natural borates	1,392	869
Oxide and acid	4	11
Cement	6,261	11,793
Chalk	2,566	2,522
Clays and products:		
Crude:		
Bentonite	71	(1)
Fuller's earth	45	6
Kaolin and refractory	8,581	11,530
Kyanite and sillimanite	9	28
Smectic	5,519	6,876
Others	435	180
Cryolite and chiolite	50	10
Diamond, industrial	NA	---------
Diatomite and other infusorial earths	730	1,069
Feldspar	43	129
Fertilizer and materials:		
Crude and manufactured:		
Nitrogenous	111,142	96,050
Potassic	32,278	26,543
Mixed	23,663	11,348
Graphite, natural	24	30
Lime	198	380
Magnesite	53	58
Mica:		
Crude including splittings and waste	17	16
Worked including agglomerated splittings	1	1
Pigments, mineral including processed iron oxides:		
Natural	360	370
Processed iron oxides	562	521
Precious and semi-precious stones (except diamond): troy ounces	5,822	1,116
Salt	41	(1)
Sodium and potassium compounds n.e.s	7,650	7,857
Stone, sand and gravel:		
Dimension	352	888
Dolomite	569	1,458
Gravel and crushed rock	164	60
Quartz and quartzite	248	53
Sand excluding metal bearing	9,581	12,587
Sulfur:		
Elemental, all forms	13,083	5,871
Sulfuric acid	11	11
Talc, steatite, soapstone and pyrophyllite	1,203	805
Other n.e.s.:		
Oxides and hydroxides of strontium, magnesium, etc	11	15
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	---------	4
Coal and coke including briquets	77,225	76,491
Gas carbon	1,755	2,030
LP gases — 42-gallon barrels	46,604	171,922
Hydrogen, helium, and rare gases	7	6
Peat including briquets and litter	5	3
Petroleum:		
Crude — 42-gallon barrels	9,402,640	9,915,509
Refinery products:		
Gasoline (including natural) — do	76,976	86,464
Kerosine and jet fuel — do	361,711	416,755
Distillate fuels — do	137,390	123,078
Residual fuels — do	151,941	95,854
Lubricants — do	153,118	177,676
Mineral jelly and wax — do	101,488	130,809
Others n.e.s — do	248,115	33,510

NA Not available.
[1] Less than ½ unit.
[2] Includes tungsten, tantalum, and rare-earth metals.
Source: Royaume du Maroc. Statistiques du Commerce Extérieur, 1968. 665 pp. Royaume du Maroc. Statistiques du Commerce Extérieur, 1969. 716 pp.

COMMODITY REVIEW

METALS

Antimony.—Under the very high price conditions in effect during the first 4 months of 1970, Morocco raised mine output for the year to over 4,300 metric tons of concentrate analyzing mostly 40 to 45 percent antimony. Morocco's yearend stocks were about 2,200 tons of concentrate. The five largest producers, with their 1970 concentrate output in tons in parentheses, were as follows: Tourtit (1,079) in Meknes Province; Tarmilet (1,052) in Meknes Province; Mejmaa Salihi (725) in Kenitra Province; Ich Ou Mellal (439) in Meknes Province; and Béni Mézala (378) in Tangier Province. Whereas most output was exported, the Tarmilet and Ich Ou Mellal operations sold primarily to the local market. Because of the sharp drop in antimony prices from US$4 per pound in April to only 70 US cents at yearend, Morocco's antimony industry cannot be expected to do as well in 1971 as in 1970.

Cobalt.—Moroccan authorities were concerned about the decline in mine cobalt output which dropped to less than half of the approximately 1,400 tons produced in 1969. Thirty Soviet mining engineers were aiding the Government in developing new deposits located in the Bou Azzer area.[6] Currently, cobalt concentrates are exported to France for refining.

Copper.—BRPM and the Franco-Moroccan firm, Omnium Nord Africain, together, and the Japanese firm of Mitsui Mining and Smelting Co., Ltd., jointly agreed to explore and exploit copper deposits at Bleida and El Hassel in the region of Zagora, Ouarzazate Province. The Japanese agreed to buy the copper output which may result from this exploration.[7]

Iron.—Iron ore is mined only at Uixan near Nador. The downward trend in output since 1966 was halted in 1970. New interest is focused on iron ore deposits of Gara-Djebilet, near Tindouf in the Algerian-Moroccan border region. Recently, the Governments of both of these countries jointly announced that a newly organized Algerian-Moroccan firm will exploit these deposits. The deposits contain approximately 3 billion tons of ore, analyzing 50 to 55 percent iron, some with phosphorus.

The Government awarded a contract in March to Midland-Ross Corp. (United States) to construct two vertical shaft furnace pelletizing systems capable of processing 850,000 tons of iron oxide pellets annually. An agreement also was made with the Schneider Creusot (ENSID) group of France and Swindell-Dressler (United States) for the construction and partial financing of a steel mill near Nador. This facility will produce about 250,000 tons of steel-mill products annually from domestic ore pellets.[8]

Lead.—Morocco has numerous, small, scattered lead deposits, which can be worked profitably when the deposits of the Bou-Beker, Touissit, Mibladen, and Aouli mines become depleted. Some of the small deposits are now being worked manually and occasionally the veins are unusually rich, like several in the Ksar-es-Souk area which assay 78 to 80 percent lead.[9]

An agreement was signed in December 1969, between BRPM and Zellidja Mining Company to jointly exploit lead deposits at Zeida, 20 miles northwest of Midelt. As a result, both of these parties organized a new firm, Société de Développement Industriel et Miniere de la Haute Moulouya. Mining equipment and technical personnel for the new operation were to come from the Zellidja-Boubeker mine which recently closed down. Two distinct ore deposits, 9 miles apart, exist near Zeida. The reserves are estimated at 11 million tons of ore containing 2.75 percent lead. Open pit mining methods will be employed and output is expected to be 3,000 tons of ore per day.[10]

Zinc.—The sharp decline in the output of zinc concentrate is caused by the depletion of ore at Bou-Beker and Touissit mines, the two major operations. The Bou-Beker mine is expected to close within 2 years. The Touissit mine, however, will continue to operate afterward, but at a decreasing production rate.[11]

An agreement was reportedly made between the Government and the Yugoslav State firm, Invest-Import, to erect facilities at Rich to produce 3,000 tons of electro-

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[6] Metal Bulletin. No. 5492, Apr. 21, 1970, p. 18.
[7] U.S. Embassy, Rabat. State Department Airgram A-44, Mar. 16, 1970, p.3.
[8] U.S. Embassy, Rabat. State Department Airgram A-118, July 13, 1970, 10 pp.
[9] Work cited in footnote 4.
[10] Work cited in footnote 4.
[11] Work cited in footnote 4.

lytic zinc annually from calamine ore derived from the Ait Labbes mine. Cheap electrical power will be available in 1972 from a dam under construction on the Ziz River between Rich and Ksar-es-Souk.[12]

NONMETALS

Barite.—Barite production showed little change compared with that of 1969. The only important producer continued to be Djebel Irhoud in Marrakech Province, which produced 77,603 metric tons or nearly 92 percent of the national total. The bulk of the output was exported to the United Kingdom and the United States.

Cement.—Five cement plants were in operation within Morocco, one each in Casablanca, Meknes, Agadir, Tetouan, and Tangier. Three plants, including the two largest, employ the wet process, and the other two employ dry process. The Casablanca plant, with four kilns and an annual capacity of at least 650,000 metric tons, was at one time by far the leading cement plant in Morocco. Next in line was the Meknes plant, with a single kiln and a yearly capacity of 150,000 tons reported a few years back. The country's cement output in 1970 was unusually large, increasing more than one-fifth over that of 1969 and producing more than 1.4 million metric tons.

Fertilizer Materials.—West Germany approved an additional loan of $17 million to Morocco for increasing the output of phosphate rock. The loan to Morocco thus far totaled $99 million, half of which was invested in the phosphate industry.[13]

The country's phosphate industry, which ranked second in the world with output at 11.4 million metric tons in 1970, continued to be hampered by high production costs and rising competition from foreign sources, including the United States. To meet this competition, the Office Cherifien des Phosphates (OCP), the Moroccan State phosphates enterprise, has been investing heavily in new equipment, largely financed by a loan from the U.S. Export-Import Bank. OCP apparently abandoned plans announced 2 years ago to develop the phosphate resources at Ben Guerir and, instead, will concentrate on developing Grand Douai, a newly developed site within the very extensive Khouribga zone of deposits in Casablanca Province. This project is being financed by approximately $12 million in West German credits.

Most of Morocco's phosphate rock was produced in Casablanca Province during 1970, and primarily within the Khouribga zone of deposits which provided 61.8 percent of the national total. Beni-Idir in Casablanca supplied 13.6 percent and Oued-Zem in Casablanca supplied 6.0 percent. The only district elsewhere was Youssoufia in Safi Province, which provided the remaining 18.6 percent.

Morocco continued to sell phosphate rock to many countries around the world. Of the approximately 11.2 million metric tons exported in 1970, 14.5 percent went to France, 10.8 percent to Spain, 10.2 percent to Belgium, 9.6 percent to the United Kingdom, 5.4 percent to Italy, 5.2 percent to Mainland China, and 5.2 percent to Japan. All other countries received less than 0.5 million tons during the year.

The Maroc Chimie chemical complex at Safi, which produces triple superphosphate and diammonium phosphate, continued to operate uneconomically. The use of low-grade phosphates from Youssoufia and sulfur from pyrrhotite from Kettara created major problems. Calcite accumulates at the rate of 400,000 tons annually and corrosion of equipment is excessive. Two U.S. firms were engaged to study the phosphate refining operations and also the recovery of iron and copper byproducts.[14]

A Danish firm studied the feasibility of building a new phosphoric acid plant for OCP. The study included the possible expansion of existing facilities at Safi.[15]

Maroc Chimie planned to construct a 67,200-short-tons-per-year ammonium sulfate plant and an additional 168,000-ton-per-year monoammonium phosphate plant costing a total of $15.5 million at the firm's operations at Safi.[16]

Fluorspar.—Moroccan fluorspar output ceased when the El Hamman mine in the Meknes Province closed down in the mid-sixties. The area, however, was known to have further potential. BRPM reportedly made a comprehensive survey in the area

[12] Work cited in footnote 4.
[13] Phosphorus and Potassium (London). No. 49, September–October 1970, p. 56.
[14] Bureau of Mines. Mineral Trade Notes. V. 68, No. 1, January 1971, pp. 19–20.
[15] Phosphorus and Potassium (London). No. 49, September–October 1970, p. 11.
[16] Nitrogen (London). No. 66, July–August 1970, p. 18.

and found some attractive reserves of high-grade ore. The principal vein has an average thickness of 5 meters and is accessible by a 1,500-meter drift. So far, the proven reserves consist of 2 million tons of ore, averaging 54 percent fluorite and an additional 1.5 million tons of ore averaging 50 percent fluorite.

Ugine-Kuhlmann, a French chemical company which recently embarked on a phased merger with Compagnie Péchiney, reportedly, was awarded permission to explore the neighboring locality of Achemeche for fluorite.[17]

Salt.—Three rocksalt deposits, discovered near Casablanca, were being evaluated by a representative from the International Salt Co. (United States) at the request of the United Nations.[18]

MINERAL FUELS

Anthracite.—The semipublic-owned coal mining firm of Charbonnages Nord-Africains will sell coal to an electric powerplant under construction at Djerada. This plant will use 700,000 tons of coal annually or 80 percent of the productive capacity of the mines. The coal company has reserves estimated at 100 million tons, but the layers of coal are thin, fractured, and difficult to mine.[19]

Natural Gas.—Natural gas output in 1970 came from fields near Essaouira and Meknes. The gas discovery in the Douar Jabar field in the Gharb in 1969 was estimated to contain 5 billion cubic feet. A 50-kilometer pipeline is to be laid from this field to Kenitra in 1971; the gas will be used by a paper and box company.[20]

Petroleum.—The Ministry of Commerce and Industry authorized both the Société Anonyme Maroco-Italienne de Raffinage (SAMIR) and the Société Cherifienne des Pétroles (SCP) in March to double the capacities of their refineries. SAMIR's capacity will be eventually increased to 2.5 million tons of crude oil per year and SCP's capacity to 800,000 tons per year.

The oilfields at Sidi Kacem and Essouira, which only produced 58,500 tons of crude oil in 1969, may soon be depleted. The search for oil is continuing, especially in offshore areas. Numerous offshore concessions have been granted and, by midyear, offshore zones were assigned from the northern border of the Spanish Sahara to Tangier, covering 50,000 square kilometers, excluding the area between El Jadid and Rabat. Two concession agreements were made with U.S. firms since the first of the year. One agreement, with the Texas Eastern Maroc, Inc., a subsidiary of Texas Eastern Transmission Corp. (United States) grants petroleum exploration rights in two offshore concession areas known as the Ifni Maritime and Souss Maritime zones, each having an area of 3,690 square kilometers. The Ifni zone is unknown geologically, but the Souss zone may contain extensions of the formations from the Essouira basin. Any commercial petroleum production which may result will be shared on an equal basis.[21] The other agreement was made with Bosco Petroleum Corp. for exploring 7,800 square kilometers between Rabat and Tangier. In addition, Société Nationale des Pétroles d'Aquitaine (SNPA) of France and BRPM signed an agreement in April for exploration and exploitation of two on-shore concessions involving 16,150 square kilometers in the Soukkala (coast between Safi and El Jadida) on the Guercif Plain. The French firm already had an offshore concession between El Jadida and Cape Sim, which was granted in March 1969.[22]

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[17] Industrial Minerals (London). No. 38, November 1970, p. 33.
[18] Mining Journal. V. 274, No. 7021, Mar. 13, 1970, p. 223.
[19] Work cited in footnote 8.
[20] U.S. Embassy, Rabat. State Department Airgram A-47, Mar. 12, 1971, 3 pp.
[21] U.S. Embassy, Rabat. State Department Airgram A-22, Feb. 4, 1970, p. 1.
[22] Work cited in footnote 8.

The Mineral Industry of the Netherlands

By Frank J. Cservenyak [1]

The mineral industry of the Netherlands was highlighted in 1970 by continuation of rapid advances in petroleum refining and natural gas production. The changing energy market caused by the increasing arrival of natural gas necessitated the continuing closure of coal mines with a resultant drop in the output of Netherlands coal. Natural gas supplied 27 percent of the energy consumed in 1970, and this proportion is expected to increase to 38 percent in 1980 with a resultant increase in domestic gas consumed to 2½ times the 1970 amount.

However, oil products continued to hold the dominant position providing nearly two-thirds of domestic energy needs. The importance of the petroleum industry to the Netherlands is demonstrated by the fact that it supplies a significant and growing share of the gross national product (GNP). The GNP share of this industrial sector has increased from 4.5 percent in 1968 to 6.1 percent in 1969 and to 7.1 percent in 1970. Consumption of petroleum products is expected to increase by more than 60 percent by 1980. Domestic sales of petroleum products in 1970 increased about 9 percent and refinery production jumped about 18 percent.

Economic indicators for 1970 and predictions for 1971 indicate that the Netherlands national economy peaked in 1970 and the outlook for the next few years appears to be favorable. In 1970, industrial production, investment, labor productivity, disposable income, and consumer spending increased in real terms considerably more than in 1969.

The GNP in 1970 increased about 11 percent, to $31.5 [2] billion in current prices. Industrial production rose about 9 percent in 1970 with export orders accounting for a significant portion of the increase. Average worker productivity increased almost 10 percent, whereas average industrial wages increased about 13½ percent. Unemployment was at a low of 1.1 percent at the end of 1970 and registered job openings well surpassed unemployment.

Plans were announced for the construction of two uranium enrichment plants and a centrifuge factory in Almelo. Future plans include the construction of nuclear power stations and the development of reactors by combined Netherlands and foreign enterprises.

The long-standing jurisdictional dispute concerning the delineation of the North Sea Continental Shelf boundaries between the Netherlands, West Germany, and Denmark was resolved. By agreement a portion of the shelf was ceded to West Germany by the Netherlands and companies holding exploration concessions in the ceded area will have to re-apply to the German Government for permits.

Construction of new pipelines continued. Agreement was reached during the year between the Belgian and Netherland Governments for construction of a pipeline to supply crude oil from Rotterdam to Antwerp. Construction started in 1970 and the pipeline with an initial capacity at 24 million tons of crude oil per year is expected to start operating in 1971.

Increased concern was directed toward the abatement of air, water, and land pollution from new and expanded installations, especially in the rapidly growing chemical and oil refining industries. Public

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[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from Netherlands Guilders (NGs) to U.S. dollars at the rate of NGs 3.62=US$1.00.

concern about the environment has led to the passage of laws to abate air and water pollution and a bill on solid waste disposal was under consideration by the executive branch. These laws will fix the responsibility for the cost of pollution abatement on the companies and agencies causing it. Estimates of the cost range from $1 billion over a period of 15 years for reduction of water pollution to a yearly expenditure of 1 percent of the gross national income for all antipollution measures.

PRODUCTION

Following the trend established during the past several years, the output of most mineral commodities, particularly natural gas and petroleum products, continued to rise in 1970 and the production of crude oil, coke, coal, and fuel briquets continued to decline. Production of aluminum, pig iron, crude steel, lead, and tin showed moderate increases whereas natural gas and petroleum products reflected significant advances during the year.

Table 1.—Netherlands: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1968	1969	1970 [p]
METALS			
Aluminum, primary	49,143	72,144	75,148
Cadmium [e]	140	[r] 140	140
Iron and steel:			
Sintered ore (from imported ore) ... thousand tons	3,360	3,387	3,191
Pig iron including blast furnace ferroalloys ... do	2,821	3,459	3,594
Crude steel ... do	3,707	4,713	5,030
Semimanufactures ... do	[r] 3,080	3,727	3,995
Lead, primary	17,185	14,794	17,613
Tin, primary ... long tons	7,983	5,298	5,937
Zinc, primary	42,076	46,627	46,223
NONMETALS			
Cement ... thousand tons	3,436	3,296	3,830
Fertilizer materials manufactured:			
Nitrogenous, nitrogen content ... do	[r] 891	878	752
Phosphatic, phosphorus pentoxide content ... do	[r] 262	250	249
Salt, all types ... do	[r] 2,413	2,669	2,869
Sand, industrial ... do	NA	NA	21,559
Sulfur:			
Elemental, byproduct	40,400	31,000	[e] 35,000
Sulfuric acid (100 percent H_2SO_4) ... thousand tons	462	557	587
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	77,100	81,400	86,000
Coal, anthracite and bituminous ... thousand tons	[r] 6,662	5,554	4,334
Coke:			
Coke oven ... do	[r] 2,930	2,030	1,997
Gashouse ... do	[r] 3	3	-------
Fuel briquets, all grades ... do	1,054	1,047	886
Gas:			
Manufactured, all types ... million cubic feet	87,318	[2] 73,588	[2] 72,293
Natural:			
Gross production ... do	[r] 498,429	773,176	1,118,375
Marketable ... do	487,093	762,687	1,107,427
Peat [e] ... thousand tons	400	400	400
Petroleum:			
Crude oil ... thousand 42-gallon barrels	14,645	13,792	13,080
Refinery products:			
Aviation gasoline ... do	1,736	1,682	1,967
Motor gasoline ... do	28,764	34,833	39,228
Jet fuel ... do	8,512	14,104	16,440
Kerosine ... do	9,083	8,448	9,300
Distillate fuel oil ... do	71,355	101,366	127,827
Residual fuel oil ... do	107,532	142,178	169,430
Lubricants ... do	1,946	314	3,297
Bitumen ... do	3,594	3,951	4,818
Liquefied petroleum gas ... do	6,125	7,180	8,166
Other ... do	28,324	38,507	47,202
Refinery fuel and losses ... do	28,156	32,596	[e] 28,000
Total ... do	295,127	385,159	455,675

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

[1] In addition to the commodities listed, the Netherlands presumably produces a variety of crude construction materials (such as clays, sand, and stone and gravel) but no data are published.

[2] Coke oven and blast furnace gas only. (Data exactly comparable with those for 1968 are not available).

TRADE

Total exports in 1970 covered less than 88 percent of imports thereby reversing the improving balance of trade experienced by the Netherlands in 1968 and 1969. During 1970 total exports of about $11 billion were up 10 percent, while imports increased by almost 22 percent to about $13.5 billion.

Table 2.—Netherlands: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite	386	987	West Germany 665.
Oxide and hydroxide	4,430	5,871	West Germany 1,506; Italy 1,310; Sweden 634.
Metal including alloys:			
Scrap	11,832	16,811	West Germany 14,649; France 828; Belgium-Luxembourg 774.
Unwrought	43,722	64,067	West Germany 27,092; Belgium-Luxembourg 19,581; Italy 8,863.
Semimanufactures	26,975	37,363	West Germany 17,614; Belgium-Luxembourg 6,486; France 3,753.
Bismuth including alloys, all forms	148	86	West Germany 27; France 23; Italy 14.
Cadmium including alloys, all forms	r 409	194	West Germany 80; Belgium-Luxembourg 76.
Chromium:			
Chromite	2,771	2,596	Italy 1,003; France 649; West Germany 264.
Oxide and hydroxides	402	634	West Germany 343; France 176.
Cobalt:			
Oxide and hydroxide	1	4	Turkey 2.
Metal including alloys, all forms	44	67	France 31; West Germany 14.
Columbium and tantalum, tantalum including alloys, all forms	2	2	France 1.
Copper including alloys:			
Scrap	r 30,638	34,187	West Germany 17,727; Belgium-Luxembourg 14,121.
Unwrought	10,682	9,269	West Germany 6,778; Italy 784; Spain 511.
Semimanufactures	18,368	20,019	West Germany 8,133; United States 2,816; Belgium-Luxembourg 2,780.
Gold [1] thousand troy ounces	2,328	1,664	West Germany 1,036; Belgium-Luxembourg 494; France 113.
Iron and steel:			
Ore and concentrate, except roasted pyrites thousand tons	3	8	Belgium-Luxembourg 6; West Germany 1.
Roasted pyrite do	70	79	All to West Germany.
Metal:			
Scrap do	711	684	West Germany 492; Belgium-Luxembourg 144; France 29.
Pig iron and ferroalloys [2] do	122	62	NA.
Steel, primary do	741	1,018	United Kingdom 284; West Germany 238; Belgium-Luxembourg 199.
Semimanufactures:			
Bars, rods, angles, shapes, and sections do	386	399	West Germany 179; United Kingdom 39; France 33.
Universals, plates, sheets do	1,120	1,278	West Germany 295; United States 237; United Kingdom 166.
Hoop and strip do	108	121	West Germany 89; Italy 7; Belgium-Luxembourg 6.
Rails and accessories do	11	37	Italy 14; West Germany 12; Israel 5.
Wire do	30	29	West Germany 11; France 5; Italy 3.
Tubes, pipes and fittings do	202	354	West Germany 110; Nigeria 58; Senegal 39.
Castings and forgings do	4	6	Belgium-Luxembourg 4; West Germany 1.
Lead:			
Oxides	2,437	3,055	Belgium-Luxembourg 2,104; Czechoslovakia 549.
Metal:			
Scrap	8,153	8,619	Belgium-Luxembourg 4,676; West Germany 3,558.
Unwrought	16,608	14,601	West Germany 11,685; Belgium-Luxembourg 1,785.
Semimanufactures	1,620	1,333	Norway 285; Belgium-Luxembourg 274; West Germany 101.
Magnesium including alloys, all forms	r 319	620	West Germany 467; mainland China 50; United Kingdom 42.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Manganese:			
Ore and concentrates	21,783	25,082	West Germany 7,125; Italy 3,108; France 2,141; United Kingdom 1,922.
Oxide	3,066	4,496	Italy 1,801; West Germany 663.
Mercury 76-pound flasks	667	290	Belgium-Luxembourg 87; West Germany 29; Republic of South Africa 29; Israel 29.
Molybdenum including alloys, all forms	87	115	West Germany 53; France 20.
Nickel:			
Oxide and hydroxide	140	783	France 306; Belgium-Luxembourg 204; West Germany 161.
Metal including alloys:			
Scrap	2,236	2,054	West Germany 927; United Kingdom 372; Belgium-Luxembourg 254.
Unwrought and semimanufactures	1,445	2,074	Sweden 668; West Germany 538; France 125.
Platinum-group, all forms troy ounces	r 20,866	18,229	United States 4,019; Hong Kong 2,829; United Kingdom 2,058.
Silver including alloys, all forms thousand troy ounces	r 2,221	4,451	United Kingdom 1,179; West Germany 1,165; Belgium-Luxembourg 1,056.
Tellurium, elemental and arsenic	6	4	All to France.
Tin:			
Ore and concentrate long tons	34	--------	
Metal including alloys:			
Scrap do	579	451	United Kingdom 168; Denmark 122; West Germany 104.
Unwrought do	9,319	7,272	West Germany 3,908; France 777; Switzerland 353.
Semimanufactures do	342	359	Belgium-Luxembourg 119; Norway 74; West Germany 29.
Titanium dioxide	14,621	21,530	West Germany 4,228; Italy 3,887; France 2,379.
Tungsten:			
Ore and concentrate	270	121	United Kingdom 91; West Germany 24.
Metal including alloys, all forms	210	222	West Germany 134; France 19; Belgium-Luxembourg 12.
Zinc:			
Ore and concentrate	20,391	22,756	Belgium-Luxembourg 17,194; France 3,526; Italy 2,036.
Oxide	11,051	11,245	West Germany 2,373; Belgium-Luxembourg 1,420; Italy 952.
Metal including alloys:			
Scrap	8,527	7,430	France 6,668; Belgium-Luxembourg 544.
Dust (blue powder)	193	65	West Germany 30; France 18.
Unwrought	24,785	30,181	West Germany 15,968; France 5,989; Denmark 2,722.
Semimanufactures	r 1,390	939	West Germany 553; Belgium-Luxembourg 109.
Other:			
Ore and concentrate	r 16,631	12,504	West Germany 3,981; France 1,864; Austria 1,725.
Ash and residues containing nonferrous metals:			
Iron and steel thousand tons	103	132	Belgium-Luxembourg 100; West Germany 30.
Lead	4,667	4,395	Belgium-Luxembourg 3,288; West Germany 1,024.
Tin long tons	r 497	--------	
Zinc	r 6,903	5,617	West Germany 3,179; Belgium-Luxembourg 1,507; France 861.
Other	11,459	10,868	West Germany 8,600; Belgium-Luxembourg 1,561; Sweden 465.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum	5,259	5,613	West Germany 690; France 534; Belgium-Luxembourg 239.
Dust and powder of precious and semiprecious stones including diamond thousand carats	1,273	1,640	West Germany 588; France 290; Italy 158.
Grinding and polishing stones	1,005	1,198	West Germany 456; United Kingdom 156; France 125.
Asbestos	55	162	Belgium-Luxembourg 103; West Germany 49.
Borates, crude natural	246,653	273,756	West Germany 94,184; United Kingdom 57,374; France 44,516.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Cement	25,784	58,414	West Germany 48,486; Belgium-Luxembourg 9,371; United Kingdom 435.
Chalk	38,078	40,842	Belgium-Luxembourg 40,348; West Germany 280.
Clays and products:			
Crude:			
Bentonite	--------	2,915	France 1,298; Belgium-Luxembourg 905.
Kaolin	21,126	38,153	Belgium-Luxembourg 38,021; France 108.
Refractory	2,387	4,052	Belgium-Luxembourg 1,651; Sweden 877; West Germany 566.
Other thousand tons	108	102	West Germany 65; Belgium-Luxembourg 35; France 1.
Products:			
Refractory including nonclay bricks	6,660	12,464	West Germany 3,334; Belgium-Luxembourg 3,244; Norway 1,182.
Nonrefractory thousand tons	652	612	West Germany 477; Belgium-Luxembourg 110; France 4.
Diamond not set or strung, except dust and powder thousand carats	1,220	1,332	NA.
Diatomite and other infusorial earths	1,309	254	West Germany 172; Indonesia 24.
Feldspar and leucite	1,048	120	Belgium-Luxembourg 63.
Fertilizer materials:			
Crude:			
Nitrogenous	850	542	Sweden 462; West Germany 79.
Phosphatic	227	7,191	France 3,047; Belgium-Luxembourg 2,918.
Potassic salts	--------	20	All to Belgium-Luxembourg.
Other	52,715	43,296	Belgium-Luxembourg 30,624; West Germany 9,850; France 2,630.
Manufactured:			
Nitrogenous thousand tons	876	855	Mainland China 240; United Kingdom 112; Brazil 83.
Phosphatic:			
Thomas slag	r 187	15	NA.
Other thousand tons	309	283	France 165; West Germany 8.
Potassic	r 1,259	1,694	NA.
Other including mixed thousand tons	670	786	France 178; Belgium-Luxembourg 15; West Germany 2.
Ammonia, anhydrous	r 128,616	196,133	West Germany 134,931; Belgium-Luxembourg 46,025; France 6,372.
Fluorspar	75	42	NA.
Lime	7,638	2,462	Belgium-Luxembourg 826; France 309.
Magnesite	16,911	19,548	West Germany 6,870; France 2,164; Belgium-Luxembourg 1,337.
Mica	r 98	93	Belgium-Luxembourg 72; West Germany 15.
Pigments, mineral, including processed iron oxides	r 503	649	Ceylon 128; Indonesia 86; West Germany 78.
Precious and semiprecious stones except diamond kilograms	9,082	20,102	United Kingdom 18,720; West Germany 670.
Salt thousand tons	1,422	1,629	Belgium-Luxembourg 669; Sweden 448; Finland 183.
Stone, sand and gravel:			
Dimension:			
Unworked and partly worked	r 3,814	3,064	Belgium-Luxembourg 2,060; West Germany 851.
Worked	4,863	2,708	Belgium-Luxembourg 1,898; West Germany 709.
Gravel and crushed stone thousand tons	2,075	3,158	Belgium-Luxembourg 2,875; West Germany 281.
Quartz and quartzite	r 2,847	3,930	Belgium-Luxembourg 2,492; West Germany 1,160.
Sand excluding metal bearing thousand tons	6,998	8,168	Belgium-Luxembourg 7,563; France 296; West Germany 213.
Sulfur:			
Elemental, all forms	r 835	1,417	West Germany 1,148; Belgium-Luxembourg 256.
Sulfur dioxide	786	1,018	West Germany 59; Belgium-Luxembourg 30.
Sulfuric acid, oleum thousand tons	56	108	West Germany 41; Belgium-Luxembourg 25.
Talc and steatite	175	427	Belgium-Luxembourg 218; West Germany 32; Denmark 14.
Other nonmetals n.e.s thousand tons	203	219	Belgium-Luxembourg 122; West Germany 61; France 28.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	37	7	Belgium-Luxembourg 1.
Carbon black	r 68,497	75,260	France 24,031; West Germany 15,250; Sweden 8,432.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,975	1,792	Belgium-Luxembourg 928; France 541; West Germany 242.
Briquets of anthracite and bituminous coal do	801	836	West Germany 364; Belgium-Luxembourg 278; France 162.
Lignite briquets	9,854	299	Belgium-Luxembourg 81.
Coke and semicoke thousand tons	1,497	789	Belgium-Luxembourg 349; France 308; West Germany 67.
Gas, hydrocarbon:			
Natural, including liquefied petroleum gas thousand tons	437	451	Belgium-Luxembourg 148; West Germany 76; United Kingdom 62.
Hydrogen, helium, and rare gases	336	545	Belgium-Luxembourg 386; France 76; Denmark 32.
Petroleum: [3]			
Crude thousand 42-gallon barrels	130	7,743	West Germany 3,468; Belgium-Luxembourg 1,863; United Kingdom 611.
Refinery products:			
Gasoline do	30,320	41,863	West Germany 16,006; United Kingdom 14,714; Belgium-Luxembourg 2,982.
Kerosine and jet fuel do	6,675	8,556	United Kingdom 3,174; Ireland 2,731; Sweden 1,689.
Distillate fuel oil do	36,017	54,861	West Germany 31,407; Belgium-Luxembourg 6,529; International bunkers 5,664.
Residual fuel oils do	62,877	89,104	International bunkers 39,714; United Kingdom 10,443; United States 9,957.
Lubricants do	3,315	3,436	United Kingdom 702; Belgium-Luxembourg 389; West Germany 281.
Mineral jelly and wax do	284	589	United Kingdom 251; West Germany 209; France 29.
Bituminous mixtures do	180	199	West Germany 64; Belgium-Luxembourg 59; Guinea 16.
Other do	1,289	1,617	West Germany 823; Sweden 180; Belgium-Luxembourg 96.
Mineral tar and coal, petroleum or gas derived crude chemicals thousand tons	197	250	West Germany 74; Belgium-Luxembourg 57; United Kingdom 29.

r Revised. 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: World Trade Annual, volumes I, II, and III, 1968 and 1969; Maandstatistiek van de Buitenlandse Handel per Goederensoort, December 1968 and December 1969.

Table 3.—Netherlands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	40,943	107,608	Greece 103,213; Guyana 4,294.
Alumina	r 121,709	158,420	Surinam 139,070; West Germany 11,989.
Metal including alloys:			
Scrap	8,783	9,612	West Germany 2,669; United States 2,269; Belgium-Luxembourg 1,803.
Unwrought including alloys	33,225	43,324	Norway 25,432; West Germany 4,053; Cameroon 2,164.
Semimanufactures	41,280	51,180	West Germany 20,065; Belgium-Luxembourg 18,092; France 5,630.
Antimony:			
Ore and concentrate	10	5	All from Austria.
Metal including alloys, all forms	146	122	Belgium-Luxembourg 59; United Kingdom 23; West Germany 20.
Arsenic, oxides and acids	947	1,040	Belgium-Luxembourg 800; France 206.
Bismuth including alloys, all forms	235	179	Belgium-Luxembourg 41; Peru 39; Japan 28.
Cadmium including alloys, all forms	349	123	Belgium-Luxembourg 61; West Germany 26.
Chromium:			
Chromite	3,288	4,134	Mozambique 2,791; West Germany 1,163.
Oxide and hydroxide	1,058	1,492	West Germany 629; U.S.S.R. 523; France 144.
Metal including alloys, all forms	16	30	West Germany 12; France 10; United Kingdom 8.
Cobalt:			
Oxides and hydroxides	188	404	Belgium-Luxembourg 320; France 83.
Metal including alloys, all forms	177	243	Belgium-Luxembourg 143; West Germany 62; United Kingdom 20.
Columbium and tantalum, tantalum	6	7	United States 3.
Copper including alloys:			
Scrap	7,699	7,428	Belgium-Luxembourg 2,775; West Germany 2,665; East Germany 713.
Unwrought	41,865	44,197	Belgium-Luxembourg 14,338; Zambia 5,924; Chile 4,514.
Semimanufactures	62,683	68,819	Belgium-Luxembourg 43,129; West Germany 16,965; France 4,162.
Gold [1] thousand troy ounces	111	855	Belgium-Luxembourg 560; West Germany 248.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	4,359	4,962	Liberia 1,342; Canada 1,010; Sierra Leone 581.
Metal:			
Scrap do	154	317	Belgium-Luxembourg 254; West Germany 34.
Pig iron [2] do	32	48	West Germany 20; Norway 7; Belgium-Luxembourg 3.
Ferroalloys do	37	50	Norway 25; France 8; West Germany 7.
Steel, primary do	327	274	West Germany 196; Norway 54; Japan 13.
Semimanufactures:			
Bars, rods, angles, sections do	1,268	1,317	Belgium-Luxembourg 668; West Germany 437; France 134.
Universals, plates and sheets do	628	792	West Germany 336; Belgium-Luxembourg 317; France 45.
Hoop and strip do	230	256	West Germany 168; Belgium-Luxembourg 77; France 6.
Rails and accessories do	39	44	West Germany 25; Belgium-Luxembourg 11; France 8.
Wire do	68	86	Belgium-Luxembourg 47; West Germany 33.
Tubes, pipes and fittings do	531	617	West Germany 393; France 100; Belgium-Luxembourg 55.
Castings and forgings do	6	8	West Germany 4; Belgium-Luxembourg 3.
Lead:			
Ore and concentrates	5	7	NA.
Oxides	10,269	12,672	Belgium-Luxembourg 4,498; West Germany 3,139; Mexico 2,698.
Metal including alloys:			
Scrap	4,536	2,384	Belgium-Luxembourg 1,084; West Germany 582.
Unwrought	54,412	61,219	United Kingdom 19,620; Belgium-Luxembourg 12,161; Australia 9,552.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Lead—Continued			
Metal including alloys—Continued			
Semimanufactures	3,505	6,470	North Korea 3,078; Belgium-Luxembourg 2,064; West Germany 929.
Magnesium including alloys:			
Scrap	117	304	Norway 129.
Unwrought	274	527	U.S.S.R. 320.
Semimanufactures	56	70	United States 17; Austria 17; West Germany 16.
Manganese:			
Ore and concentrates	36,135	57,922	West Germany 3,675; India 1,098; France 724.
Oxide	r 1,016	848	Japan 261.
Mercury 76-pound flasks	1,305	2,002	Spain 1,305; United States 261; Belgium-Luxembourg 174.
Molybdenum including alloys, all forms	15	26	Austria 7; United States 5.
Nickel:			
Matte, speiss and similar materials	182	277	United Kingdom 159; Cuba 112.
Metals including alloys:			
Scrap	1,391	1,491	West Germany 326; United States 208; France 199.
Unwrought	1,933	1,807	Norway 567; United Kingdom 408; France 170.
Semimanufactures	3,223	3,811	West Germany 1,881; United Kingdom 593; France 327.
Platinum-group, all forms thousand troy ounces	70	52	France 22; West Germany 13; United Kingdom 8.
Silver including alloys, all forms do	6,872	8,472	West Germany 3,291; France 976; United Kingdom 705.
Tellurium, elemental and arsenic	10	14	Belgium-Luxembourg 9; United Kingdom 2; U.S.S.R. 2.
Tin:			
Ore and concentrate long tons	11,461	10,378	Australia 3,071; Chile 2,687; Congo (Kinshasa) 1,616.
Oxide do	68	85	Belgium-Luxembourg 63.
Metal including alloys:			
Scrap do	238	311	Belgium-Luxembourg 297.
Unwrought do	4,405	6,473	United Kingdom 2,330; Thailand 1,276; Indonesia 739.
Semimanufactures do	66	82	West Germany 67.
Titanium:			
Ore and concentrate	4,824	571	Australia 563.
Dioxide	4,253	5,616	West Germany 4,062; Italy 484; United Kingdom 368.
Tungsten:			
Ore and concentrate	218	373	Portugal 223; United Kingdom 80.
Metal including alloys, all forms	28	12	France 5; West Germany 3; United Kingdom 3.
Zinc:			
Ore and concentrate	96,260	102,152	Canada 33,947; Finland 21,848; Sweden 20,285.
Oxides	1,826	2,689	West Germany 1,001; United Kingdom 484.
Metal including alloys:			
Scrap	557	1,609	West Germany 1,163; Denmark 254.
Dust (blue powder)	3,082	3,129	West Germany 1,901; Norway 539; United Kingdom 337.
Unwrought	18,485	18,027	North Korea 5,670; West Germany 2,866; Belgium-Luxembourg 2,794.
Semimanufactures	4,961	4,658	Belgium-Luxembourg 3,644; West Germany 867.
Other:			
Ores and concentrates:			
Columbium, molybdenum, tantalum, vanadium, and zirconium	15,410	13,994	United States 13,722; France 170.
Not specified	2,350	1,166	Republic of South Africa 543; Peru 121; Burma 114.
Ash and residues containing nonferrous metals:			
Lead	713	1,744	West Germany 484; Spain 475; Morocco 456.
Tin long tons	r 820	---------	
Zinc	33,975	40,143	West Germany 23,912; Belgium-Luxembourg 4,789; United Kingdom 3,944.
Other	43,456	49,682	Canada 44,582; U.S.S.R. 2,393; West Germany 1,298.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Other—Continued			
Metals including alloys, all forms:			
Metalloids:			
Phosphorus	35	42	West Germany 27; Sweden 10.
Selenium	4	6	United Kingdom 3; Belgium-Luxembourg 1.
Silicon	r 464	719	France 392; Italy 140; United Kingdom 83.
Alkali, alkaline-earth and rare-earth	r 180	206	West Germany 203.
Oxides of barium, strontium, and magnesium	587	803	West Germany 238; United Kingdom 227.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc. thousand tons	r 379	382	West Germany 373; Turkey 6.
Dust and powder of precious and semiprecious stones thousand carats	1,417	1,528	Ireland 1,247; United Kingdom 212.
Grinding and polishing stones	1,706	1,950	West Germany 1,073; Austria 251.
Asbestos	23,307	20,653	Canada 13,979; Italy 2,217.
Barite and witherite	30,075	34,569	West Germany 28,969.
Boron materials:			
Crude natural borates	281,428	310,018	United States 300,355; Turkey 8,760.
Oxide and acid	1,321	1,808	United States 797; France 460.
Cement thousand tons	2,263	2,182	West Germany 1,322; Belgium-Luxembourg 843.
Chalk	137,192	138,319	Belgium-Luxembourg 81,978; France 44,549; West Germany 11,433.
Clays and products:			
Crude:			
Bentonite thousand tons	--------	14	United States 7; West Germany 4; Italy 2.
Kaolin do	153	193	United Kingdom 148; Czechoslovakia 14; United States 14.
Refractory do	111	132	West Germany 105; France 6; United Kingdom 6.
Other do	499	509	West Germany 476; United Kingdom 19.
Products:			
Refractory including nonclay bricks do	51	82	United Kingdom 31; West Germany 30.
Nonrefractory do	174	206	West Germany 93; Belgium-Luxembourg 83; Italy 17.
Cryolite and chiolite	1,034	747	All from Denmark.
Diamond, all grades:			
Gem not set or strung thousand carats	1,276	1,455	NA.
Industrial thousand kilograms	293	292	Brazil 220; West Germany 46; United States 21.
Diatomite and other infusorial earths	8,041	10,699	Denmark 4,285; United States 3,077.
Feldspar and leucite	32,056	32,874	Norway 9,987; West Germany 7,399; Belgium-Luxembourg 5,975.
Fertilizer materials:			
Crude:			
Nitrogenous	4,307	30,215	Chile 30,214.
Phosphatic thousand tons	1,243	1,237	Morocco 420; Togo 288; United States 241.
Potassic salts do	54	41	West Germany 22; France 19.
Other do	32	36	West Germany 28; Belgium-Luxembourg 6.
Manufactured:			
Nitrogenous do	8	15	Belgium-Luxembourg 9; West Germany 4
Phosphatic:			
Thomas slag (P_2O_5 content) do	23	21	Belgium-Luxembourg 18; West Germany 3.
Other (P_2O_5 content) do	30	29	United States 26.
Potassic do	431	424	West Germany 171; France 70; East Germany 63.
Other including mixed do	r 34	32	Belgium-Luxembourg 9; United States 9; France 6.
Ammonia, anhydrous	50,025	203,571	United States 149,342; Belgium-Luxembourg 14,137; Trinidad and Tobago 13,859.
Fluorspar	22,607	27,996	France 2,491; West Germany 307.
Graphite, natural	239	450	United Kingdom 151; mainland China 99; Austria 90.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Gypsum and plasters ____thousand tons__	250	253	West Germany 134; France 102; Belgium-Luxembourg 17.
Lime __________do____	727	846	West Germany 452; Belgium-Luxembourg 370; Poland 23.
Magnesite __________	33,449	38,930	Greece 12,372; Austria 10,376; India 4,815.
Mica:			
Crude including splittings and waste_	r 1,687	1,090	United Kingdom 554; India 29.
Worked including agglomerated splittings __________	59	65	Switzerland 33; United Kingdom 12.
Pigments, mineral:			
Natural, crude __________	2,809	2,804	West Germany 1,849; Austria 501.
Iron oxides, processed __________	10,428	12,552	West Germany 7,916; France 2,421; Spain 1,345.
Precious and semiprecious stones, except diamond __________kilograms__	294,901	295,367	Brazil 221,563; West Germany 47,025; United States 22,485.
Pyrite __________thousand tons__	123	97	Cyprus 81; Portugal 10.
Salt __________	54,279	63,449	West Germany 36,181; France 27,132.
Sodium and potassium compounds, n.e.s.:			
Caustic soda __________	r 84,529	52,373	West Germany 33,220; Belgium-Luxembourg 11,619; Italy 4,924.
Caustic potash __________	r 6,461	5,992	France 2,773; Belgium-Luxembourg 1,932.
Stone, sand and gravel:			
Dimension:			
Unworked and partly worked thousand tons__	2,347	2,385	Belgium-Luxembourg 1,419; West Germany 581; Sweden 311.
Worked __________	28,111	32,505	Italy 13,905; Belgium-Luxembourg 6,665; West Germany 5,229.
Dolomite __________thousand tons__	r 467	686	Belgium-Luxembourg 595; United Kingdom 54; West Germany 26.
Gravel and crushed rock_____do____	13,510	13,817	West Germany 8,519; United Kingdom 2,544; Belgium-Luxembourg 2,091.
Limestone __________do____	919	949	Belgium-Luxembourg 926; West Germany 12.
Quartz and quartzite _________do____	54	53	Belgium-Luxembourg 26; Norway 13; West Germany 13.
Sand excluding metal bearing_do____	6,456	7,351	West Germany 6,864; Belgium-Luxembourg 481.
Sulfur:			
Elemental __________do____	335	389	United States 300; France 87; West Germany 2.
Sulfur dioxide __________	2,481	1,365	West Germany 1,320.
Sulfuric acid, oleum __________	31,526	25,487	West Germany 12,149; Belgium-Luxembourg 9,791; Norway 3,431.
Talc and steatite __________	15,264	14,960	Norway 5,149; Austria 4,613; mainland China 1,444.
Other nonmetals n.e.s____thousand tons__	1,923	2,289	West Germany 1,590; Belgium-Luxembourg 662; Australia 12.
Slag, dross, and similar waste not metal bearing:			
From iron and steel manufacture do____	3,157	3,255	West Germany 2,005; Belgium-Luxembourg 1,237.
Slag and ash n.e.s __________do____	499	495	West Germany 256; Belgium-Luxembourg 238.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural __________	1,967	1,286	Trinidad 608; West Germany 322; United States 290.
Carbon black (including gas carbon)_____	r 13,312	15,966	West Germany 10,830; Italy 1,738; United Kingdom 1,737.
Coal and briquets:			
Anthracite and bituminous coal thousand tons__	7,412	5,930	West Germany 3,281; United States 1,292; United Kingdom 730.
Briquets of coal __________do____	19	12	West Germany 10.
Lignite and lignite briquets___do____	144	63	All from West Germany.
Coke and semicoke __________do____	397	1,003	West Germany 593; United States 213; Spain 86.
Gas, hydrocarbon, natural including liquefied petroleum gas _________do____	117	134	West Germany 86; Belgium-Luxembourg 37.
Peat __________do____	93	123	Mainly from West Germany.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum: [3]			
Crude___thousand 42-gallon barrels__	243,986	329,649	Libya 70,464; Kuwait 68,542; Saudi Arabia 60,806; Iran 37,433.
Refinery products:			
Gasoline_______________do____	7,686	8,130	Italy 2,563; Belgium-Luxembourg 2,172; West Germany 1,190.
Kerosine and jet fuel____do____	4,672	4,101	Italy 1,335; Belgium-Luxembourg 1,227; Venezuela 432; United Kingdom 352.
Distillate fuel oil________do____	14,114	13,085	United Kingdom 2,970; Italy 2,845; Bahrain 1,447.
Residual fuel oil_________do____	16,304	10,842	West Germany 5,448; Indonesia 1,641; Belgium-Luxembourg 845; Singapore 91.
Lubricants_____________do____	2,604	2,883	Netherlands Antilles 1,385; United Kingdom 367; France 246.
Mineral jelly and wax____do____	149	164	West Germany 70; France 37; Indonesia 21.
Bituminous mixtures_____do____	55	64	West Germany 29; Belgium-Luxembourg 25; United Kingdom 6.
Other_________________do____	4,191	4,223	United States 1,610; Belgium-Luxembourg 1,237; West Germany 970.
Mineral tar and coal, petroleum or gas derived crude chemicals thousand tons__	r 196	217	Netherlands Antilles 58; West Germany 40; United States 34.

r Revised. NA Not available.
[1] Excluding gold coin and gold and alloys shipped by post.
[2] Including spiegeleisen; sponge iron, shot, grit and pellets.
[3] Includes bunkers.

Source: World Trade Annual, volumes I, II, and III, 1968 and 1969; Maandstatistiek van de Buitenlandse Handel per Goederensoort, December 1968 and December 1969.

COMMODITY REVIEW

METALS

Aluminum.—Aluminium Delftzijl N.V. (ALDEL) continued to be the only producer of primary aluminum metal. Plant capacity has expanded during recent years and is scheduled to reach 96,000 tons in 1971.

The Péchiney aluminum smelter in Flushing will initiate operations in 1971. Construction of this plant was started in 1969. The plant will include two potlines each with a capacity of 75,000 tons per year.

The aluminum extrusion plant constructed in Roermond by Amax Aluminium Extruders N.V. started production of aluminum shapes in 1970. The year 1970 was highlighted by an increase of over 20 percent in the apparent consumption of aluminum. Of significant interest was the increased application of aluminum in the building industry.

Expansion of the Aluminium Hardenberg N.V. facility in 1970 has increased the secondary aluminum capacity to about 10,000 tons per year.

N.V. Metaalgieterij G. Giesen in Tegelen commemorated 25 years of operation by producing an aluminum casting of 8.2 by 4.5 by 3.5 meters, believed to be the largest casting in the world.

International interest increased in the aluminum industry. The Swedish concern Skandinaviska Aluminium Profiler A.B. announced that it will construct an extrusion plant in Hoogezand. Kaiser Aluminium and Chemical Holdings in The Hague was founded to promote aluminum and chemical activities, and Reynolds Aluminium Holland N.V. announced that its fourth extrusion press will be placed in operation in 1971.[3]

Uranium.—The Netherlands, West Germany, and the United Kingdom entered into an agreement on March 4, 1970, to cooperate in the construction of a uranium enrichment plant at Almelo, Netherlands, to be operational during the second half of 1971. The agreement calls for the production of this plant to be used for peaceful purposes only and provision is made for safeguards against its use to proliferate nuclear weapons. West German plans to construct a second uranium enrichment

[3] Aluminium. V. 47, No. 1, January 1971, p. 54.

plant at Almelo were announced at the end of 1970. Uranit G.m.b.H of Julich, near Aachen, West Germany, has requested the Almelo municipality for permission to buy a building site for the plant. Initial construction of the plant is planned early in 1971.

A centrifuge factory was completed in Almelo on the order of N.V. UC-Nederland. The Netherlands, the United Kingdom, and West Germany plan to combine their experience in the ultracentrifuge field. The United Kingdom is working in Capenhurst on the further improvement of its centrifuge. Although the West Germans are building their enrichment plant in the Netherlands, their centrifuge will be constructed in their own country, at Benzberg.

Electric power producers expect that a minimum of four nuclear power stations will be completed in the Netherlands in the next decade. It is anticipated that the construction of nuclear power stations and development of reactors will be carried out in the near future by combined foreign and Netherlands enterprises. Nuclear energy applications will however have to compete with the economically advantageous Netherlands natural gas and mineral oil and the resultant large tax proceeds derived from the latter.[4]

MINERAL FUELS

Petroleum and Natural Gas.—The Netherlands petroleum industry expanded in virtually all phases and supplied a significant and growing share (over 7 percent) of the GNP in 1970. Production, consumption, and exports of natural gas continued to rise in 1970 and the long-range outlook for extraction and sales of gas reflects at least a 100-percent increase by 1980.

Oil refining is one of the fastest growing industrial activities in the Netherlands. The refining capacity tripled in the past decade. Based on firm expansion plans the total annual processing capacity of oil refineries will increase from 67 million tons in 1970 to 84.5 million tons of crude oil in 1973.

The jurisdictional disagreement of several years duration between the Netherlands, Denmark, and West Germany over the North Sea Continental Shelf boundaries was finally resolved by tripartite signature of negotiated agreements on January 28, 1970. This agreement cedes 5,000 square kilometers of the Continental Shelf to Germany by the Netherlands. Companies which have received exploration concessions in the ceded area from the Netherlands Government will have to reapply to the West German Government to receive permits covering the same area.

No new exploration concessions were granted by the Netherlands Government in 1969; however, in 1970 a number of concessions were awarded in the North Sea area. This included 24 areas conceded to 12 companies or groups of companies.

Environmental pollution caused by oil refineries and other industries has led to the passage of laws to control water, air, and solid waste pollution. On December 1, 1970, a first decree implementing the basic frame work law on water pollution (1969) came into effect. About the same time a new law on air polution was passed and a draft law on solid waste disposal was under consideration by the executive branch. The general theme of these laws is to fix the responsibility for pollution abatement costs on the companies and agencies that cause it, although it is generally recognized that such costs will be eventually paid by the consumer. Permission is given to a refinery to start production or for expansion, according to stated policy, only if the authorities are satisfied that the environmental demands can be met. The pollution problem so far has not seriously retarded development plans but the decline of available desirable land has forced refining plants into new areas, such as Zeeland and Limburg provinces.

The Belgian and Netherlands Governments reached agreement on the construction of a pipeline for the supply of crude oil from Rotterdam to Antwerp. A company named the Rotterdam-Antwerpen Pijpleiding (Nederland) N.V. has been set up in Rotterdam to operate the pipeline. Oil companies presently participating in this project are BP, Esso, Chevron, and Mafina (part of the Petrofina concern). Construction of the pipeline was started in May 1970, and it is expected to be put in operation in 1971. The pipeline will have an initial capacity of 24 million tons of crude oil per year and will later be increased to 40 million tons. Total costs of the project, including land purchases, are estimated at almost $27 million.[5]

[4] U.S. Embassy, The Hague, Netherlands. State Department Dispatch, A-84, Mar. 3, 1970; A-96, Mar. 6, 1970; and A-490, Nov. 23, 1970.

[5] U.S. Embassy, The Hague, Netherlands. State Department Dispatch, A-148, Apr. 16, 1971.

The Mineral Industry of New Zealand

By Robert A. Clifton [1]

The value of New Zealand's mineral production increased again in 1970 to $55.15 million,[2] an increase of about 3 percent from 1969. Nonmetallics—sand, rock and gravel, limestone, and clays—dominated the market with nearly two-thirds of the mineral production value. An indication of future trends, however, lies in the fact that metallics have quadrupled their share of the production value since 1968. Value of total mineral production by year is shown in the following tabulation:

Year	Percent			Total value, million dollars [1]
	Metals	Non-metals	Fuels	
1960	2.2	55.2	42.6	55.33
1965	.7	66.4	32.9	65.78
1966	.5	68.0	31.5	69.52
1967	1.0	67.7	31.3	58.89
1968	.8	67.6	31.6	50.99
1969	1.7	67.8	30.5	53.25
1970	3.2	66.8	30.0	55.15

[1] Values for 1968, 1969, and 1970 converted from New Zealand currency devalued November 1967.

New Zealand has been and will remain one of the world's leading farming countries. However, with 90 percent of its exports in pastoral products and its trade primarily oriented to the United Kingdom, economic diversification was being emphasized, particularly with the United Kingdom's pending entry into the European Common Market.

Greater industrialization, as typified by the new steel plant in operation at Glenbrook and the new aluminum smelter nearly operational at Bluff, is a partial answer. The value of manufacturing production has doubled in the last 6 years.

The reassessment of natural resources by the National Development Conference and its Mineral Resources Council have led to the conclusion that the country's mineral wealth may hold the key to providing the economy with massive transfusions in a short time if needed.

[1] Physical chemist, Division of Nonmetallic Minerals.

[2] Unless otherwise indicated, values herein are in U.S. dollars converted from New Zealand dollars at the rate of NZ$1=US$1.12.

Table 1.—New Zealand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Cadmium mine output, metal content [1]	--	11	10
Copper mine output, metal content [2]	50	70	46
Gold mine output, metal content [3] ... troy ounces	8,626	10,717	11,283
Iron and steel:			
Iron ore, gross weight	3,339	1,167	673
Iron sands, gross weight [4]	--	19,170	141,170
Sponge iron ... thousand tons	--	NA	23
Crude steel ... do	68	68	68
Lead mine output, metal content [2]	--	891	766
Silver mine output, metal content [2] ... troy ounces	3,854	21,950	16,428
Tungsten mine output, metal content	19	8	5
Zinc mine output, metal content [1]	--	1,542	1,436
NONMETALS			
Cement, hydraulic ... thousand tons	e 764	803	829
Clays:			
Bentonite	r 3,102	5,630	19,722
Fire	258,759	260,376	256,902
Kaolin (including china clay)	4,729	10,048	11,641
Diatomite	2,066	2,163	5,883
Kauri gum	26	37	25
Magnesite	805	800	484
Perlite	1,870	--	2,032
Pumice	16,577	19,306	19,207
Salt	56,000	49,297	52,793
Sand and gravel:			
Glass sand	84,088	107,485	135,629
Common sand and gravel ... thousand tons	25,810	25,412	27,069
Stone:			
Dolomite	8,246	10,076	10,273
Limestone:			
Agricultural and industrial ... thousand tons	980	1,140	1,283
For cement ... do	1,425	1,494	1,523
Serpentine ... do	88	78	78
Unspecified:			
Crushed ... do	926	2,879	1,339
Dimension	25,457	22,551	19,366
Sulfur	--	--	122
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite ... thousand tons	(5)	--	--
Bituminous ... do	581	488	450
Subbituminous ... do	1,507	1,705	1,746
Lignite ... do	172	171	190
Total ... do	2,260	2,364	2,386
Coke:			
Metallurgical ... do	5	5	6
Gashouse [6] ... do	60	48	36
Fuel briquets ... do	18	NA	17
Gas, natural, marketed production ... million cubic feet	3	2	3,769
Petroleum:			
Crude ... thousand 42-gallon barrels	2	3	467
Refinery products:			
Gasoline ... do	9,825	9,472	10,394
Distillate fuel oil ... do	r 4,883	4,824	5,327
Residual fuel oil ... do	r 4,148	4,458	5,220
Other ... thousand 42-gallon barrels	r 1,411	1,349	1,101
Refinery fuel and losses ... do	r 1,380	1,453	1,588
Total ... do	21,647	21,556	23,630

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 lead-copper concentrate.

4 Average 60 percent iron.

5 Less than ½ unit.

6 Year beginning April 1 of that stated.

TRADE

During 1968-69, New Zealand's exports of mineral commodities increased NZ$2.2 million and imports increased NZ$18.4 million compared with 1967–68. The beginning of iron sands exportation accounted for most of the increase in value of exports.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal destination, 1968–69
METALS			
Aluminum:			
Metal including alloys:			
Scrap	555	1,132	Australia 830; Japan 290; West Germany 6.
Unwrought and semimanufactures	415	469	Japan 200; Australia 153; Philippines 61.
Copper:			
Ore and concentrate	107	10	All to West Germany.
Metal including alloys:			
Scrap	1,194	744	Australia 312; Belgium-Luxembourg 147; West Germany 134.
Unwrought and semimanufactures	3,907	4,434	Japan 1,741; Australia 1,092; West Germany 626.
Gold, refined [2] value	$63,862	$27,010	NA.
Iron and steel:			
Metal:			
Scrap	5,621	5,818	Japan 3,447; Netherlands 1,282; Belgium-Luxembourg 623.
Steel, primary forms	1	16	West Germany 9; American Samoa 6.
Semimanufactures:			
Bars, rods, angles, shapes, sections	1,075	2,653	Fiji 2,317; American Samoa 152; Western Samoa 63.
Universals, plates, and sheets	23	261	Fiji 108; Tonga 64; American Samoa 54.
Hoops and strips	2	39	Japan 35; Australia 4.
Wire	184	392	Hong Kong 319; Fiji 69.
Tubes, pipes and fittings	25	202	Australia 97; American Samoa 45; Fiji 29.
Castings and forgings, rough	62	31	West Germany 10; Australia 9; Hong Kong 7.
Lead:			
Ore and concentrate	780	1,137	All to Japan.
Metal including alloys:			
Scrap	1,030	1,188	Australia 610; Republic of South Africa 446; United Kingdom 60.
Unwrought and semimanufactures	640	363	Australia 291; Italy 39; Republic of South Africa 12.
Nickel, scrap	8	7	Australia 6; United States 1.
Platinum-group and silver ores [2] value	$72,225	$140,243	Australia $80,485; United Kingdom $49,805; West Germany $9,953.
Tin including alloys:			
Scrap long tons	6	17	Australia 10; United Kingdom 7.
Unwrought and semimanufactures do	5	3	United Kingdom 2; Australia 1.
Zinc:			
Ore and concentrate	1,155	1,776	All to Japan.
Metal including alloys:			
Scrap and ash	160	256	Japan 172; Australia 28; Belgium-Luxembourg 18.
Unwrought and semimanufactures	25	10	Australia 8; Fiji 1.
Other:			
Ore and concentrate of base metals, n.e.s	15	63	Australia 21; Canada 20; United Kingdom 15.
Ash and residue containing nonferrous metals [2] value	$253,317	$285,556	United Kingdom $131,844; Australia $78,543; Belgium-Luxembourg $38,363.
NONMETALS			
Asbestos articles and building materials [2] do	$101,269	$229,813	Fiji $153,224; American Samoa $38,166; Western Samoa $18,762.
Cement	951	1,606	Australia 763; New Hebrides 545; British Solomon Island 203.
Clays and products (including all refractory brick):			
Crude n.e.s	168	690	Australia 640; Fiji 35; West Germany 15.
Products [2] value	$75,864	$144,707	Australia $104,031; Fiji $33,618; Tonga $2,832.
Fertilizer materials:			
Crude	1,059	3,103	United Kingdom 2,389; Japan 345; Malaysia 224.
Manufactured:			
Nitrogenous	19	26	Western Samoa 20; French Polynesia 4.
Phosphatic	654	436	Fiji 235; French Polynesia 142; Western Samoa 30.
Potassic	67	35	French Polynesia 15; Western Samoa 10.
Other	11	92	Fiji 81.
Kauri gum	22	30	United States 15; Italy 10.
Lime	3	20	Tonga 12; French Polynesia 5.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal destination, 1968–69
NONMETALS—Continued			
Precious and semiprecious stones, except diamond [2] ... value	$1,033	$442	Australia $250; United Kingdom $114.
Pumice	649	611	Australia 467; Fiji 112; Republic of South Africa 20.
Stone, sand and gravel	284	331	Australia 223; American Samoa 51; Fiji 44.
Stone, monumental [2] ... value	$10,125	$10,820	Fiji $4,706; American Samoa $2,848; Australia $929.
Other	r 18	37	Australia 26; Western Samoa 5; Fiji 5.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	69	221	All to Fiji.
Coal and coke including briquets	37	308	Singapore 221; Fiji 31; Malaysia 30.
Petroleum:			
Crude and partly refined ... 42-gallon barrels	106	--	--
Refinery products:			
Gasoline (including natural) ... do	629	4	All to Pitcairn Island.
Kerosine and jet fuel ... do	6	(3)	NA.
Distillate fuel oil ... do	811,076	875,591	Ships stores 871,831; Fiji 3,065.
Residual fuel oil ... do	1,140,319	1,673,559	Singapore 822,464; Ships stores 605,910; Australia 180,748.
Lubricants ... do	56	581	Ships stores 298; Fiji 185; Tonga 15.
Other ... do	546	4,912	New Caledonia 4,816.

r Revised. NA Not available.
[1] Fiscal period, July 1 through June 30.
[2] Converted from NZ$ at a prorated value of US$1.2327 for 1967–68, and at NZ$1 = US$0.995310 for 1968–69.
[3] Less than ½ unit.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal sources, 1968–69
METALS			
Aluminum:			
Oxides and hydroxides	688	2,752	Japan 2,032; Australia 179; West Germany 150.
Metals and alloys:			
Unwrought	6,899	9,827	Canada 6,135; Australia 1,666; United States 1,065.
Semimanufactures	4,444	5,888	Canada 3,995; Australia 690; United Kingdom 597.
Antimony [2] ... value	$21,368	$39,058	United Kingdom $12,364; Australia $8,898; Belgium-Luxembourg $8,289.
Arsenic, trioxide, pentoxide and acid	143	164	Sweden 134; France 30.
Chromium oxides and hydroxides	88	112	West Germany 58; United Kingdom 32; Australia 16.
Copper including alloys:			
Unwrought	r 193	175	United Kingdom 159; Australia 10.
Semimanufactures	r 10,609	11,075	Australia 8,018; United Kingdom 1,754; Canada 954.
Gold unworked ... troy ounces	7,317	9,728	Australia 6,619; United Kingdom 2,924.
Iron and steel:			
Metal:			
Pig iron including cast iron	5,702	6,552	Australia 6,549; Japan 3.
Sponge iron, powder and shot	493	479	United Kingdom 339; Australia 58; Sweden 57.
Spiegileisen	184	202	All from Republic of South Africa.
Ferroalloys	836	1,708	Republic of South Africa 689; India 478; Norway 296.
Steel, primary forms	54	1,206	Australia 1,072; United Kingdom 95; Austria 35.
Semimanufactures:			
Bars, rods, angles, shapes, sections	115,714	131,575	Australia 107,233; United Kingdom 18,975; Japan 2,969.
Universals, plates and sheets	161,427	227,449	Japan 95,826; United Kingdom 54,655; Australia 43,710.
Hoop and strip	10,369	12,879	United Kingdom 5,208; Japan 3,829; Australia 3,207.
Rails and accessories	13,141	10,322	Australia 6,235; India 3,528; United Kingdom 501.
Wire	17,093	17,434	Australia 7,832; United Kingdom 7,568; Japan 1,619.
Tubes, pipes and fittings	43,165	53,045	United Kingdom 23,713; Australia 15,382; India 9,819.
Castings and forgings, rough	19	83	United Kingdom 80; Australia 3.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal sources, 1968–69
METALS—Continued			
Lead:			
Ore and concentrate	98	230	All from Australia.
Oxides	280	517	Australia 449; United Kingdom 45; France 10.
Metal including alloys:			
Scrap	--	103	All from Australia.
Unwrought	4,461	4,485	Australia 4,414; United Kingdom 61.
Semimanufactures	19	9	United Kingdom 8.
Magnesium unwrought	7	20	United States 18; Norway 2.
Manganese:			
Ore and concentrate	40	103	Norway 90.
Oxides	396	701	United States 460; Japan 142; Australia 83.
Mercury 76-pound flasks	107	75	Spain 41; United Kingdom 29.
Nickel including alloys:			
Unwrought	25	107	United Kingdom 60; Canada 42.
Semimanufactures	r 194	171	United Kingdom 119; Canada 29; Australia 17.
Platinum-group and silver:			
Metal including alloys:			
Platinum-group thousand troy ounces	9	3	Mostly from United Kingdom.
Silver do	1,228	1,884	Australia 1,563; United Kingdom 248.
Tin:			
Oxides long tons	8	15	United Kingdom 12; Australia 2.
Metal including alloys:			
Unwrought do	293	315	Malaysia 208; Australia 85; United Kingdom 20.
Semimanufactures do	14	23	United Kingdom 19; Australia 4.
Titanium oxides	575	1,117	Australia 730; Japan 169; West Germany 108.
Zinc:			
Oxide and peroxide	16	22	West Germany 9; United Kingdom 6; Australia 4.
Metal including alloys:			
Scrap and blue powder	39	64	Australia 42; United Kingdom 17; United States 5.
Unwrought	3,635	9,655	Australia 9,452; Canada 152; United Kingdom 31.
Semimanufactures	558	503	Australia 279; United Kingdom 187; West Germany 27.
Other:			
Ore and concentrate	389	410	Australia 386; Japan 15.
Ashes and residues containing nonferrous metals	4	8	All from Australia.
Oxides, hydroxides and peroxides of metals, n.e.s	48	120	United Kingdom 69; United States 20; Australia 18.
NONMETALS			
Asbestos	5,946	5,853	Canada 4,315; Republic of South Africa 1,183; United States 141.
Barite	873	1,578	Australia 977; West Germany 477; United Kingdom 66.
Cement	2,927	145	United Kingdom 77; Japan 53; West Germany 9.
Chalk	1,048	998	France 519; United Kingdom 326; Belgium-Luxembourg 86.
Clays and products:			
Crude n.e.s.:			
Fuller's earth, chinas, chamotte	180	366	United Kingdom 315; United States 32.
Kaolin (china clay)	2,452	3,906	United States 3,176; United Kingdom 659; Australia 66.
Other	2,241	3,662	United States 1,311; Republic of South Africa 1,009; United Kingdom 797.
Products, refractory (including nonclay bricks)	475	486	United Kingdom 416; Australia 39; United States 23.
Cryolite and chiolite	9	27	Denmark 20; Australia 6.
Diamond:			
Gem not set or strung [2] value, thousands	$408	$1,268	Republic of South Africa $831; United Kingdom $300; Belgium-Luxembourg $81.
Industrial [2] do	$47	$32	Republic of South Africa $26; United Kingdom $6.
Diatomite and other infusorial earths	884	1,015	United States 988; Australia 12.
Feldspar, fluorspar, and nepheline syenite	1,406	1,979	Sweden 1,479; Norway 257; United Kingdom 128.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1967–68	1968–69	Principal Sources, 1968–69
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	747	1,075	Chile 569; United Kingdom 506.
Phosphatic ------ thousand tons	886	1,036	Nauru 574; Gilbert Islands 169; Australia 160.
Other	21	1	All from Norway.
Manufactured:			
Nitrogenous	19,903	29,435	Japan 14,449; West Germany 11,882; United Kingdom 1,301.
Phosphatic including basic slag	22,115	10,644	Belgium-Luxembourg 5,688; United States 4,729.
Potassic	120,487	154,301	Canada 109,450; U.S.S.R. 21,294; United States 14,338.
Graphite, natural	131	101	United Kingdom 49; Australia 15; mainland China 14.
Gypsum and plasters	89,021	96,583	Australia 95,770; West Germany 643.
Lime	303	297	United Kingdom 291; France 6.
Magnesite	r 403	307	Mainland China 117; India 115; Australia 61.
Pigments, minerals including processed iron oxide	643	914	West Germany 404; United Kingdom 277; Austria 105.
Precious and semiprecious stones, except diamond [2] ------ value, thousands	$51	$421	Australia $217; West Germany $91; India $48.
Salt and brines	45,769	36,025	United Kingdom 28,157; Australia 6,296; West Germany 572.
Sodium and potassium compounds, n.e.s.	7,490	7,000	United Kingdom 2,554; Netherlands 2,213; Australia 894.
Stone, sand and gravel:			
Dimension stone	816	1,599	Republic of South Africa 297; Sweden 138; Italy 124.
Gravel and crushed rock	64	137	Italy 82; United Kingdom 45; France 10.
Limestone	9	12	All from United Kingdom.
Quartz and quartzite	1,249	1,487	Belgium-Luxembourg 1,067; Australia 212; Japan 151.
Sand excluding metal bearing	382	272	Australia 250; United Kingdom 21.
Sulfur, elemental, all forms	169,097	160,273	Canada 105,434; United States 54,308; United Kingdom 213.
Talc, steatite, soapstone, and pyrophyllite	1,429	1,677	Australia 1,390; mainland China 118; United States 96.
MINERAL FUELS AND RELATED MATERIALS			
Bitumen, natural	213	295	Trinidad and Tobago 264; United States 26.
Carbon, black and gas	3,889	5,475	Australia 3,636; United States 1,424; United Kingdom 344.
Coal and coke including briquets	5,151	41	United Kingdom 23; United States 17.
Gas hydrocarbon [2] ------ value, thousands	$94	$123	Australia $64; United States $58.
Peat including peat briquets and litter	12	22	United Kingdom 18; Ireland 4.
Petroleum:			
Crude and partly refined ------ thousand 42-gallon barrels	r 19,293	21,282	Kuwait 10,866; United States 1,424; United Kingdom 344.
Refinery products:			
Gasoline ------ do	2,036	1,855	Southern Yemen 529; Australia 452; Iran 337.
Kerosine and jet fuel ------ do	1,196	1,538	Australia 742; Iran 323; Southern Yemen 242.
Distillate fuel oil ------ do	903	1,229	Australia 794; Bahrain 125; Singapore 100.
Residual fuel oil ------ do	--	2	All from Australia.
Lubricants [2] ------ value, thousands	$5,064	$4,407	Australia $1,854; United States $1,371; United Kingdom $1,102.
Mineral jelly and wax [2] ------ do	$546	$528	United States $249; India $96; Indonesia $81.
Other [2] ------ do	$1,221	$1,690	United States $894; Australia $330; United Kingdom $180.
Mineral tar from coal, petroleum or gas ------ thousand 42-gallon barrels	21	30	United States 28; Australia 2.

r Revised.
[1] Fiscal period, July 1 through June 30.
[2] Converted from NZ$ at a prorated value of US$1.2327 for 1967–68, and at NZ$1 = US$0.995310 for 68–69.

COMMODITY REVIEW

METALS

Aluminum.—Construction on the Bluff smelter was proceeding, and startup was forecast for spring 1971. The planned expansion may be delayed by environmentalists' objections to enlargement of Lake Manapouri that an increased electrical energy demand would necessitate. Alumina feed for the smelter would come from the Gladstone refinery in Queensland, Australia.

Iron and Steel.—The large titanium-containing iron sand reserves of the North Island are beginning to pay off. Production has begun at Waikato where New Zealand Steel Ltd. is mining and concentrating the ore for export to Japan and for internal use at its new Glenbrook steel mill. The deposit at Waipipi-Waverly will be mined, concentrated, and exported by Waipipi Ironsands Ltd. With Japanese contracts in hand, the establishment of mining, concentrating, and shiploading facilities at Waipipi was well under way at yearend.

Magnetic separation and concentration of the titano-magnetite is relatively simple and produces a concentrate of 60-percent Fe and 8-percent TiO_2. For domestic steel production this concentrate is pelletized and prereduced, 20- to 25-percent scrap added, and melted in an electric furnace.

Platinum.—The platinum discovered at Kerikeri, North Auckland, by the Georgia Kaolin Co. has been described, on the basis of limited testing, as being of somewhat higher grade than the South African ore. The sulfide deposits contain platinum, gold, silver, and other minerals in a very unusual occurrence.

Silver.—A pilot concentrating plant was built by the Consolidated Silver Mining Co. of New Zealand, Ltd., near Thames to treat ore from three mines, which were being reopened after more than 30 years. The mines were being extended downward.

Titanium.—The ilmenite sands of the West Coast of South Island have continued to draw interest. At least two companies in separate areas are defining reserves and continuing studies into the best method to produce a high-titania product from the concentrates.

NONMETALS

Clays.—The bentonite deposits at Coalgate are in full production. Lime and Marble Ltd., of Nelson, has spent $400,000 developing the deposit and setting up a processing plant. Initial plant capacity of 25,000 tons per year can be tripled if the market materializes.

The $750,000 pilot plant that Georgia Kaolin Co. is using to study the feasibility of a multimillion-dollar clays plant for New Zealand China Clays Ltd. at Kerikeri is still operational. New Zealand China Clays Ltd. said that the study was to be completed late in 1971.

Sulfur.—Cyminex Corp. has suggested a novel method of recovering the sulfur from its Rotokaua thermal lake find. It would use the geothermal hot water and steam abundantly available nearby to power a Frasch-process recovery system.

MINERAL FUELS

Coal.—Coal production remained virtually static with less than a 1-percent increase in production. The new markets gained at the Glenbrook steel mill and the Meremere Power Station were offset by losses elsewhere. At present the steel mill is using 25 tons per hour of Huntley coal from Weaver mine. This subbituminous coal is remarkably ash-free, has a high-carbon content, and is described by the makers of the Stelco-Lurgi kiln at Glenbrook as the best they have tested for the production of prereduced pellets of iron ore.

Petroleum and Natural Gas.—In 1970 the completion of pipelines, a separation plant, and other necessary projects made the Kapuni gas-condensate field a truly commercial operation. Condensate was being piped from the separation plant to a tank farm at Paritutu, New Plymouth, and transported by tanker from there to the refinery at Whangerei. The Natural Gas Corporation of New Zealand began to receive pipeline gas under contract. The Kapuni mining license has a span of 42 years and covers 56 square miles.

A total of 10 wells were drilled during 1970. Of the seven offshore and three onshore, only one was deemed productive. This was in the Maui field. A feasibility study on production from this field was started by the Shell Oil Co., British Petroleum (BP), and Todd Oil Services Ltd., and negotiations with the Government began on prices to be paid for natural gas from this field. At the end of the year petroleum prospecting licenses (329 in number) covered 53,814 square miles of land and territorial sea to the 3-mile limit. An additional 32 licenses covered 381,922 square miles of the Continental Shelf.

The Mineral Industry of Nigeria

By John R. Lewis [1]

Much progress was made in 1970 toward rebuilding and reintegrating Nigeria's economy after the damage created by the civil war. Cost to Nigeria of the war, which formally ended on January 15, 1970, was put at well over $840 million [2] by Nigeria's Federal Finance Commissioner. The postwar rehabilitation activity, plus an increase in the money supply which was created by continued deficit financing by the Government, engendered persistent increases in general price levels. Population in 1970 was 56.5 million, 24 percent urban, and growing at an annual rate of 2.8 percent.[3] In 1966, the last full year before the outbreak of hostilities, the gross national product (GNP) was $5.45 billion with a per capita GNP of $125. During the war years, the diminished economic vigor caused a drop in GNP to $4.8 billion and to $88 per capita by 1969. In 1969, the mining and petroleum industry contributed about 5 percent to Nigeria's GNP.

After dwindling to about 500,000 barrels per day at the height of the war, exports of crude petroleum climbed to 1 million barrels per day by April 1970. This increase was responsible for much of the country's export surplus as Nigeria rapidly moved up among the world's crude oil exporting nations. It was expected that daily crude output would be 2 million barrels per day by sometime in 1971.

After holding fifth place among the world's tin-producing nations for a number of years, Nigeria relinquished this position in 1970 to Australia. Annual tin ore production dropped to slightly more than 7,800 long tons compared with Australia's 8,800 tons, and at the 7,800-ton rate, the country was furnishing about 4.3 percent of the free world's tin ore, much of which was smelted in Nigeria.

This West African nation remained the free world's third leading producer of columbite, used in the making of stainless steel. Columbite is produced as a coproduct of tin ore mining.

Government Policies and Programs.—Nigeria launched her second national development plan, covering the period from 1970 to 1974, on November 11, 1970. In hopes of raising national incomes by an average annual rate of 7 percent, the plan envisaged an outlay of $4,480 million by the Government sector plus an additional $2,240 million investment by the private sector. A national prospecting and mining company was to be established as a part of the plan, but such action did not materialize during 1970. It was held most likely that at its inception the mining corporation would be limited to the management of Government shares in privately owned mining ventures, and that actual mining activities would be initiated in the future. One main objective will be the immediate utilization of known and commercially viable resources, within the bounds of economic exploitation practices. In view of the strategic role that oil will play in the nation's economy, more direct government involvment is planned. During the new plan, the Government will participate in exploration, drilling, refining, distribution, and marketing. A national oil corporation and associated publicly owned corporations were to be established for this purpose.

The improvement of Nigeria's railroads, port facilities, and highways will command particular attention in the plan, and should result in better flow of all trade, including minerals except crude petroleum, most of which moves by pipeline or water.

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[1] Physical scientist, Division of Nonferrous Metals.

[2] When necessary, values have been converted from Nigerian Pounds (N£) to U.S. dollars at the rate of N£1=US$2.80.

[3] Agency for International Development. Economic Data Book. Revision No. 257, April 1971, p. 5.

PRODUCTION

Petroleum production, both crude and refined, increased greatly in 1970. Other mineral production generally showed varying mild degrees of recovery when compared with levels of 1966, the last full year of operation before the civil war. Two commodities, both important in Nigeria's export trade, however, fell short. Tin concentrate production was 16 percent below that of 1966, and coal, which is produced mainly in the Eastern Region where much of the civil war fighting took place, was only able to muster about 5 percent of its 1966 output. Although coal production was up one-third in 1970 over 1969, demand for Nigerian coal has been so markedly reduced that it appears quite unlikely that production of coal for domestic consumption or for export will resume the pace of 1966 for quite some time.

Table 1.—Nigeria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Columbium and tantalum:			
Columbite concentrate	1,147	1,515	1,617
Tantalite concentrate	11	6	4
Gold ... troy ounces	215	298	123
Rare-earth metals, monazite concentrate	[e] 6	13	[e] 10
Tin:			
Mine output, cassiterite concentrate:			
Gross weight ... long tons	13,031	11,630	9,759
Tin content ... do	[r] 9,649	8,603	7,833
Smelter ... do	[r] 9,843	8,839	7,283
NONMETALS			
Cement ... thousand tons	574	566	596
Clays, kaolin	237	469	579
Stone:			
Limestone ... thousand tons	647	691	678
Marble	175	1,168	1,098
Salt	831	6	NA
MINERAL FUELS AND RELATED MATERIALS			
Coal	(2)	15,854	35,798
Gas, natural:			
Gross production ... million cubic feet	51,628	145,714	285,804
Marketed production ... do	5,190	2,252	3,920
Petroleum:			
Crude ... thousand 42-gallon barrels	51,907	197,204	395,836
Refinery products:			
Gasoline ... do	-------	-------	1,848
Kerosine ... do	-------	-------	1,166
Distillate fuel oil ... do	-------	-------	1,718
Residual fuel oil ... do	-------	-------	2,317
Liquefied petroleum gas ... do	-------	-------	13
Refinery fuel and losses ... do	-------	-------	338
Total ... do	-------	-------	7,400

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] In addition to the commodities listed, a variety of crude construction materials are also presumably produced, but available information is inadequate to make reliable estimates of output levels.
[2] Revised to none.

TRADE

As the war began to lose momentum near the end of 1969, changes were occurring in Nigeria's mineral commodity trade situation. Exports of all mineral commodities were up 190 percent over those of 1968. Petroleum was responsible for most of this improvement. Crude from noncombat coastal areas plus vastly increased output from offshore concessions, mostly exported to the United Kingdom, showed a gain of 283 percent over 1968. Tin, Nigeria's second largest mineral export commodity, showed a small increase in value, owing to firmer 1969 price levels. Tonnages of tin exported in 1969 were actually down about 10 percent. Although tonnages and values were not large, the value of all metallic scrap exported in 1969 was almost double that of 1968. Exports of minerals in 1969 were 47 percent of Nigeria's total export trade, up from 25 percent a year earlier, due mainly to petroleum export increases.

Mineral imports rose mildly in 1969, owing to the desperate need for iron and steel and some construction materials. The increase was tempered by downtrending petroleum products imports including jet fuel and the middle distillates. Severe controls continued to throttle all but the most strategic imports. Mineral imports were 19.4 percent of all trade in 1968 but were 18.1 percent in 1969. The trend continued in 1970.[4]

Earnings from all exports, including reexports, hit a new high of $1,240 million, or about 37 percent higher than for the previous year. Total imports, meanwhile, increased in 1970 to $1,082 million, leaving a 24 percent decrease in Nigeria's trade surplus ($209 million in 1969 compared with $158.5 million in 1970). Again in 1970, it was the shipment of crude oil that accounted for most of Nigeria's export increase.

A surge in imports to record levels was widely spread over all commodity sections, except for reduced imports of mineral fuels and lubricants because of the reopening of the Port Harcourt refinery.

Total foreign trade compared with mineral trade for 1967-69 follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1967	246	680
1968	147	r 587
1969	424	r 905
Imports:		
1967	91	626
1968	105	541
1969	r 126	696

r Revised.

Import licensing was eased in 1970 so that mining enterprises could bring in at more reasonable duties what was needed in the way of machinery, raw materials, and spare parts.

[4] Standard Bank Limited, London. Annual Economic Review, Nigeria. June 1971, 24 pp.

Table 2.—Nigeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Columbite ore and concentrate	1,371	r 1,339	United Kingdom 617; Netherlands 281; Japan 216.
Iron and steel:			
Scrap	7,528	r 20,502	Belgium-Luxembourg 10,232; United Kingdom 6,068; Italy 1,700.
Semimanufactures	56	7	All to Congo (Kinshasa).
Lead ore and concentrate	52	(1)	
Nickel and worked-nickel alloys	NA	163	All to Niger.
Tantalum including alloys, all forms	16	17	United Kingdom 10; United States 5; Netherlands 2.
Tin:			
Ore and concentrate ---- long tons	1,151	4	All to United Kingdom.
Metal and unwrought alloys ---- do	11,280	10,110	United Kingdom 8,108; West Germany 711; United States 610.
Zinc ore and concentrate	------	43	All to United Kingdom.
Other nonferrous base metals: [2]			
Ore and concentrate	772	1,110	Netherlands 597; United States 499; Belgium-Luxembourg 12.
Scrap	1,662	r 2,414	West Germany 1,282; Netherlands 255; Italy 162.
NONMETALS			
Cement	(2)	51	All to Cameroon.
Fertilizers (crude)	r 345	233	Ghana 178; Ivory Coast 23; Togo 13.
Building materials	24	-----	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	18	r 1,048	Togo 1,032.
Gas, hydrocarbon ---- value only	$1,955	$904	NA.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 51,969	r 198,962	United Kingdom 44, 279; United States 34,776; Netherlands 28,923.
Refinery products:			
Gasoline (including natural) ---- do	r 62	1	Mainly to Niger.
Kerosine and jet fuel ---- do	r 37	(3)	NA.
Distillate fuels ---- do	r 50	(3)	NA.
Residual fuel oil ---- do	r 8	21	Ships' stores 13; Dahomey 3; Senegal 2.
Lubricants ---- do	r 14	r 13	NA.
Other ---- do	r 1	(3)	NA.

r Revised NA Not available.

[1] Less than ½ unit.

[2] Includes copper, zirconium, and others.

[3] Unspecified quantity valued as follows: Kerosine and jet fuel (1969) $103; distillate fuels (1969) $20; others (1969) $9,984.

Table 3.—Nigeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	2,974	r 4,691
Copper including alloys, all forms	1,208	894
Iron and steel:		
Scrap	78	------
Pig iron, ferroalloys, and similar materials	599	754
Steel, primary	2,336	r 8,286
Bars, rods, angles, shapes, and sections	61,804	78,001
Universals, plates and sheets	68,783	100,876
Hoops and strips	4,076	6,370
Rails and accessories	159	311
Wire	3,762	4,557
Tubes, pipes and fittings	91,673	135,287
Castings and forgings, rough	178	674
Lead including alloys, all forms	371	908
Nickel including alloys, all forms	16	12
Platinum including alloys, all forms ... troy ounces	2,117	r 2,985
Silver including alloys, all forms ... do	1,368	13,186
Tin including alloys, all forms ... long tons	90	r 451
Zinc including alloys, all forms	1,728	r 6,271
Other:		
Ore and concentrate of base metals, n.e.s	16	519
Nonferrous metal scrap	199	245
Oxides, hydroxides, peroxides of metals, n.e.s	524	901
Miscellaneous base metals (nonferrous), all forms	3	r 19
NONMETALS		
Abrasives:		
Natural, including industrial diamonds	44	125
Grinding and polishing wheels and stones	126	118
Asbestos (crude washed or ground, including wastes)	15,277	20,358
Cement	91,521	104,531
Clay construction materials and refractory construction materials	8,021	9,467
Fertilizers:		
Crude	204	2,136
Manufactured:		
Nitrogenous	r 12,922	4,251
Phosphatic	24,348	26,512
Potassic	198	r 464
Others, n.e.s	1,722	11,980
Ammonia	272	453
Lime	5,720	7,713
Mica, all forms	13	146
Salt	129,833	140,153
Sodium and potassium compounds, n.e.s., caustic soda and hydroxide	12,340	r 13,632
Stone, sand and gravel	18,266	25,370
Sulfur, all forms	257	118
Other n.e.s	6,099	3,233
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	49,296	r 79,114
Coal and coke including briquets	2,308	5,014
Petroleum and refinery products:		
Gasoline ... thousand 42-gallon barrels	r 2,414	r 3,005
Kerosine, jet fuel and white spirit ... do	1,523	r 1,078
Distillate fuels ... do	2,475	r 2,430
Residual fuels ... do	r 1,744	r 2,263
Lubricants ... do	169	r 231
Other:		
Special purpose oils ... do	2	12
Pitch petroleum asphalt and bituminous emulsions	12,606	14,306
Mineral tar and other coal-petroleum or gas derived crude chemicals	8,432	618

r Revised.

COMMODITY REVIEW

METALS

Nigeria and the Soviet Union signed an agreement in Lagos on October 16, 1970, under which Soviet experts will reportedly make large-scale aeromagnetic surveys and investigate miscellaneous ground prospects for metallurgical raw materials, including coking coal. The period of the agreement was said to be 5 years.

Tin.—Nigeria's tin is mined on the Jos Plateau in the northern area by slightly more than 100 mining companies, four or five of which are large and one of which, Amalgamated Tin Mines of Nigeria, Ltd., produces about half of Nigeria's total output of cassiterite. About 50,000 persons are employed in tin production.

In 1970, the world supply and demand for tin was approximately in balance, and many of Nigeria's tin producers expressed concern over the postwar situation under which they were encountering high costs and reduced production. Exchange control and import restrictions by the Government, coupled with selective and increased tax rates, were hampering development. The increasing coproduct production of columbite, at least in some operations, seemed to be the financial windfall necessary to maintain operation. Problems of the major tin-mining companies, not the least of which were dwindling reserves, were shared by all companies in varying degrees. For some, mine working costs had doubled between 1960 and 1969 while profits had nearly halved. For some of the smaller companies, even the contribution to the buffer stock of the International Tin Council (ITC) represented a heavy drain upon cash resources. The depletion of known ore deposits near the surface and the lack of investment in larger equipment (especially earth movers) needed to mine the deeper ore were blamed for the declining Nigerian tin output. Ore veins were being worked so far below the surface that smaller companies could not afford their exploitation. On the other hand, some industry experts in Nigeria feel that there is still a large reserve of cassiterite in the Jos Plateau but that the deeper veins will require more sophisticated techniques than are presently being employed.

Meanwhile, the Makeri Tin Smelter at Jos (owned by Consolidated Tin Smelter, Ltd., London), continued to perform well despite the 15-percent reduction in throughput to only 7,400 tons, made necessary by declining markets.

Uranium.—Nuclear Mining & Exploration Co. signed an agreement early in 1970 with the Nigerian Government for a uranium-centered exploration program that included vanadium, thorium, and other radioactive minerals which may exist in the 225-square-mile area between the towns of Kano and Sokoto, in northern Nigeria. Concession area limits and acreage were not available.[5] Another similar action that was completed during the year involved licensing a foreign firm to explore for uranium in the North-Eastern State.[6]

NONMETALS

Cement.—The lack of properly trained technicians has traditionally been a problem for the Nigerian cement industry. Expatriates frequently have been employed. A training center and apprentices' hostel have been established, at a cost of $224,000 at Ewekoro, Western State, by the West African Portland Cement Co., Ltd. Apprentices, who are Nigerian nationals on a 4-year regimen, are now at their studies, which are designed to provide electrical, mechanical, automotive, and instrumentation craftmen for the industry. West African Cement's plant at Ewekoro is one of Nigeria's largest cement plants. Its capacity was 600,000 tons per year in 1970, but when present expansion plans are completed, output is expected to increase to 800,000 tons annually. In 1970 production was close to the plant's capacity.

Clays.—*Kaolin.*—Nigeria's Federal Institute of Industrial Research recommended the establishment of two kaolin-processing plants within the country. Nigeria imports its requirements at present, although investigation has indicated that domestic kaolin would prove satisfactory for local pulp, paper, rubber, paint, ceramic, and insecticide makers. Sites named for the two plants were Jos, in Benue Plateau State, and either Abeokuta or Pategi near the coastal industrial areas. Domestic white kaolin will satisfy the estimated annual consumption of from 6,625 to 7,000 tons, Nigerian sources indicated, and an annual demand of 7,000 tons was projected for the early 1970's.

MINERAL FUELS

Coal.—Railway dieselization and development of hydroelectricity in postwar Nigeria was sharply curtailing demand for coal, and unless satisfactory coking coal could be found for the developing iron and steel industry, it appeared that the nation's coal output will stabilize at around the 250,000-ton level annually after having been at the 640,000-ton level in 1966. Nigeria's best mines are centered around Enugu in East-Central State and were closed and flooded during the war, which created severe financial strains upon the owners, the Nigerian Coal Corp. (NCC) as they sought to resume operations in 1970. The Federal Military Government granted NCC $5.6 million to enable the corporation to reorganize its disrupted operations.

[5] Engineering and Mining Journal. V. 171, No. 3, March 1970, p. 246.

[6] Nigeria Trade Journal. V. 18, No. 2, April–June 1970, p. 54.

NCC also began vigorously to seek new uses and customers for Nigerian coal, but planned to open only one of the four mines at Enugu and rehire only a small fraction of the more than 4,400 workers formerly employed.

Petroleum.—Postwar recovery by Nigeria's petroleum industry, particularly in the crude-producing sector, was more rapid in 1970 than even the most optimistic of forecasts. Each month produced a new high in production as new onshore and offshore wells were drilled, old war-damaged onshore wells were rehabilitated, and transportation and storage facilities were improved. Final 1970 data showed total crude production of 395,836,000 barrels, which was an average of 1,084,482 barrels per day. This was an increase of 100.8 percent over the 1969 daily average of 540,284 barrels. The momentum was expected to carry well into 1971, about to the 2-million-barrel-daily mark before leveling off began. Even at the 1970 rate, Nigeria's output was sufficient to move her into 10th place among world oil-producing nations (edging out Algeria), and since most of the crude was exported, the added income did much to assist economic recovery. Nigerian crude is high gravity, low in sulfur, and geographically located so as to make it attractive to the European and North American markets.

The successful restoration of the petroleum industry's vigor in Nigeria was the result of careful study and planning, some of it undertaken even before, but most of it during, the crisis. As soon as feasible after hostilities ceased, experts were sent into the secessionist areas, where most of the onshore production was then located, to assess damage to wells and other field installations, and to arrange for rehabilitation. There were indications that the Government of Nigeria would take over a 35-percent participating interest in Safrap (Nigeria) Ltd., an affiliate of the French national petroleum company, Enterprise de Recherches et d'Activités Pétrolières (ERAP). It was expected that this interest would eventually increase to 50 percent.

The Shell-BP Petroleum Development Company of Nigeria, Ltd. (Shell-BP) Port Harcourt Refinery went back into limited operation in May 1970. Throughput increased almost weekly until, by yearend, it was close to 40,000 barrels per day. Rated capacity at the time was 46,000 barrels of oil per day. Cost to rehabilitate was $7.2 million. Domestic petroleum products generally were sold within Nigeria, which reduced the need to import motor and diesel fuel and other products and also had a favorable effect upon Nigeria's foreign exchange. An even better situation was expected during 1971. To meet domestic demand, a second refinery, near Lagos, was under proposals by Shell-BP and a consortium of Texaco Nigeria, Ltd.; Mobil Exploration Nigeria, Ltd.; Nigerian Agip Oil Co., Ltd.; and Total Nigeria, Ltd. The forecast need for a second refinery was expected to be urgent by 1973–74, and funds were projected in the Development Plan, with some possibility that petrochemical facilities would be included.

Only about 35 of the 115 fields discovered in Nigeria by the end of 1970 were in production, because of construction problems involved in developing auxiliary facilities. The majority of the fields were one-well, shut-in discoveries, waiting for pipeline connections and further development.

By September 1970, a large number of companies[7] were engaged in negotiating, exploring, or developing the country's petroleum resources. Front runner was Shell-BP, which had numerous seismograph parties in the field during the year, was very active in its drilling-development and gathering-systems program, and was building or completing two swamp area pipeline systems feeding into new or enlarged coastal terminals. At yearend, Shell-BP was producing 994,000 barrels per day. Nigerian Gulf Oil Co., Ltd., was also very active, mainly in the offshore areas which it had been able to develop during the war and where, in April, it drilled into a 416-foot-thick pay section of a new field, the Isan, about 10 miles farther north than any previous Nigerian offshore oil had been found. Nigerian Gulf also was pro-

[7] Nigerian AGIP Oil Co., Ltd. (AGIP) (50 percent Phillips Petroleum Co., Nigeria); Delta Oil (Nigeria), Ltd.; Great Basins Petroleum Co. (Nigeria) Ltd.; Nigerian Gulf Oil Co., Ltd.; Mobil Exploration Nigeria, Ltd.; Phillips Petroleum Co.; SAFRAP (Nigeria), Ltd.; Tenneco Oil Company of Nigeria, Inc., (25 percent Sun Oil Co.); Shell-BP Petroleum Development Co. of Nigeria, Ltd. (Shell-BP); Union Oil Company of Nigeria; Texaco Overseas (Nigeria) Petroleum Co.; Chevron Oil Co. (Nigeria); Japan Oil (a consortium of Mitsui, Teijin, and Teikoku); Deminex of West Germany; Monsanto Co. (including Nigerian Oil Resources Co., Ltd.); Henry Stephens and Sons, Ltd., of Nigeria with Westates Petroleum Co. of the United States; and Occidental Petroleum Corp.

ceeding with development of its five established offshore fields from which, in December 1970, it produced a total of 265,012 barrels of crude per day.

Mobil became Nigeria's second offshore producer during March 1970 when production from three offshore finds was piped to a common gathering point and exported. Mobil and Texaco were using moored tankers as field gathering tanks pending the completion of onshore storage facilities. American Overseas Petroleum Ltd. (AMOSEAS), held jointly by Texaco Inc. and Standard Oil Company of California, began production in March 1970 from their offshore Pennington field, and output approximated 1,200 barrels per day by yearend.

Union Oil of Nigeria's concessions offshore from Lagos and the Western States were tested during 1970 without success, and the company was considering relinquishing its rights after three dry holes.

Meanwhile, onshore operations also were moving forward. Two new fields in the East Central State began production toward the end of the year, when Phillips and Agip (the operator) started producing at their Ebocha and Mbede fields at a combined rate of 34,000 barrels per day. One seismograph crew was also in the field for Agip, and there were four drilling rigs working in the highly promising area. Other companies which had made discoveries in earlier years were still unable to produce owing to the lack of gathering or trunk pipelines. These bottlenecks, however, were rapidly being eliminated at yearend.

In August, five companies or consortia were granted provisional rights on previously relinquished offshore concessions. Negotiations between the Government and the groups continued without definite results by yearend, but greater Government participation in profits realized from development of these concessions was known to be a major factor in the bargaining. A government policy ensuring greater Nigerian private or public interest in new oil ventures appeared to be emerging. Recognizing the emerging influence of petroleum on the nation's economy, the Ministry of Mines and Power reconstituted its Petroleum Division into the Department of Petroleum Resources during midyear 1970 and planned on a comprehensive increase in the size of its staff. No target date for completion of the reorganization was available, however, and the new unit remains under the Ministry.

Widespread flaring of natural gas in Nigeria has attracted the attention of several substantial companies interested in exporting liquefied natural gas (LNG). Shell-BP had proposed such a scheme to the Government, which would export LNG to the U.S. East Coast, but no final disposition had been made as the year ended.

The Mineral Industry of Norway

By F. L. Klinger [1]

Norway's mineral industry continued to grow on many fronts in 1970 despite static conditions in some sectors and declines in production and exports in others. Shortages of hydroelectric power caused temporary cutbacks in production of several metals and chemicals. Lower market prices for sulfur and copper appeared to depress Norwegian output of pyrite and byproduct copper and zinc concentrates, but several new mines were being developed, particularly in the far north. Sharp declines in production and exports of ferroalloys and in exports of aluminum were partly responsible for a substantial deficit in mineral commodity trade, but production capacity for these metals continued to increase. There was record production of such diverse commodities as iron ore, cement, ilmenite, nepheline syenite, steel, nonferrous metals, and petroleum products. The variety of investment projects, in exploration as well as in mines and processing plants, was encouraging.

Oil and gas explorations in the Norwegian sector of the North Sea were particularly successful in 1970. The existence of a major oilfield (Ekofisk) 185 miles southwest of Stavanger was confirmed. Additional discoveries were reported south, west, and north of this oil-bearing structure, and the northern discovery appeared to be especially promising. A fourth deposit was discovered 175 miles farther north.

PRODUCTION

Volume indices of production for various branches of the mineral industry in 1968–1970 are given in the following tabulation. Most of the indices for 1968 and 1969 are revised.

[1] Physical scientist, Division of Ferrous Metals.

Industry sector	1961 = 100		
	1968	1969	1970
Mining and quarrying:			
Coal mines	97	116	138
Metal mines	197	216	232
Mineral quarries	129	145	141
Stone, sand and gravel	191	225	226
Mineral processing:			
Primary metals	179	193	196
Nonmetallic mineral manufacturing	142	151	155
Coal and petroleum	187	200	221
Chemicals	161	169	173
All mining and quarrying	176	201	211
All industry	145	153	159

Source: Statistisk Sentralbyrå (Oslo). Statistisk Månedshefte (Monthly Bulletin of Statistics), No. 2, 1971, pp. 17–18.

Table 1.—Norway: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
METALS			
Aluminum:			
Alumina [e]	17,000	11,000	2,500
Metal ingots:			
Primary	468,299	507,943	530,167
Secondary	13,051	17,758	NA
Superpure [e]	3,000	3,000	3,000
Cadmium	87	90	[e] 95
Cobalt	643	735	782
Copper:			
Mine output, metal content:			
In copper concentrate	9,890	13,886	12,948
In cupriferous pyrite	6,886	7,258	6,999
Total	16,776	21,144	19,947
Metal:			
Primary:			
Blister	23,583	27,890	32,092
Refined	18,160	22,063	25,806
Secondary	11,029	12,005	NA
Iron and steel:			
Iron ore and concentrate ... thousand tons	3,704	3,854	4,006
Roasted pyrite ... do	113	161	[e] 155
Pig iron ... do	674	682	678
Ferroalloys:			
Ferrosilicon (45-percent basis) ... do	356	353	222
Ferromanganese ... do	170	209	331 (Ferromanganese, Ferrosilicomanganese and Other combined)
Ferrosilicomanganese ... do	142	147	
Other ... do	47	51	
Total ... do	715	760	553
Crude steel ... do	812	849	870
Semimanufactures:			
Rolled products ... do	[r] 647	607	NA
Wire uncoated ... do	47	NA	NA
Lead mine output, metal content	3,531	3,513	[e] 3,150
Magnesium, primary	31,286	31,146	35,343
Molybdenum mine output, metal content	221	288	251
Nickel:			
Mine output, metal content	225	248	[e] 325
Metal, primary	32,172	35,601	38,478
Platinum-group metals (exports) ... troy ounces	21,670	20,544	19,805
Selenium, elemental [e]	18	22	26
Silicon, elemental (exports)	18,387	26,243	26,330
Titanium:			
Ilmenite concentrate	402,215	490,738	578,960
Dioxide [e]	15,000	17,000	17,000
Vanadium mine output, metal content [e]	[r] 940	1,010	1,080
Zinc:			
Mine output, metal content	11,841	11,188	[e] 10,570
Metal, primary	60,110	58,775	61,420
NONMETALS			
Cement, hydraulic ... thousand tons	2,297	2,492	2,635
Feldspar:			
Lump	132,686	128,056	[e] 130,000
Ground and other	26,875	[e] 45,000	[e] 55,000
Fertilizer materials manufactured:			
Nitrogen (total) ... thousand tons	459	527	519
Nitrogenous:			
Ammonia ... do	568	590	NA
Fertilizers, gross weight ... do	1,091	1,141	NA
Phosphatic ... do	18	1	NA
Compound and other ... do	[r] 681	735	NA
Graphite	8,271	9,320	[e] 9,000
Lime (quicklime and hydrated lime)	[r] 223,345	212,319	[e] 215,000
Mica (exports)	4,814	3,807	4,306
Olivine	89,300	121,100	[e] 120,000
Pyrite and pyrrhotite (including cupreous):			
Gross weight	692,585	766,607	747,044
Sulfur content	314,338	351,559	[e] 418,000
Quartz and quartzite unground	538,070	628,661	NA

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
NONMETALS—Continued			
Stone, sand and gravel, n.e.s.:			
Dimension stone:			
Granite	135,990	NA	NA
Marble	41,430	NA	NA
Syenite (labrador)	41,917	54,557	e 55,000
Slate thousand square meters	280	401	NA
Crushed and broken stone (unground):			
Dolomite	388,838	330,886	NA
Limestone thousand tons	4,338	5,247	NA
Nepheline syenite	83,023	e 130,000	e 145,000
Other including gravel thousand cubic meters	e 4,800	e 5,000	NA
Sand do	4,797	e 4,800	NA
Sulfuric acid (100 percent)	261,526	310,284	290,027
Talc, soapstone, steatite:			
Unground	74,955	67,667	e 68,000
Other	76,678	64,235	e 64,000
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades thousand tons	346	385	465
Coke, all types do	310	320	311
Gas manufactured million cubic feet	860	1,083	1,149
Peat:			
For agricultural use	9,850	11,400	e 12,000
For fuel use e	4,060	3,600	e 3,600
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	4,097	4,512	5,058
Jet fuel do	742	993	1,504
Kerosine do	621	779	1,225
Distillate fuel oil do	11,103	11,420	11,802
Residual fuel oil do	13,987	16,053	18,362
Lubricants do	225	167	2,051
Other do	2,835	2,983	
Refinery fuel and losses do	2,200	1,938	2,859
Total do	35,810	38,845	42,861

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

TRADE

From small export surpluses in 1968 and 1969, Norwegian trade in mineral commodities shifted to the deficit side in 1970. The deficit amounted to roughly $105 million.[2] Record imports of liquid fuels, iron and steel, and nonferrous ores and concentrates, coupled with reduced exports of ferroalloys, aluminum, and petroleum products, were largely responsible for the deficit. The value of exports increased to approximately $875 million, while the value of imports jumped to about $980 million.

As in 1969, the principal destination of Norway's mineral commodity exports, in terms of value, was West Germany, followed by the United Kingdom and Sweden. Owing to the large imports of nickel-copper matte, Canada was the leading supplier of mineral commodity imports, followed by the United Kingdom and Sweden.

The value of trade in 1968 and 1969 is summarized as follows:

[2] Where necessary, values have been converted from Norwegian Kroner (NKr) to U.S. dollars at the rate of NKr7.14=US$1.00.

	Value (thousand dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1968	613,961	1,937,783
1969	720,428	2,203,675
Imports:		
1968	563,018	2,706,387
1969	632,755	2,941,503

Table 2.—Norway: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum including alloys:			
Scrap	5,588	6,745	West Germany 5,028; Sweden 1,358; Netherlands 243.
Unwrought	435,197	480,333	United Kingdom 150,468; West Germany 129,544; United States 44,434.
Semimanufactures	r 12,329	25,715	United Kingdom 9,220; Sweden 8,098; Denmark 3,539.
Cadmium	76	79	NA.
Cobalt	511	960	NA.
Copper:			
Ore and concentrate	20,040	35,578	West Germany 31,114; Sweden 4,464.
Metal including alloys:			
Scrap	1,519	1,711	Belgium-Luxembourg 640; Sweden 426; West Germany 426.
Unwrought:			
Unrefined	5,449	5,683	West Germany 5,064; Sweden 619.
Refined	16,977	20,787	West Germany 9,584; United Kingdom 3,077; France 2,319.
Semimanufactures	r 2,518	3,331	Sweden 2,409; Denmark 629; Israel 69.
Gold unworked or partly worked troy ounces	1,672	2,476	Denmark 1,125; Finland 650; Italy 650.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	2,741	2,732	West Germany 1,302; United Kingdom 657; Finland 407.
Roasted pyrite	139,392	140,384	West Germany 117,775; United Kingdom 15,395; Denmark 5,054.
Metal:			
Scrap	r 29,634	37,538	West Germany 27,938; Sweden 5,237; Belgium-Luxembourg 2,521.
Pig iron including cast iron	192,717	180,759	United Kingdom 68,451; West Germany 24,633; Japan 16,054.
Ferroalloys:			
Ferromanganese	143,753	188,118	United Kingdom 45,249; West Germany 41,381; Belgium-Luxembourg 33,104.
Other	507,887	538,875	West Germany 151,798; United Kingdom 151,243; Belgium-Luxembourg 43,511.
Steel, primary	r 163,799	174,815	Denmark 58,603; Netherlands 57,928; United Kingdom 35,894.
Semimanufactures:			
Bars, rods, angles, shapes, sections	r 202,622	187,281	United Kingdom 77,984; Sweden 28,308; West Germany 20,776.
Universals, plates, sheets	r 74,019	79,529	Sweden 28,846; United Kingdom 10,060; Denmark 8,091.
Hoop and strip	r 198	717	Sweden 375; West Germany 300.
Rails and accessories	192	597	Sweden 563.
Wire	6,738	8,478	United Kingdom 1,857; Poland 1,712; Greece 1,054.
Tubes, pipes, fittings	r 24,499	27,201	NA.
Castings and forgings, rough	6,541	9,580	Sweden 6,669; Denmark 1,125; Liberia 824.
Total semimanufactures	314,809	313,383	
Lead:			
Ore and concentrate	6,420	7,301	United Kingdom 3,721; West Germany 2,371; Poland 1,040.
Metal including alloys:			
Scrap	4,809	4,700	Denmark 2,608; West Germany 961; Sweden 884.
Unwrought	521	364	Sweden 142; France 92; Denmark 52.
Semimanufactures	402	40	Sweden 33; Denmark 7.
Magnesium including alloys value, thousands	$16	$19	NA.
Manganese ore and concentrate	1,610	153	All to United Kingdom.
Molybdenum ore and concentrate	417	495	NA.
Nickel:			
Ore and concentrate	r 4,252	5,060	All to Finland.
Metal including alloys:			
Scrap	181	202	West Germany 74; United Kingdom 60; Netherlands 39.
Unwrought	30,446	35,419	United States 11,237; Sweden 6,805; West Germany 6,468.
Semimanufactures	200	204	Netherlands 56; Sweden 47; Italy 38.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Platinum-group and silver:			
Waste and sweepings kilograms	50,629	39,759	West Germany 21,233; United Kingdom 12,763; Denmark 3,107.
Metal including alloys:			
Platinum-group troy ounces	22,763	20,544	United States 14,339; Netherlands 2,861; France 2,797.
Silver do	51,891	322,182	United Kingdom 176,765; Denmark 105,647; France 22,505.
Silicon, elemental	18,387	26,243	West Germany 8,643; United Kingdom 7,086; U.S.S.R. 5,264.
Tin including alloys:			
Scrap long tons	r 76	78	West Germany 33; Denmark 26.
Unwrought do	256	216	Sweden 194; Finland 10.
Titanium ore and concentrate (ilmenite)	395,987	455,238	NA.
Zinc:			
Ore and concentrate	13,090	13,668	Poland 11,421; West Germany 2,247.
Oxide	268	444	Sweden 334; Denmark 34; Finland 28.
Metal including alloys:			
Scrap	392	309	Denmark 107; Netherlands 84; West Germany 64.
Unwrought	r 53,712	46,279	Sweden 21,409; West Germany 9,505; United Kingdom 5,475.
Semimanufactures	r 530	324	Netherlands 87; Hong Kong 45; Sweden 40.
Other:			
Ore and concentrate	26	-------	
Ash and residues containing nonferrous metals	36,577	26,648	Sweden 16,030; West Germany 5,776; United Kingdom 2,577.
Oxides, hydroxides, and peroxides of metals n.e.s	2,029	1,985	NA.
Base metals including alloys, all forms	674	1,043	NA.
NONMETALS			
Abrasives (grinding and polishing wheels and stones)	r 1,195	1,483	Poland 414; Finland 191; Sweden 189.
Cement	840,596	1,089,343	Ghana 391,898; United States 319,683; Spain 119,106.
Clay products:			
Refractory (including nonclay bricks)	11,023	10,535	West Germany 8,746; Netherlands 639; Sweden 601.
Nonrefractory value, thousands	r $77	$190	West Germany $106; United Kingdom $56.
Feldspar and fluorspar	131,149	198,184	United Kingdom 57,193; Netherlands 39,460; West Germany 36,660.
Fertilizer materials:			
Manufactured:			
Phosphatic thousand tons	8	-------	
Other do	286	384	NA.
Graphite, natural	8,695	8,627	NA.
Lime	46	-------	
Mica, all forms	4,814	3,861	France 1,288; West Germany 616; Spain 313.
Pyrite (gross weight)	522,202	503,803	West Germany 411,222; Sweden 72,896; United Kingdom 9,843.
Salt	r 3,690	3,118	Iceland 1,409; Sweden 659.
Stone, sand and gravel:			
Dimension:			
Crude and partly worked:			
Marble and other calcareous	5,474	3,116	West Germany 1,397; Italy 592; Sweden 482.
Slate	47,710	50,376	Netherlands 21,993; West Germany 10,130; Denmark 8,369.
Other	r 63,350	68,148	France 20,864; West Germany 17,556; Italy 16,740.
Worked, all types	164	393	Denmark 211; Sweden 109.
Dolomite	95,474	81,198	Sweden 23,193; Denmark 16,525; West Germany 11,118.
Gravel and crushed rock	759,440	776,150	West Germany 531,142; United Kingdom 116,577; Denmark 76,408.
Limestone	14,285	15,515	Sweden 12,257; Denmark 2,422.
Quartz and quartzite	6,374	3,452	Denmark 1,097; West Germany 354; United Kingdom 242.
Sand excluding metal bearing	126	230	Libya 210.
Sulfur:			
Elemental	-------	18	NA.
Sulfur dioxide	5,640	4,505	Sweden 4,420.
Talc, steatite, soapstone, pyrophyllite	72,950	63,391	United Kingdom 18,750; West Germany 9,107; Sweden 8,340.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Other n.e.s.:			
Slag, dross and similar waste not metal bearing	-------	1,402	West Germany 288.
Other	882	386	West Germany 138.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6,408	144	Indonesia 76.
Coal and coke including briquets:			
Anthracite and bituminous coal	67,473	62,726	West Germany 61,596; United Kingdom 617.
Coke and semicoke	125,016	63,966	Belgium-Luxembourg 18,853; Sweden 13,977; Denmark 13,681.
Gas, hydrocarbon, liquefied petroleum gas	15,565	18,706	United Kingdom 14,506; Finland 2,252; Sweden 1,656.
Peat including peat briquets	r 401	52	All to Japan.
Petroleum refinery products:			
Gasoline including natural thousand 42-gallon barrels	2,170	2,548	Sweden 1,908; United Kingdom 249; Denmark 184.
Kerosine and jet fuel do	19	1	Mainly to Sweden.
Distillate fuel oil do	2,719	2,553	Sweden 2,507; Denmark 44.
Residual fuel oil do	5,586	6,039	Sweden 5,313; Denmark 726.
Lubricants do	154	93	Denmark 48; Sweden 18; Portugal 14.
Bitumen and other do	1	2	Mainly to Denmark.
Mineral tar and other coal, petroleum, or gas derived crude chemicals	22,116	18,486	France 9,328; West Germany 4,597; Spain 2,834.

r Revised. NA Not available.

Table 3.—Norway: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	37,096	22,323	Greece 21,917.
Oxide and hydroxide	932,244	988,021	Jamaica 334,637; United States 225,188; Guinea 179,043.
Metal including alloys:			
Scrap	587	53	Sweden 39; United Kingdom 6.
Unwrought	21,583	25,904	Sweden 10,349; U.S.S.R. 6,094; United Kingdom 2,723.
Semimanufactures	10,489	16,597	Belgium-Luxembourg 6,535; Sweden 3,804; United Kingdom 1,859.
Antimony including alloys	121	71	Mainland China 68; Netherlands 2.
Arsenic trioxide, pentoxide, and acid	107	67	All from Sweden.
Chromium:			
Chromite	69,617	95,274	Turkey 67,117; U.S.S.R. 13,025; Greece 7,888.
Oxide	179	152	West Germany 116; Poland 16; United Kingdom 11.
Cobalt:			
Oxide and hydroxide	3	2	NA.
Metal including alloys, all forms	1	5	All from Belgium-Luxembourg.
Copper including alloys:			
Scrap	55	7	United States 5.
Unwrought	3,660	2,745	United States 1,317; Sweden 999; United Kingdom 413.
Semimanufactures	r 20,554	23,714	Sweden 9,574; Belgium-Luxembourg 4,551; United Kingdom 2,582.
Gold worked or partly worked troy ounces	54,881	50,316	United Kingdom 37,423; West Germany 10,320.
Iron and steel:			
Ore and concentrate	13,854	47,658	Liberia 28,448; Sweden 18,977.
Scrap	12,956	20,852	United Kingdom 9,376; Denmark 5,959; Sweden 4,683.
Pig iron, ferroalloys, and similar materials	20,266	27,812	Finland 7,494; Sweden 6,066; Republic of South Africa 5,156.
Steel, primary	64,226	73,670	Netherlands 60,253; Belgium-Luxembourg 5,363; Denmark 3,344.
Semimanufactures:			
Bars, rods, angles, shapes, sections	230,622	273,990	West Germany 67,600; France 59,678; Sweden 43,790.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and Steel—Continued			
Semimanufactures—Continued			
Universals, plates, sheets	449,714	540,666	United Kingdom 125,572; West Germany 115,326; Sweden 85,634.
Hoop and strip	66,672	76,375	Belgium-Luxembourg 42,156; France 9,307; West Germany 7,327.
Rails and accessories	6,029	10,836	Sweden 5,771; United Kingdom 2,042; Austria 1,165.
Wire	8,820	9,637	Belgium-Luxembourg 3,711; United Kingdom 1,614; Sweden 1,457.
Tubes, pipes, fittings	70,148	76,937	West Germany 25,160; United Kingdom 16,605; Sweden 13,331.
Castings and forgings, rough	587	793	West Germany 185; Denmark 177; Sweden 162.
Total semimanufactures	832,592	989,234	
Lead:			
Oxides	1,485	1,656	Sweden 781; United Kingdom 458; West Germany 322.
Metal including alloys:			
Scrap	113	125	Denmark 74; Sweden 51.
Unwrought	r 10,461	10,686	West Germany 4,549; Canada 2,283; Denmark 1,316.
Semimanufactures	1,252	1,204	Belgium-Luxembourg 287; Netherlands 275; West Germany 260.
Magnesium including alloys, all forms	268	552	West Germany 493; Sweden 25; Finland 19.
Manganese:			
Ore and concentrate	r 650,627	627,025	Ghana 184,262; Brazil 148,617; Republic of South Africa 114,202.
Oxides	310	446	Netherlands 186; Japan 127; Belgium-Luxembourg 55.
Mercury ——76-pound flasks	754	986	Yugoslavia 435; Netherlands 203; Italy 174.
Molybdenum including alloys, all forms	-------	2	All from France.
Nickel:			
Matte, speiss, and similar materials	r 77,715	69,837	All from Canada.
Metal including alloys:			
Scrap	697	668	West Germany 532; United Kingdom 135.
Unwrought	91	156	United Kingdom 80; Venezuela 53; United States 18.
Semimanufactures	r 306	303	United Kingdom 113; West Germany 105; Sweden 60.
Platinum-group and silver:			
Waste and sweepings ——kilograms	244	12,691	United States 10,772; British West Indies 1,151; Denmark 766.
Metal including alloys:			
Platinum-group ——troy ounces	3,633	7,330	United Kingdom 6,655; Denmark 161; West Germany 161.
Silver ——thousand troy ounces	2,610	3,767	United Kingdom 2,324; West Germany 1,119; United States 182.
Tin including alloys:			
Scrap ——long tons	24	33	Belgium-Luxembourg 21; Sweden 12.
Unwrought ——do	647	605	United Kingdom 346; Netherlands 113; Denmark 72.
Semimanufactures ——do	r 460	488	United Kingdom 394; Netherlands 67; West Germany 21.
Titanium:			
Ore and concentrate	142	138	All from Australia.
Dioxide	964	1,859	West Germany 1,562; United Kingdom 214; Belgium-Luxembourg 50.
Tungsten including alloys, all forms	2	2	United Kingdom 1.
Zinc:			
Ore and concentrate	113,015	103,362	Sweden 61,628; Australia 21,154; Canada 20,580.
Oxide	653	1,195	East Germany 739; Sweden 196; West Germany 142.
Metal including alloys:			
Scrap	2,780	3,706	Sweden 1,963; France 1,250; Denmark 493.
Unwrought	2,650	4,645	Poland 1,843; Peru 1,524; North Korea 889.
Semimanufactures	1,233	1,051	Belgium-Luxembourg 646; West Germany 144; Netherlands 131.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Other:			
Ore and concentrate	982	231	Australia 209.
Ash and residues containing nonferrous metals	174	608	Netherlands 300; Sweden 137; Republic of South Africa 87.
Oxides, hydroxides, and peroxides of metals, n.e.s	384	431	West Germany 178; United Kingdom 132; Mainland China 60.
Metals including alloys, all forms:			
Metalloids	16	18	Sweden 15.
Alkali, alkaline earth, and rare-earth alloys	49	51	All from United Kingdom.
Pyrophoric alloys	3	4	United Kingdom 2; Australia 1.
Base metals including alloys, all forms, n.e.s	r 379	550	Republic of South Africa 251; Sweden 107; Yugoslavia 79.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	399	549	West Germany 264; Netherlands 105; United States 95.
Grinding and polishing wheels and stones	r 630	733	United States 185; Sweden 160; West Germany 122.
Asbestos	4,725	6,945	Canada 4,258; U.S.S.R. 1,970; Republic of South Africa 458.
Barite and witherite	16,327	16,304	Italy 6,794; Ireland 4,153; United Kingdom 3,316.
Boron materials:			
Crude natural borates	550	815	United States 765; Turkey 50.
Oxide and acid	299	349	United Kingdom 151; France 98; United States 43.
Cement	7,954	25,889	Sweden 15,287; Denmark 5,580; United Kingdom 3,288.
Chalk	7,581	8,921	France 3,406; Denmark 3,146; Sweden 1,422.
Clays and products:			
Crude:			
Fuller's earth, dinas, chamotte	2,204	1,245	United Kingdom 1,091; West Germany 122.
Kaolin	73,923	87,120	United Kingdom 86,270; Czechoslovakia 367.
Other	47,267	46,802	United Kingdom 26,858; United States 5,375; Sweden 3,937.
Products:			
Refractory	r 22,786	28,693	Sweden 11,885; West Germany 5,035; United Kingdom 3,663.
Nonrefractory value, thousands	r $3,055	$3,269	Sweden $892; United Kingdom $488; Denmark $466.
Cryolite and chiolite	4,432	4,374	All from Denmark.
Diamond, gem not set or strung carats	210,000	250,000	West Germany 125,000; Japan 40,000; U.S.S.R. 40,000.
Diatomite and other infusorial earths	4,234	3,768	Denmark 2,201; United States 910; France 296.
Feldspar	24	15	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	-------	223	All from West Germany.
Phosphatic	313,551	281,685	U.S.S.R. 141,726; United States 80,802; Morroco 59,130.
Manufactured:			
Nitrogenous	667	761	West Germany 380; Austria 235; Belgium-Luxembourg 146.
Phosphatic	9,410	6,683	Sweden 6,018; Netherlands 479.
Potassic	193,808	202,555	Spain 89,920; France 78,673.
Other	74	75	Sweden 37; Netherlands 7.
Ammonia	67,858	66,067	United States 64,558; Denmark 1,003; West Germany 504.
Fluorspar	2,819	2,295	Mainland China, 1,038; United Kingdom 912; West Germany 340.
Graphite, natural	347	390	United Kingdom 303; West Germany 47.
Gypsum and plasters	138,618	140,582	Poland 92,305; France 46,592; West Germany 1,511.
Lime	13,027	18,085	Denmark 16,367; Poland 991; Sweden 523.
Magnesite	5,129	5,516	Mainland China 3,640; Austria 715; United Kingdom 658.
Mica, all forms	5,660	3,807	India 2,044; Brazil 950; Republic of South Africa 620.
Pigments, mineral:			
Natural, crude	483	426	West Germany 184; United States 116; Denmark 22.
Iron oxides processed	1,927	2,096	West Germany 1,937; United Kingdom 98.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Precious and semiprecious stone, except diamond, including synthetic stone, dust, and powder ---------kilograms--	300	424	West Germany 331; Switzerland 13.
Salt and brine	r 322,596	309,098	Netherlands 130,966; Spain 48,327; United Kingdom 37,410.
Sodium and potassium compounds:			
Caustic soda	19,469	20,616	Netherlands 13,428; France 5,008; Sweden 1,737.
Caustic potash, sodic and potassic peroxides	1,327	1,306	Sweden 597; West Germany 462; France 157.
Stone, sand and gravel:			
Dimension:			
Crude and partly worked:			
Calcareous	279	245	Italy 118; Sweden 95.
Slate	2,559	3,160	Sweden 2,234; United Kingdom 613; Denmark 273.
Other	1,445	2,428	Sweden 2,006; East Germany 374.
Worked, all types	832	1,221	Sweden 510; East Germany 296; mainland China 253.
Dolomite	2,580	2,335	West Germany 1,139; Sweden 772; United Kingdom 317.
Flint	1,181	954	Denmark 950.
Gravel and crushed rock	38,727	36,332	Sweden 32,894; Denmark 1,796; Belgium-Luxembourg 472.
Limestone	268,859	279,058	United Kingdom 266,432; Denmark 10,508.
Quartz and quartzite	80,077	100,490	Spain 46,749; Portugal 29,259; Sweden 19,482.
Sand excluding metal bearing	151,284	155,870	Belgium-Luxembourg 98,037; Sweden 26,692; Netherlands 16,058.
Sulfur:			
Elemental	26,274	34,464	Poland 17,054; France 6,315; Finland 5,000.
Sulfuric acid	858	881	Sweden 799; Netherlands 51.
Talc, steatite, soapstone, pyrophyllite	6,017	8,034	India 4,500; mainland China 1,052; France 584.
Other n.e.s.:			
Crude	58,646	53,018	West Germany 44,984; East Germany 6,087; Sweden 1,425.
Slag, dross, and similar waste, not metal bearing	58,374	63,367	Sweden 47,686; France 14,505; Finland 855.
Oxides and hydroxides of magnesium, strontium, and barium	294	190	Belgium-Luxembourg 80; United Kingdom 67; Sweden 11.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,279	370	United States 334.
Carbon black and gas carbon	3,795	4,279	United Kingdom 1,326; Sweden 1,311; Netherlands 731.
Coal and coke including briquets, anthracite and bituminous coal	537,532	552,670	United States 273,534; United Kingdom 133,152; Poland 97,345.
Coke and semicoke	692,356	727,387	United Kingdom 535,130; West Germany 95,058; France 27,895.
Gas, hydrocarbon	5,147	5,298	Sweden 2,518; United Kingdom 1,388; Denmark 1,312.
Peat including peat briquets and litter	3,660	3,333	Sweden 3,161; Finland 106.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	35,810	37,758	Venezuela 11,108; Saudi Arabia 8,742.
Refinery products:			
Gasoline (including natural) do	4,077	4,953	United Kingdom 1,525; U.S.S.R. 965; Bahrain 710.
Kerosine and jet fuel do	2,242	2,040	United Kingdom 1,194; Belgium-Luxembourg 386; Netherlands 212.
Distillate fuel oil do	8,274	8,782	United Kingdom 2,870; U.S.S.R. 1,476; Belgium-Luxembourg 875.
Residual fuel oil do	7,109	7,311	United Kingdom 3,848; Sweden 1,193; U.S.S.R. 718.
Lubricants do	400	413	United Kingdom 161; Sweden 92; Denmark 73.
Mineral jelly and wax do	45	49	West Germany 30; U.S.S.R. 6; mainland China 5.
Other do	2,474	2,850	United States 1,253; West Germany 342; United Kingdom 328.

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Despite power shortages that forced cutbacks in production at several smelters, the total output of primary aluminum in 1970 increased 4.4 percent over 1969 output. Imports of alumina exceeded 1 million tons for the first time and were valued at more than $79 million. Exports of metal dropped to 430,000 tons, 10 percent less than in 1969, but more favorable prices kept the total export value ($259 million) close to the 1969 level.

The smelters of AS Årdal og Sunndal Verk (ASV) at Årdal and Sunndalsøra produced about 259,000 tons, nearly half of the national output. Annual production capacity of ASV plants increased 27,000 tons during 1970 to a total of 290,000 tons. A further increase of 45,000 tons was planned. ASV is jointly owned by the Norwegian Government and Alcan, Ltd.

Mosjøen Aluminium A/S (Mosal) produced 84,200 tons of aluminum in 1970 and shipped 82,200 tons. Annual production capacity of the Mosjøen smelter was 95,000 tons of aluminum and alloys. The company's new smelter at Lista was nearly completed by yearend, and production was expected to start in January 1971. Production capacity at Lista was about 25,000 tons annually; this will increase to 50,000 tons by the end of 1971. Mosal is jointly owned by A/S Elkem and the Aluminum Co. of America.

A/S Alnor, owned 51 percent by Norsk Hydro-Elektrisk Kvaelstofaktieselskab (Norsk Hydro) and 49 percent by Harvey Aluminum Inc., was expanding production capacity at Karmøy in 1970. It will reach 100,000 tons annually by the end of 1971. The plant produced 79,000 tons of aluminum in 1969, 30 percent of which was sold in semifabricated forms. A major increase in production capacity at Karmøy appears to be scheduled for the next 7 years; expenditures of $114 million are reportedly planned.[3]

Copper and Zinc.—Production and exports of mine concentrates in 1970 were slightly below the levels of 1969. This appeared to be partly due to lower world prices for copper and a decline in the market for pyrite. Most Norwegian mine output of copper and about one-third of the mine zinc are byproducts of pyrite operations.

A/S Sulitjelma Gruber, one of the principal producers of mine copper, reported a record output of blister copper (6,300 tons) in 1970 although production of crude ore and pyrite at Fauske was lower than it was in 1969.[4] The blister copper is normally exported to West Germany. Output of zinc concentrates was 1,800 tons (1,688 tons in 1969).

Production of mine copper and zinc in 1970 by Folldal Verk A/S was not available. The company produced 26,577 tons of copper concentrate (23.3 percent copper) and 5,327 tons of zinc concentrate (51.0 percent zinc) from the new Tverfjellet mine in 1969, along with 197,000 tons of pyrite. Most of the copper concentrate was exported.

Production of refined copper and zinc, which is based mainly on imported raw materials, reached record levels in 1970. Imports of nickel-copper matte and zinc concentrates increased by 35 percent and 43 percent, respectively, above 1969 imports. Exports of refined copper rose 19 percent, while exports of slab zinc were almost unchanged from the 1969 level.

Exploration and development of pyritic copper and zinc deposits in northern Norway continued in 1970. The 2-kilometer tunnel being driven into the Joma deposit by A/S Grong Gruber was half completed by yearend. Mining of the Joma deposit was scheduled to begin in 1972 at the rate of 250,000 tons of ore annually. Annual output of 20,000 tons of copper concentrate and 5,000 tons of zinc concentrate was planned. Development of the Repparfjord deposit (0.7 percent copper) was being assisted by a $1.4 million loan from the Norwegian Government. Production may begin in 1973 at the rate of 600,000 tons of crude ore and 15,000 tons of concentrate (30 percent copper) per year. Near Kautokeino, mining of the Bidjovagge deposit was apparently started in September 1970 by A/S Bleikvassli Gruber. Planned annual production was 250,000 tons of ore containing 1.5 percent copper and 5 to 10 percent sulfur. This produc-

[3] American Metal Market. V. 78, No. 4, Jan. 6, 1971, p. 7.
[4] Bergverks-Nytt (Trondheim). V. 18, No. 1, January 1971, p. 30.

tion will yield 15,000 to 18,000 tons of flotation concentrate containing 23.5 percent copper and small quantities of gold. A graphite concentrate will also be recovered. The concentrates will be trucked about 75 miles to the port of Alta for shipment. The first 10 years of production has been sold in advance to a Spanish company.[5]

In other developments, A/S Vigsnes Kobberverk was planning to double its crude ore production, drawn from the Gammelgruva and Rødklev mines, to 100,000 tons annually. The company produced about 1,600 tons of copper and zinc concentrates from 35,000 tons of pyritic crude ore in 1969 before the concentrator was destroyed by fire late in the year. A new concentrator was under construction in 1970, and production was expected to resume in 1971. The Vigsnes ore contains 0.6 to 0.8 percent copper and 1 to 2 percent zinc.

A/S Røros Kobberverk announced discovery of about 2 million tons of "probable" ore containing an estimated 1.1 percent copper and 2.2 percent zinc. The discovery was made near Harsjøen-i-Hessdalen in the Røros region south of Trondheim. About 30 drill holes, the deepest of which was about 550 feet, had been completed by yearend.

A/S Killingdal Grubeselskab was planning to close the Undals mine near Rennebu in February 1971. The mine produced about 26,000 tons of ore in 1969, less than half of the company's output. Ore from the Undals and Ålen mines, processed in Trondheim, yielded 2,160 tons of copper and zinc concentrates in 1969.

Iron Ore.—The increase in iron ore production in 1970 was mainly generated by operations of A/S Sydvaranger at Kirkenes. The company produced 2,529,000 tons (dry weight) of concentrate in 1970, including 961,000 tons of pellets. Pellet production appeared to be 80 percent of rated capacity at the "grate-kiln" plant, which was completed in late 1969. Ore shipments by the company in 1970 totaled 2,442,000 tons in 158 vessels ranging from 7,000 to 60,000 deadweight tons. Preliminary statistics indicated that exports of iron ore from Norway in 1970 totaled 2,964,000 tons.

Production capacity for iron concentrate at the Fosdalen mine was expected to increase to 500,000 tons annually by 1972, and an output of 430,000 tons was scheduled for 1971. At the Tellnes ilmenite mine (see "Titanium") production of by-product magnetite is expected to reach 50,000 tons annually when the current expansion program is completed. Output of magnetite at Tellnes in 1970 was estimated at 30,000 tons.

Production of crude iron ore and concentrates and average work force in 1969, by company and mine, are given in the following tabulation:

Company and mine	Crude ore (thousand metric tons)	Concentrate: Thousand metric tons	Concentrate: Type	Concentrate: Iron content (percent)	Average number of workers
A/S Sydvaranger: Bjornevatn	15,782	2,412	Magnetite	65.5	777
A/S Norsk Jernverk: Rana	6,168	589	Hematite	63.1	309
		292	Magnetite	70.3	
Fosdalens Bergverks A/S: Fosdalen	863	358	do	66.57	321
Christiania Spigerverk (CS):					
Rødsand	659	150	do	63.4	138
Bråstad	64	24	Hematite	50–66	28
A/S Titania:[1] Tellnes	1,698	26	Magnetite	60.84	241
Orkla Grube-Aktiebolag:[2] Løkken	464	3	do	64.28	86
Total	25,698	3,854			1,900

[1] Principal product is ilmenite concentrate.
[2] Principal product is pyrite concentrate.

Source: Statistisk Sentralbyrå (Oslo). Industristatistikk 1969 (Industrial Statistics, 1969), 1971, p. 80.

Iron and Steel.—Apparent consumption of iron and steel continued to rise in 1970. Production of pig iron remained at about the 1969 level; exports declined 17 percent. Output of crude steel rose 2.5 percent, but net imports of semimanufactures increased 186,000 tons, a 17-percent rise over 1969 imports. The largest increase (109,000 tons) was again registered in imports of plates and sheets, followed by an increase

[5] Bergverks-Nytt (Trondheim). V. 17, No. 9, September 1970, pp. 172–5.

of 30,000 tons in bars, rods, and sections.[6] Apparent consumption of steel in 1970 was estimated at about 1.6 million tons.

Output of metal by the major producers in 1969 was as follows, in metric tons:

Company	Pig iron	Crude steel
A/S Norsk Jernverk	595,000	606,000
Christiania Spigerverk (CS)	85,500	150,000

A shortage of iron concentrate at the A/S Norsk Jernverk plant in the first half of 1970 led to importation of 50,000 tons of concentrate from the Soviet Union. The plant's ore requirements are usually met by shipments from the Rana mine, supplemented by shipments from A/S Sydvaranger. Most of the ore smelted by CS comes from the Rødsand mine.

Ferroalloys.—Production and exports of ferroalloys in 1970 were well below the levels of 1969. Exports of ferrosilicon (45-percent-silicon basis) dropped 37 percent, while exports of other ferroalloys averaged nearly 17 percent less. The value of exports increased 16 percent, however, to $99 million. Imports of manganese ore and chromite also declined, to 545,000 and 78,600 tons, respectively.

Part of the drop in production was due to a shortage of electric power. In the early part of the year, A/S Elkem had to reduce output 15 percent at the Fiskaa works and 25 percent at the Porsgrunn Elektrometallurgiske (PEA) facility. An explosion in April at the largest PEA furnace caused additional production loss.

Elkem's new ferrosilicon furnace at Salten was completed early in 1970. This furnace doubled the plant's annual production capacity to 55,000 tons (75-percent-silicon basis). A third furnace, which will raise annual capacity to 90,000 tons, will be added during 1971–72. The company also decided to install a new furnace for manganese alloys at PEA. The furnace is to begin production by the end of 1971, and it will increase net capacity for ferromanganese by 40,000 tons annually. Capacities at PEA in 1970 were 75,000 tons of ferromanganese and 40,000 tons of silicomanganese.

Magnesium.—Exports of magnesium and alloys in 1970 were valued at $26 million, 33 percent above 1969 exports. Quantities were not available, but Norsk Hydro reported that annual production capacity reached 40,000 tons in 1970. The company also stated that further increases were planned. Norsk Hydro reportedly supplied more than 40 percent of West European consumption of magnesium and alloys. The largest single customer was Volkswagenwerk of West Germany.

Nickel.—Increased production of nickel concentrate by A/S Titania at Tellnes in 1970 was indicated by a 30-percent rise in exports over 1969 exports. Exports in 1970 totaled more than 6,600 tons.

A record output of refined nickel was achieved in 1970 at the Kristiansand refinery of Falconbridge Nikkelverk A/S. Depleted supplies of matte, resulting from the 3-month strike at the parent company's Canadian mines in late 1969, led to low output of metal in the early months of the year. The shortage was eased by midyear, and monthly production in the last quarter averaged more than 3,900 tons. Imports of nickel-copper matte (94,575 tons), exports of unwrought nickel (37,044 tons), and exports of refined copper (29,103 tons) were all at record levels in 1970. Exports of byproduct cobalt (720 tons) and platinum-group metals (609 kilograms), however, were less than those in 1969.

Silicon.—Exports of elemental silicon in 1970 totaled 26,330 tons. The tonnage was only slightly higher than exports in 1969, but total value increased 17 percent to nearly $9.2 million.

At Svelgen, CS was increasing production capacity for silicon at its Bremanger works to 10,000 tons annually. Present output capacity is believed to be about 5,000 tons.

Titanium.—Production and exports of ilmenite concentrate increased more than 16 percent in 1970 above 1969 levels. Expansion of production capacity at Tellnes was apparently well underway, and monthly output of concentrate in the last quarter averaged more than 60,000 tons. The expansion program, costing approximately $6 million, was expected to raise annual production capacity to 1 million tons by 1972. The Tellnes plant is operated by A/S Titania, a subsidiary of National Lead Co.

NONMETALS

Cement.—The increase of 5.7 percent in production of cement in 1970 appears to have been generated by domestic rather

[6] Imports of tubular products were erroneously reported in the 1969 Minerals Yearbook as having increased to 141,000 tons in 1969. The actual total was 76,934 tons.

than export demand. In the construction industry, the total number of buildings completed was 10 percent higher than in 1969, although the number of buildings started and under construction increased only slightly. Exports were slightly below the 1969 total, but they still exceeded 1 million tons for the second consecutive year. Norway remained the largest exporter of cement in Western Europe.

Feldspar and Nepheline Syenite.—Exports of both feldspar and nepheline syenite increased about 13 percent in 1970 over 1969 levels.

Production and exports of nepheline syenite increased for the ninth consecutive year. A/S Norsk Nefelin, the sole producer, planned to produce 165,000 tons in 1971 and 260,000 tons annually within a few years. The material is mined underground at Stjernøy in the Lofoten Islands.

Details of the Stjernøy operation were published in 1970.[7] The nepheline syenite occurs as a steeply dipping body about 6,500 feet long and 1,000 feet wide. Its depth has not been determined, but reserves are very large. The mine is in a mountainside close to the sea. The portal is several hundred feet above sea level, and the mining level is considerably higher. Crude ore is transported to underground crushing stations in 10- and 25-ton trucks. The ore is crushed to 50 millimeters before being conveyed to the surface for beneficiation. At the concentrator the ore is dried, then crushed to 8 millimeters before passing through rolls that reduce the maximum particle size to 0.55 millimeter. Iron-bearing mineral impurities, such as magnetite, hornblende, and mica, are removed by magnetic separators so that the iron content of the final product is 0.07 percent or less. The 0.55-millimeter material is marketed as "glass grade." A "ceramic grade," ground to 50-percent — (minus) 0.01 millimeter (0.04-millimeter maximum), is also produced. About 85 percent of the final product is "glass grade," with "ceramic grade" making up the remainder. The final product amounts to about 65 percent of the tonnage of crude ore produced. The principal market is the United Kingdom.

Talc.—The Knarrevik processing plant of A/S Norwegian Talc near Bergen was rebuilt in 1970 after being seriously damaged by fire in mid-1969. Production of "micronized" materials from the new sections was expected to start in early 1971. The plant has an annual production capacity of 100,000 tons of micronized materials, including mica, dolomite, and talc. Output of micronized talc in 1970 was reportedly about 25,000 tons. The company also operated a smaller mill in the Sognefjord area, which produces about 12,000 tons annually of "coarse" (200-mesh) talc.[8] Exports of talc from Norway in 1970 totaled about 66,000 tons, slightly more than exports in 1969 but below the levels of 1967–68.

MINERAL FUELS

Coal and Coke.—Production of coal in 1970 was the highest since 1962. The increase appears to have resulted from new mine production as well as more favorable market conditions. Exports of coal in 1970 increased to 101,000 tons, substantially above the levels of 1968–69, while imports declined 16 percent to 461,000 tons.

Store Norske Spitsbergen Kulkompani A/S, the only producer of coal, hoped to increase production in 1971 and subsequent years. In 1970 the company began a survey of old mines in the Svea area, about 50 miles south of Longyearbyen, to study the possibility of mining the deposits by mechanical methods. Thicknesses of coal in the Svea area were said to be frequently two to four times as great as the 25- to 30-inch thickness encountered in the Longyearbyen mines.

Norsk Koksverk A/S was seeking Government permission to increase coke production capacity by 50 percent. If approved, output capacity of the company's plant at Mo-i-Rana will be about 450,000 tons annually. Imports of coke (from coal) rose 15 percent in 1970 to 840,000 tons. Imports of petroleum coke continued to rise and totaled 324,000 tons valued at $12 million in 1970.

Petroleum.—*Offshore Exploration.*—The Phillips exploration group confirmed the discovery of a major petroleum deposit in the Norwegian sector of the North Sea. Three wells drilled in 1970 penetrated about 700 feet of productive strata at a depth of approximately 10,000 feet, and production tests indicated that each was

[7] Bergverks-Nytt (Trondheim). V. 17, No. 1, January 1970, pp. 6–9.
[8] Industrial Minerals (London). No. 40, January 1971, p. 28.

capable of producing about 10,000 barrels per day of low-sulfur crude oil with a viscosity of about 36° API. The deposit, known as the Ekofisk field, is believed to contain minimum recoverable reserves of 1 billion barrels of petroleum. The discovery well (drilled in late 1969) and three confirmation wells were scheduled to begin production of about 40,000 barrels of oil daily in the spring of 1971. A temporary platform will be used, and output will be loaded from the platform into tankers. Plans call for establishing permanent production facilities in 1972. Additional wells are expected to increase the output of the field to 300,000 barrels daily. Owners of the group are the Phillips Petroleum Co. (37 percent), Petrofina S.A. (30 percent), A/S Petronord (20 percent), and Ente Nazionale Idrocarburi (ENI) (13 percent).

The Phillips group discovered another oil-bearing structure five miles west of the Ekofisk field late in 1970. The discovery well (called West Ekofisk) penetrated more than 600 feet of productive formation and, like the Ekofisk wells to the east, indicated a production potential of 10,000 barrels of oil per day. Another exploratory well (Eldfisk), 7 miles south of the Ekofisk field, found a third oil-bearing structure. Tests of this well in December yielded small quantities of oil, and additional drilling was planned.

A fourth oil-bearing structure (Ergfisk or Torfelt), 9 miles northeast of Ekofisk, was discovered in late 1970 by the Amoco-Noco exploration group. The well penetrated 630 feet of productive formation, and tests yielded 3,600 barrels per day of low-sulfur, 40° API oil. Confirmation wells were expected to be drilled in the spring, including one by the Phillips group, whose concession area covers part of this structure. Participants in the Amoco-Noco group are Standard Oil Co. of Indiana, Texas Eastern Transmission Corp., and Norwegian Oil Consortium A/S.

In the same general area, the Phillips group discovered an oil-bearing structure (the Josephine) in the British sector of the North Sea about 25 miles west of the Ekofisk field. The productive formation here was found to be about 45 feet thick, and tests of the well yielded oil at the rate of 800 barrels per day.

Esso Exploration Norway, Inc., also found oil in 1970. The discovery was made about 170 miles north of the Ekofisk field and 115 miles west of Bergen. Tests of the well yielded 902 barrels per day of "medium quality" oil. Four other wells drilled in the vicinity yielded smaller quantities of oil. The discovery well was drilled in 530 feet of water.

Imports, refining, and consumption.—Imports of crude oil and petroleum products continued to increase in 1970. Crude oil imports rose to 6,528,000 tons, a 26-percent increase over those in 1969. Imports of petroleum products rose to 4.27 million tons, up 16 percent from imports in 1969, while exports declined 3 percent to 1.58 million tons. Statistics for the first 9 months of 1970, released by the Organization for Economic Cooperation and Development (OECD),[9] indicated that refinery output was running 10 percent above output during the comparable period of 1969, while inland consumption had increased 12 percent.

Electric Energy.—Hydroelectric power continued to be Norway's principal source of primary energy in 1970. Power production was 57 billion kilowatt-hours, virtually unchanged from the 1969 level and 4 percent below the record production of 1968. The low level of reservoirs in some parts of the country resulted in cutbacks of production at various plants producing aluminum, ferroalloys, and chemical products.

The relative importance of various sources of primary energy in Norway's annual consumption is shown by the following tabulation:

	Quantity consumed (million tons of oil-equivalent)		Percent of total consumption	
	1960	1969	1960	1969
Hydroelectric power	4.670	8.318	51.7	53.8
Oil	3.240	6.159	35.9	39.8
Coal and coke	.805	.807	8.9	5.2
Wood and peat	.320	.186	3.5	1.2
Total	9.035	15.470	100.0	100.0

Source: (Organization for Economic Cooperation and Development), Paris. Energy Committee Document No. DIE/E/EN/71.29, Mar. 30, 1971.

[9] Organization for Economic Cooperation and Development (OECD) Paris. Provisional Oil Statistics by Quarters. 3rd Quarter 1970, 21 pp.

The Mineral Industry of Pakistan

By Benjamin Petkof [1]

Pakistan continued to be a minor consumer and producer of mineral commodities during 1970. Natural gas was the country's only mineral resource of economic consequence by world standards. Reserves of some low-unit-value nonmetals appear appreciable but local demand is limited. Cement and to a lesser extent, coal, oil, and fertilizers were of importance to the domestic economy, in addition to natural gas. A few items like metallurgical chromite, cement, salt, and barite found markets abroad and this enabled the country to earn some foreign exchange. Like most developing countries however, Pakistan has had to spend large amounts of foreign exchange buying foreign iron and steel, petroleum, and fertilizer products, to supplement its small domestic output.

During the year, efforts to develop the mineral industry continued to emphasize improvement of the nation's self-sufficient position. It was recognized however, that economic growth was dependent upon imports of significant quantities of mineral products. To ease the foreign exchange situation, attention was given to providing processing facilities for crude mineral imports instead of importing more finished products of higher unit value.

The mineral imbalance between East and West Pakistan relating to production and consumption continued in 1970. East Pakistan, with more than half of the population but lacking resources in general, produced and exported only a small share of Pakistan's mineral products. Similarly, it also consumed minor portions of the mineral imports. To illustrate the disparity between the two areas, it need only be said that West Pakistan outproduced East Pakistan five to one or better in natural gas, oil, coal, and cement.

Pakistan Government sources credit crude mineral extraction with a contribution of only US $42 million [2] in current dollars to the gross national product GNP of $15,744 million for the fiscal year ending June 30, 1970. (Comparable final figures for the previous fiscal year were $39 million and $14,345 million, respectively). Information on value added as a result of processing both domestic and imported mineral commodities are not available, but the figure is much greater than the value of crude mineral extraction, considering that the nation's petroleum operations alone were expected to add about $256 million to Government revenue, mainly from duties and special surtaxes during the year ending June 30, 1970.

PRODUCTION

Available statistics on Pakistan's mineral production are somewhat incomplete and are on a fiscal year basis from July to June. Discrepancies in statistics often are difficult to resolve. Nonetheless, trends in the mineral industry as a whole and on some specific commodities are clear when comparing the official figures covering previous fiscal years.

Crude mineral extraction in 1969–70 showed only a slight overall increase in value over 1968–69. Presumably, natural gas, oil, coal, rock salt, and all mine and quarry products are included in the definition of crude minerals. Conversely, the value added items such as marine salt, cement, refined petroleum, metal products,

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[1] Physical scientist, Division of Nonmetallic Minerals.

[2] Where necessary, values have been converted from Pakistani Rupees (PRs) to U.S. dollars at the rate of PRs 4.7619 = US $1.00.

fertilizers, and chemicals are no doubt excluded, even though these items are clearly mineral products. The fuels headed by natural gas contributed the major share of Pakistan's crude mineral output value.

Comparison of tonnage changes during 1968–69 and 1969–70 indicated that; Natural gas gained about 14 percent; coal, chromite, fertilizers, and limestone production increased; oil, gypsum, cement, marine and rock salt, and silica sand production declined.

Table 1.—Pakistan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum, bauxite, gross weight	890	2,213	795
Antimony mine output, metal content [e]	84	NA	NA
Chromium, chromite, gross weight	26,021	23,625	[e] 28,000
Iron and steel:			
Iron ore	76	--------	--------
Crude steel ... thousand tons	[e] 100	[e] 100	[e] 100
Lead ore, gross weight	--------	--------	6
NONMETALS			
Barite	10,356	[e] 5,000	[e] 6,000
Cement, hydraulic ... thousand tons	2,437	2,678	2,632
Chalk	565	NA	NA
Clays:			
Bentonite	439	NA	NA
Fire	21,204	21,651	28,113
Kaolin (china)	3,082	3,603	7,100
Fertilizer materials manufactured:			
Nitrogenous:			
Gross weight [2]	188,934	316,526	350,417
Nitrogen content [2]	76,219	135,648	148,746
Phosphatic, gross weight	18,834	17,268	23,308
Gypsum, crude	46,000	205,410	167,522
Magnesite, crude	1,631	NA	NA
Natron manufactured (soda ash)	41,286	56,167	73,132
Pigments, natural mineral, ochers	338	659	[e] 2,300
Quartz and related materials, silica sand ... thousand tons	151	[3] 47	[3] 32
Salt:			
Rock ... do	327	356	316
Marine, evaporated ... do	571	554	445
Total ... do	898	910	761
Stone, sand and gravel, n.e.s.:			
Dimension stone, calcareous, aragonite, and ordinary marble	14,562	15,311	22,430
Crushed and broken, limestone and other calcareous ... thousand tons	1,968	2,754	[e] 2,800
Other (use not specified), dolomite	12,718	NA	NA
Strontium minerals, celestite	650	772	[e] 300
Talc and related materials, soapstone	2,617	2,255	NA
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades ... thousand tons	1,274	[e] 1,300	[e] 1,400
Gas, natural, sales ... million cubic feet	91,525	116,921	133,856
Natural gas liquids ... thousand 42-gallon barrels	39	[e] 49	[e] 56
Petroleum:			
Crude oil ... do	3,305	3,500	3,400
Refinery products:			
Gasoline, aviation ... do	154	318	NA
Gasoline, motor ... do	[r] 2,367	2,550	NA
Jet fuel ... do	2,463	2,911	NA
Kerosine ... do	2,975	4,649	NA
Distillate fuel oil ... do	5,928	7,492	NA
Residual fuel oil ... do	9,756	11,014	NA
Lubricants ... do	348	524	NA
Other ... do	1,893	2,698	NA
Refinery fuel and losses ... do	1,724	1,990	NA
Total ... do	27,608	34,146	NA

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

[1] In addition to the commodities listed, Pakistan produces a variety of additional crude construction materials (clays, gravels, sand and stone) as well as steel semimanufactures and sulfur, but available information is inadequate to make reliable estimates of output levels.

[2] Data are for urea and ammonium sulfate; ammonium nitrate is also produced, but recent data are not available for this commodity owing to Pakistan Government restrictions. In the year ending June 30, 1965 (latest available data), output of ammonium nitrate totaled 76,086 tons (gross weight) with a nitrogen content of 26,630 tons.

[3] Partial figures; Punjab and Sind Provinces only.

TRADE

Pakistan's overall trade in 1969–70 showed very minor increases in both exports and imports over 1968–69. Imports were approximately $1,070 million as compared with exports of $700 million, or an imbalance of $370 million during 1969–70. Few minerals have been available for export. Excluding petroleum products which were derived mainly from imported crude oil, accountable mineral exports added up to only about $8 million, headed by cement, chromite, stone and sand and gravel. Imports of minerals, metals, and fuels totaled about $259 million or nearly one-fourth of all imports.

The following tabulations show the value of recorded mineral commodity exports and reexports and mineral commodity imports, respectively.

Table 2, based on available official trade information, provides partial quantitative data on exports and reexports of selected commodities.

Commodity or commodity group	Value of exports and reexports (million dollars)	
	1968–69	1969–70
Chromite	NA	1.4
Other metallic ores	NA	.2
Metals including scrap	0.2	.1
Cement	2.6	3.8
Fertilizer materials	2.0	----
Gem stones, except diamond	(1)	.4
Salt	.6	.4
Stone, sand and gravel	(1)	1.0
Petroleum and petroleum products	8.6	10.5
Other	1.6	.4
Total	15.6	18.2

NA Not available.
[1] Included with other.

Commodity or commodity group	Value of imports (million dollars)	
	1968–69	1969–70
Iron and steel including scrap	124.5	95.3
Other metals including scrap	16.2	16.7
Fertilizer materials	36.2	71.5
Coal	13.1	8.1
Crude petroleum	r 38.0	43.5
Refined petroleum	19.6	10.9
Other	15.0	13.2
Total	262.6	259.2

r Revised.

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

(Metric tons unless otherwise specified)

Commodity	1968–69	1969–70
METALS		
Aluminum including alloys, semimanufactures	4	1
Chromium ores and concentrates	[2] 1,100	51,455
Copper including alloys:		
Matte	--------	44
Semimanufactures	NA	7
Iron and steel:		
Scrap	3,302	9
Semimanufactures	NA	517
Zinc:		
Ores and concentrates	--------	20
Metal including alloys, semimanufactures	NA	4
Other ores and concentrates unspecified	NA	6,300
NONMETALS		
Barite	2,756	4,808
Cement, hydraulic	[3] 213,694	288,714
Chalk (including French chalk)	NA	31
Clays and products:		
Crude (including fuller's earth)	NA	306
Fire bricks	NA	256
Fertilizer materials, nitrogenous (urea only)	[3] 20,853	--------
Gem stones other than diamond ... kilograms	--------	19,108
Gypsum	4,978	9,241
Mica	NA	4
Salt	127,911	102,887
Stone, sand and gravel:		
Dimension stone	[3] 7,937	11,091
Crushed and broken stone	NA	228
Sand	687	422
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke	819	1,222
Petroleum:		
Crude ... thousand 42-gallon barrels	--------	139
Partly refined ... do	--------	5,186
Refinery products:		
Gasoline ... do	[3] 103	75
Kerosine and jet fuel ... do	(4)	2
Distillate fuel oil ... do	[3] 149	205
Residual fuel oil ... do	[3] 5,056	3,791
Lubricants ... do	[3] NA	7
Other ... do	NA	1

NA Not available.

[1] Commodities listed had a total value of $8,146,000 in 1968–69 and $18,214,000 in 1969–70; these were about 52 percent and nearly 100 percent, respectively, of total mineral commodity exports on a value basis. Quantitative data on commodities accounting for the substantial balance of mineral commodity export value in 1968–69 were either totally unavailable or significantly incomplete.

[2] Officially reported figure; other sources indicate substantially larger exports.

[3] In addition to commodities listed specifically, additional materials classified under these headings were exported, but only value data are available.

[4] Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—Although an agreement had been reached in March 1968 between the Governments of Pakistan and Iran and the Reynolds Aluminum Corp. (United States) for the erection of a 50,000 ton-per-year aluminum plant at Ark, Iran, there was no news of startup of construction by yearend 1970. If the agreement is implemented, Pakistan will own a 10 percent share of this joint venture.

Pakistan produces small quantities of bauxite for internal nonaluminum use. Output of material for this purpose declined sharply from 2,213 tons in 1969 to 795 tons in 1970.

Chromite.—Pakistan produced about 14,030 tons of metallurgical chromite during the last half of 1970—slightly higher than the corresponding period in 1969. However, Pakistan's chromite reserves are reported to exceed 3 million tons and it can be assumed that current output levels can be supported during the near future.

During the fiscal year 1969–70, 51,455 tons of chromite were exported to the following countries: Poland, 22,600 tons; the United States, 22,202 tons; mainland China; 3,353 tons; Japan 3,300 tons. During the calendar year 1970, approximately 30,500 tons of 48 percent Cr_2O_3 grade chromite valued at about $1 million was shipped to the United States.

Iron and Steel.—Pakistan's fourth 5-year plan, introduced in midyear, for the period 1970–75 called for the production of 300,000 tons of iron ore and 750,000 tons of steel annually by the end of the plan period. Achievement of these goals will require increasing imports of iron ore or development of domestic iron resources. Although sizeable deposits of iron are found in Pakistan, beneficiation problems are difficult. Iron and steel facilities constructed during the fourth 5-year plan, therefore, probably will use imported iron ore as the metal source. Noniron minerals, for use as fuel and flux in steel manufacture, may also have to be imported.

As of 1970, West Pakistan had only very small steel facilities. There have been, however, many proposals to build a larger one in the West Wing. On the other hand, a 150,000-ton steel plant was in operation in East Pakistan, at Chittagong.

Uranium.—During the year, a bilateral agreement was reportedly signed between Pakistan and the U.S.S.R., calling for technical collaboration in the peaceful uses of atomic energy for an initial period of 10 years. The agreement covered nuclear-power reactor technology, nuclear materials, the uses of radio isotopes and radiation, and the desalinization of water by atomic energy. Scientific and technological information was to be exchanged between the two countries. The Soviet State Committee for the Utilization of Atomic Energy will give assistance to the Pakistan Atomic Energy Commission in the purchase of equipment, nuclear instruments and other material required for the development of atomic energy. The two countries will also exchange visits of scientists and specialists.

NONMETALS

Barite.—Although details of operations are not known, Pakistan's new barite industry has an annual production capacity of about 10,000 tons. Production in 1967 and 1968 was 50 and 60 percent of capacity, respectively. The bulk of the barite is exported for use in oil well drilling. From July 1969 through June 1970, 4,808 tons were exported, including 2,800 tons to the Middle East (mainly Bahrain and Dubai) and 1,400 tons to Indonesia.

Cement.—During the year, 10 cement plants were in operation. Nine of these were located in West Pakistan, producing 97 percent of the nation's total production of 2,632 million tons. During fiscal 1969–70, Pakistan exported about 289,000 tons of cement, chiefly to the lesser Arab States.

Powell Duffryn Technical Services, Ltd., has been contracted by the East Pakistan Industrial Development Corp. (EPIDC) to prepare specifications for the invitation of bids to develop a new project at the Jaipur Hat limestone deposit in East Pakistan. The development of a mine, with a daily production capacity of 5,500 tons, by sinking two shafts through 1,500 feet of water-bearing strata, is planned. In addition, a cement plant with a daily capacity of 2,000 tons of cement and 1,000 tons of clinker will be established. The clinker will be transported elsewhere for milling into cement. Establishment of such a facility will sharply raise East Pakistan's overall capacity.

Fertilizer Materials.—Five plants were in the business of producing various chemical fertilizers such as urea, superphosphate, ammonium phosphate and ammonium nitrate. Four of these plants were located in West Pakistan. Urea production in 1969–70 increased to about 350,417 tons, nearly 33,891 tons more than in 1968–69. Corresponding data were not available for ammonium nitrate but output in 1969–70 probably exceeded 55 percent of the rated capacity of 8,600 tons per year. Pakistan also produced 23,308 tons of superphosphate and 58,000 tons of ammonium sulfate in 1969–70, all in West Pakistan.

Additional plants for producing nitrogenous fertilizers have been planned or were in the process of construction. If all these plans are implemented, Pakistan will have an annual urea capacity of more than 2 million tons and an annual ammonium sulfate capacity of about 700,000 tons.

Graphite.—As of 1970, at least two graphite deposits show promise in terms of possible future development. A deposit at Reshain, located in the central mountain chain of the Koffir Kahn Range, is primarily made of metamorphased sediments with occasional igneous intrusions. The graphite occurs as large lenticular bodies of graphitic schist within certain zones which together have a stratigraphic thickness of 4,000 feet.

Another deposit is located at the boundary of two major geological divisions of Azael Kashmir. The graphitic schists, associated with limestone, are exposed in the middle and upper part of the Nauseri formation. Although grade is generally poor, workable graphite beds occur in the form of crystalline graphite in the lower part of the formation.

Salt.—At yearend 206 solar evaporation operations were in existence. East Pakistan with 191 operations and West Pakistan with only 15 operations, each produced about the same quantity of marine salt. Pakistan's output of rock and marine salt declined somewhat as compared with 1969. Rock salt was produced in six mines in West Pakistan, specifically at Khewra, Warha, Kalabagh, Jatta, Bahadurkhel and Karak. Solution mining was being considered. Overall in 1970, Pakistan produced about 761,000 tons of salt (approximately 60 percent marine salt) and exported about one-sixth of total output.

MINERAL FUELS

Pakistan energy consumption from all forms of available commercial fuels was estimated at 8.86 million tons of fuel oil equivalent in 1970, a slight increase from 8.18 millions tons of fuel oil equivalent in 1969. During the year, the contribution of the various fuels to the national energy requirement was estimated as follows: Oil, 45.8 percent; natural gas, 28.5 percent; coal, 15.9 percent; and hydroelectric power, 9.8 percent.

Coal.—The fourth 5-year plan anticipates the continued development of domestic coal resources, and a target production of 3.5 million tons annually has been established for fiscal 1974–75. This is nearly three times the output in 1969–70, the last year of the third 5-year plan. Actual output in 1969–70 was much below the production target.

Construction of a coal briquetting plant has been approved for the Makerwal/ Gullakhell coal mines at Makerwal. The plant will use unmarketable coal fines as the starting material for the annual production of 20,000 tons of briquets. If these briquets are eventually produced, steam coal imports can be reduced and foreign exchange saved.

Coal is mined in West Pakistan primarily by private operators. The coal is low grade and has the following characteristics: Volatile matter, 35 to 40 percent; ash content, a maximum of 35 percent; sulphur, 0.5 to 3.5 percent; calorific value, 7,400 to 10,500 British thermal units (Btu) per pound. Mining conditions are generally difficult. Most of the coal is consumed locally because of transportation limitations and the low grade of the coal. West Pakistan's overall coal reserves have been estimated at 335 million tons, but recoverable tonnage is probably much less.

East Pakistan relies on imports to meet its coal needs. However, this area has deep-lying coal in the Rajshahi district, and the reserves there may be comparable to those of West Pakistan. There were plans to sink two 3,900-foot-deep shafts at Jamalganj.

Natural Gas.—During 1970, Pakistan's output of natural gas, derived from six gasfields and one oilfield increased 14 percent over the 1969 level. The group of producing fields remained unchanged from that of the previous year, but the share of the total accounted for by each field showed some variation, as indicated in the following tabulation, that compares performances of the gasfield in 1969 with those in 1970:

Field	Output (million cubic feet) 1969	1970
East Pakistan:		
Chhatak	710	800
Habiganj	4,410	6,020
Titas		8,030
Sylhet	5,636	5,571
West Pakistan:		
Dhulian (oilfield)	6,239	9,900
Mari	9,186	10,094
Sui	90,740	93,441
Total	116,921	133,856

Natural gas was discovered in 1969 at Sari Singh, which lies between Karachi and Hyderabad. Reserves were estimated at 30,000 million cubic feet and were expected to provide gas for commercial use for a period from 8 to 9 years. This natural gasfield can be expected to supply gas for the natural gas purification plant at Sui. The Pakistan Government may encourage the development of this field because of its proximity to the industrial consumption centers of Karachi and Hyderabad.

Petroleum.—Crude oil production, mainly from the Dhulain and Balkassar fields in West Pakistan, declined slightly to 3.4 million barrels. This was far from adequate to meet demand, and 28 million barrels had to be imported.

Three refineries are available for processing imported crude oil, two at Karachi (53,000 and 12,000 barrels per day) and one at Chittagong in East Pakistan (30,000 barrels per day). A fourth refinery—Morgah (10,000 barrels per day) near Rawalpindi processes domestic crude petroleum. Very large tonnages of refined petroleum were also imported as such.

The West German oil firm, Wintershall A.G., signed an agreement with the Government of Pakistan in June 1969 for concession rights to two blocks of 5,000 square miles in the offshore areas of Karachi and Tatta for an initial 3-year period. The Government was to retain a 7.5-percent working interest. Rights were reserved for the Government to acquire an additional 32.5-percent interest, provided payment is made on prediscovery expenditures on a prorated basis.

A seismic survey of the Karachi coast and the Tatta district has been completed by Wintershall A.G. Additional studies were conducted in the adjacent areas of Sind and Baluchistan. Drilling may be undertaken, if warranted by survey results.

The Mineral Industry of Peru

By Frank E. Noe [1]

The military junta, which took control of the Government in 1968, undertook widespread social and economic reforms during the year. For the first time since 1966, Peru achieved an economic growth rate of more than 5 percent in real terms. Sparked by a heavy rate of monetary expansion, record exports, an accelerated rhythm of government construction, and a substantial increase in fishery production, the economy gained momentum as the year progressed and finished with a 7.3-percent increase in the real gross national product (GNP). Although the mining industry was responsible for the major share of export values, the mining sector made the smallest contribution to the GNP, only 3.8 percent. Under the impact of declining prices and production losses stemming from labor disputes, the export sales of Peru's principal mineral products fell off 33 percent during the last quarter of the year. The National Society of Mining and Petroleum indicated that total losses in production during September and October from strikes amounted to almost 300,000 tons of exportable material worth about $26 million. Labor relations in the mining industry deteriorated sharply in the last quarter. Although agreements with unions were in effect, strike activity became frequent, with costly consequences. The mining unions acted on the basis of a solidarity agreement, which made it possible to bring 85 percent of mine production to a standstill by simultaneous sympathy strikes. Despite a warning by the Minister of Labor that his Ministry would be inflexible in punishing all those who continued to create situations that would affect normal working activities, labor unrest in the mining sector remained unresolved at yearend.

The Government kept the mining industry off balance throughout the year by means of a series of decrees which changed the rules of the game as the year progressed. By so doing, the Government gained control of just about every major unworked mineral concession worth having in the country. Although aimed primarily at American companies, which held large unworked concessions, Peruvian companies as well as those of other countries lost concessions in the Government's drive for immediate development of all unworked concessions. The first move against the industry's status quo came in September 1969, when the Government issued Decree 17792 to force work on inactive concessions. Concession holders had to present "work calendars" by December 31, 1969, outlining development plans to reach minimum production capacity by April 1975. Failure to submit a work calendar meant the loss of the concession. Nearly all companies filed these plans, but out of a total of 537 presented, the Ministry of Energy and Mines objected to about 400, including the calendars for all of the big projects such as Cerro Verde, Antamina, Michiquillay, and Quellaveco. The main objection made by the Ministry was that the work schedules, as presented by the companies, did not call for sufficiently fast development of the mines. Of the 400 work schedules that met initial objection, a new deadline of March 31 was set for resolution of Government-company differences.

On April 14, the Government issued Decree 18225, the Normative Mining Law, which set forth basic principles that were to be incorporated into a new mining law to replace the 1950 Mining Code. The fundamental elements of this measure embody a revised tax structure, incentives for establishing mixed companies with State participation, and provisions for a Government monopoly on marketing all minerals

[1] Supervisory physical scientist, Division of Nonferrous Metals.

and on the refining of copper. The decree also authorized the establishment of an autonomous government agency, Empresa Minera del Peru (Minero-Peru). The organic law for the operation of Minero-Peru was not published until October 13 as Decree-Law 18436. Minero-Peru has administrative and economic autonomy and has been assigned an authorized capital of approximately US$250 million to be fully subscribed by the State. It has been assigned the management of all State mining activities as well as the economic development of its subproducts and will represent the State in the mixed mining companies that the Government appears interested in promoting. It is also charged with mining promotion programs, research and technological development, and all types of operations related to the mining industry. It will also exercise the State monopoly on the purchase of all minerals produced in Peru for domestic and export sale. Marketing of copper by Minero-Peru was not to start until October 1971. Among the benefits enjoyed by mining companies under the 1950 Mining Code, which have been eliminated by the Normative Mining Law, were the right to deduct from profits the losses from the 5 preceding years; the right to reinvest—once the contract was expired—up to 50 percent of profits, tax-free; and protection against tax increases during 6 years after the end of a contract. Decree 18225 permits a concession holder to only reinvest, tax-free, up to 30 percent of his pretax profits, but the reinvestment is limited to about $5 million. The "regulatory clauses" that were to give detailed operating instructions and could substantially weaken or strengthen the decree had still not been issued at yearend.

Apparently deciding that the "work calendar" rules of 1969 were not making things move fast enough, the Government issued Decree 18368 on August 14, which required concessionaires to resubmit their calendars of operation applying the critical path method to their projects. The decree applied to all concession holders who had submitted calendars of operations under Decree 17792 and to any project involving at least a $1.5 million investment. New calendars were to be presented before September 30, and the Director of Mining had 30 days thereafter to approve them or make observations. If such observations were made, the company was to have 30 days to make the necessary changes. Failure to present a readjusted calendar or to correct it in accordance with the observations, or disapproval of an adjusted calendar, were causes for the lapse of a concession. Another stipulation of the August decree was that concessionaires were to secure, before December 31, financing for their projects and were to present the pertinent documents to the Director of Mining who, with the advice of the Ministry of Economy and Finance, would have 30 days to approve financing arrangements. Failure to present the documents or their disapproval by the Director would be grounds for lapse of the concession. Decree 18368, then, was the mechanism by which the Peruvian Government recovered all of the major unexploited mining concessions. At yearend, more than 230 mining claims had reverted to State ownership for failure to comply with the provisions established under this decree. At yearend, it was unclear as to what the Government intended to do with all of its new concessions.

PRODUCTION

Preliminary figures indicate that production of most minerals produced during the year increased in comparison with those of 1969. An unfortunate wave of strikes, which began in September and continued intermittently throughout the remainder of the year, was responsible for the failure of the industry to set new record highs. Production of pig iron and iron and steel products dropped over 50 percent owing to the May earthquake, which curtailed the availability of power and caused some structural damage to the plant.

Production figures for metals in Peru essentially represent a calculated recoverable content. In calculating recoverable metals, the Statistical Section of the Mining Department, Ministry of Energy and Mines reportedly has deducted from the assayed metal content of the ores and

Table 1.—Peru: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Antimony:			
Mine output, metal content	786	613	1,167
Metal	352	364	408
Arsenic, white	1,227	481	772
Bismuth:			
Mine output, metal content	809	680	806
Metal	792	652	763
Cadmium:			
Mine output, metal content	450	443	482
Metal	172	168	186
Copper:			
Mine output, metal content	212,537	198,803	220,225
Copper sulfate	728	723	764
Metal:			
Blister	147,624	133,926	140,741
Refined	38,500	34,465	36,178
Gold:			
Mine output, metal content troy ounces	105,118	131,638	107,675
Metal do	65,780	75,170	55,794
Indium kilograms	312	997	1,557
Iron and steel:			
Iron ore and concentrate thousand tons	9,015	9,270	9,713
Pig iron (excluding blast furnace ferroalloys) do	111	176	e 86
Steel ingot and casting do	106	192	e 94
Lead:			
Mine output, metal content	154,524	154,543	156,770
Metal	86,421	77,923	72,510
Manganese:			
Ore and concentrate, gross weight	7,153	12,000	1,922
Metal content	2,432	2,656	635
Mercury 76-pound flasks	3,022	3,592	3,196
Molybdenum, mine output, metal content	805	224	607
Selenium kilograms	5,766	6,841	6,755
Silver:			
Mine output, metal content thousand troy ounces	36,362	35,886	39,836
Metal do	21,363	19,525	21,906
Tellurium kilograms	r 24,033	17,287	28,235
Tin, mine output, metal content long tons	99	70	101
Tungsten, mine output, metal content	r 554	689	827
Zinc:			
Mine output, metal content	291,404	300,003	299,136
Metal, refined	65,788	62,277	68,689
NONMETALS			
Barite	33,906	148,839	236,321
Cement, hydraulic thousand metric tons	1,109	1,137	1,144
Clays:			
Bentonite	12,817	25,918	35,578
Fire	r 5,685	30,955	32,245
Kaolin	1,024	1,604	1,549
Common	r 121,329	154,429	51,658
Diatomite	3,022	20,597	2,559
Feldspar	1,889	1,035	2,863
Gypsum:			
Crude	35,684	45,024	80,975
Calcined	29,957	38,378	56,595
Lime	7,659	20,953	9,715
Phosphate, guano	77,010	20,112	50,226
Salt, all types	r 116,325	92,802	190,577
Stone:			
Dimension, marble [1]	14,382	6,868	1,092
Crushed and broken:			
Dolomite	r 4,553	8,142	5,123
Gravel and sand thousand tons	1,406	2,233	2,422
Limestone do	1,567	1,078	1,841
Silica	61,310	35,358	37,454
Talc and related materials, pyrophyllite	r 6,320	7,818	7,908
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite	7,491	7,588	20,069
Bituminous	153,115	154,181	136,000
Coke, all types	41,727	47,716	29,412
Gas, natural, gross production million cubic feet	75,792	74,452	75,183
Natural gas liquids thousand 42-gallon barrels	987	987	949

See footnotes at end of table.

Table 1.—Peru: Production of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude ... thousand 42-gallon barrels	27,056	26,329	26,272
Refinery products:[2]			
Aviation gasoline ... do	27	30	12
Motor gasoline ... do	9,613	9,744	9,523
Jet fuel ... do	1,322	1,420	1,536
Kerosine ... do	3,886	3,792	3,963
Distillate fuel oil ... do	6,695	6,823	6,719
Residual fuel oil ... do	8,162	7,766	7,765
Liquefied petroleum gas ... do	233	272	310
Lubricants ... do	64	65	79
Asphalt ... do	161	215	285
Other ... do	93	336	102

e Estimate. p Preliminary. r Revised.
[1] Includes ground marble.
[2] Excludes refinery fuel and losses.

concentrates 5 percent for copper and lead; 10 percent for zinc, iron, manganese, molybdenum, and tungsten; and 35 percent for arsenic, bismuth, cadmium, and tin. These deductions were based on average recoverability experience.

TRADE

In 1970, for the first time, Peru's exports surpassed the $1 billion mark. Unofficial figures indicated a total foreign exchange income of US$1,048 million. Income from exports during 1968 and 1969 was US$866 million in both cases.

As before, minerals accounted for the major share of the total foreign exchange income; provisional figures for minerals were US$512 million, or 49 percent. Total value of mineral exports increased 7.6 percent in comparison to 1969; the increase in volume of mineral exports was only 3.5 percent. The National Society of Mining and Petroleum reported that production loss due to strikes resulted in a loss of exports valued at about $26 million.

Copper shipments during 1970, at 215,600 tons, were 7.5 percent above 1969 exports of 200,500 tons, though because of the sharp downturn in international copper prices during the last half of the year, total copper income for 1970 was only US$10 million over the previous year's total. Copper exports represented 25.7 percent by value of total exports and 52.6 percent of the value of all mineral exports.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1968	454	866
1969	476	866
1970 p	512	1,048
Imports:		
1968	74	630
1969	62	600
1970 p	NA	619
Trade balance:		
1968	+380	+236
1969	+414	+265
1970	NA	+429

p Preliminary. NA Not available.

Value of exports of zinc and silver was up 20.5 percent and 6.9 percent, respectively. The United States, Japan, and West Germany represented the major mineral markets for Peru. The five minerals listed in the following table constituted about 94 percent of the value of minerals exported:

Table 2.—Peru: Selected mineral products exported (f.o.b.)

Mineral product (fine content)	1968 [1]		1969 [1]		1970 [2]	
	Quantity (metric tons)	Value (millions)	Quantity (metric tons)	Value (millions)	Quantity (metric tons)	Value (millions)
Copper	206,531	$234	200,523	$259	215,572	$269
Silver	1,033	69	1,065	58	1,171	62
Iron ore	r 8,532,345	63	r 9,040,599	r 63	10,050,146	66
Lead	153,603	29	156,157	35	159,040	35
Zinc	303,788	33	310,843	39	331,996	47

r Revised.
[1] Ministerio de Economia y Finanzas, Dirección General de Aduanas, Lima, Peru. Estadística del Comercio Exterior, 1969, 519 pp.
[2] U.S. Embassy, Lima, Peru. State Dept. Airgram A–88, Mar. 26, 1971, 1 p., 2 encl., 4 pp.

Table 3.—Peru: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Antimony:			
Ore and concentrate	1,346	975	West Germany 253; Belgium-Luxembourg 182; Brazil 182; France 139.
Metal including alloys, all forms	367	89	All to United States.
Arsenic, trioxide	707	208	Do.
Bismuth metal including alloys, all forms	807	702	United States 231; Belgium-Luxembourg 161; Netherlands 161; West Germany 73.
Cadmium:			
Intermediate metallurgical products	71	21	NA.
Metal including alloys, all forms	165	166	United States 77; Netherlands 61.
Copper:			
Ore and concentrate	107,842	208,762	Mainly to Japan.
Matte and cement	290	1,135	Japan 675; Spain 425.
Metal including alloys:			
Blister	144,937	135,835	United States 90,290; West Germany 14,283.
Refined	33,905	32,479	Netherlands 14,815; United States 6,272.
Semimanufactures	101	234	Denmark 113; Bolivia 67; Ecuador 54.
Gold:			
Ore and concentrate [1] troy ounces	24,679	38,718	(2).
Metal unworked or partly worked [1] do	10,719	13,883	(2).
Iron and steel:			
Iron ore, concentrate, and pellets	8,532,345	9,040,599	Mainly to Japan.
Metal scrap	13,030	31,134	Japan 21,031; Argentina 8,048.
Lead:			
Ore and concentrate	154,619	167,514	Japan 49,638; United States 44,784; Belgium-Luxembourg 33,130.
Metal including alloys, all forms	79,134	75,945	Mainly to United States.
Mercury 76-pound flasks	3,514	2,109	Mainly to Japan.
Molybdenum ore and concentrate	1,175	662	West Germany 383; France 166; United Kingdom 78.
Selenium, elemental kilograms	5,542	5,424	Mainly to United States.
Silver:			
Ore and concentrate [1] thousand troy ounces	12,748	16,111	(2).
Metal including alloys: [1]			
Refined and electrolytic do	16,845	14,541	(2).
Blister and mixed bars do	3,608	3,587	(2).
Tellurium, elemental kilograms	11,433	17,795	United States 11,599; Netherlands 6,169.
Tin:			
Ore and concentrate long tons	185	162	Mainly to United Kingdom.
Metal including alloys do	40	--	
Tungsten ore and concentrate	867	2,268	Belgium-Luxembourg 1,147; Japan 535; United States 200.
Zinc:			
Ore and concentrate	477,750	484,091	Japan 295,235; United States 100,754.
Metal including alloys, all forms	56,420	59,478	United States 27,554; Brazil 11,392; Netherlands 4,699.
Other:			
Ash and residue containing nonferrous metal	65	--	
Base metals including alloys, all forms, n.e.s.	--	1	Mainly to United States.

See footnotes at end of table.

Table 3.—Peru: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS			
Barite and witherite	86,371	106,821	Mainly to United States.
Cement	27,966	58,271	Argentina 32,600; Bolivia 25,421.
Clays and products (including all refractory brick):			
Crude, bentonite	81	50	All to Ecuador.
Products	80	26	Bolivia 16; Ecuador 10.
Fertilizer materials, crude and manufactured	r 1,220	2,791	United States 1,014; Japan 1,007.
Salt	221	529	All to Ecuador.
Stone, sand and gravel	31	--	
MINERAL FUELS AND RELATED MATERIALS			
Gas, hydrocarbon, natural gas liquids	115	216	All to Ecuador.
Petroleum:			
Crude thousand tons	488,987	289,629	United Kingdom 154,454; Brazil 50,636; Argentina 36,218.
Refinery products:			
Kerosine	9	--	
Distillate fuel oil	49,268	12,476	NA.
Residual fuel oil	48,261	27,785	Panama, excluding Canal Zone 9,053.
Lubricants	1,068	57	NA.
Other	--	19	All to Bolivia.

r Revised. NA Not available.
1 Content in ores, concentrates, and refinery products of base metals included.
2 Country distribution not separately reported.

Source: Estadística del Comercio Exterior. Ministerio de Economia y Finanzas, Dirección General de Aduanas, Lima, Peru, 1968, 626 pp; 1969, 519 pp.

Table 4.—Peru: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	1,202	1,562	United States 814; West Germany 548; Guyana 200.
Oxide (alumina) and hydroxide	1,461	2,327	Mainly from West Germany.
Metal including alloys:			
Unwrought	3,361	2,947	Canada 1,485; United States 1,452.
Semimanufactures	1,720	1,641	United States 308; France 237; Austria 230; West Germany 228.
Arsenic, natural sulfides kilograms	--	4,426	All from United States.
Cadmium metal including alloys, all forms do	104	262	West Germany 137; United States 125.
Chromium:			
Oxide and hydroxide do	23,583	28,449	Mainly from West Germany.
Metal including alloys, all forms do	1,749	391	All from United States.
Copper metal including alloys, all forms:			
Unwrought	9	2	Belgium-Luxembourg 1; United Kingdom 1.
Semimanufactures	641	570	West Germany 123; Chile 83; Italy 69; Sweden 60; Japan 46; United Kingdom 40.
Gold, unworked or partly worked troy ounces	77	67	All from West Germany.
Iron and steel:			
Ore and concentrate	60	25	All from United States.
Metal:			
Scrap	7,114	2,942	Do.
Sponge iron, powder, shot	128	141	Mainly from United States.
Ferroalloys	1,423	936	Mainly from Republic of South Africa.
Steel, primary forms	212	130	United Kingdom 83; United States 34.
Semimanufactures	134,504	155,036	Japan 78,815; United States 23,401; West Germany 9,949.
Lead metal including alloys, all forms	77	45	United States 21; United Kingdom 13; Japan 6.
Magnesium metal including alloys, all forms kilograms	8,425	5,220	Mainly from United States.
Mercury 76-pound flasks	2	8	Mainly from West Germany.
Nickel metal including alloys, all forms	48	33	Do.

See footnotes at end of table.

Table 4.—Peru: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Platinum-group metals including alloys, all forms troy ounces	527	186	Mainly from Switzerland.
Selenium and tellurium	2,503	223	All from West Germany.
Silver metal including alloys troy ounces	4,212	--	
Tin metal including alloys, all forms long tons	195	203	United States 63; Malaysia 41; Denmark 31; Taiwan 30.
Titanium, oxide	1,394	1,298	West Germany 449; Finland 417; United Kingdom 207.
Zinc:			
Oxide	11	15	United States 9; West Germany 5.
Metal including alloys:			
Unwrought	5	7	Mainly from West Germany.
Semimanufactures	129	128	West Germany 39; United States 38; United Kingdom 19.
Other:			
Ore and concentrate	1,049	1,621	Mainly from United States.
Metals including alloys, all forms	1	11	Do.
NONMETALS			
Abrasives, natural, n.e.s	222	249	United States 63; West Germany 50; United Kingdom 29; Japan 15.
Asbestos	3,967	2,694	Canada 2,202; United States 244.
Barite and witherite	202	248	Mainly from Italy.
Boron materials	178	249	Mainly from United States.
Cement	27,871	12,091	Venezuela 3,585; Colombia 2,887; West Germany 2,384.
Chalk	843	899	Mainly from France.
Clays and products (including all refractory brick):			
Bentonite	1,280	439	Mainly from United States.
Kaolin	2,928	2,918	United Kingdom 1,601; United States 1,295.
Other	2,184	2,023	United Kingdom 1,084; Czechoslovakia 303; Japan 233.
Diatomite and other infusorial earths	1,225	1,849	Mexico 1,285; United States 518.
Feldspar and fluorspar	1,474	745	Republic of South Africa 404; Canada 147.
Fertilizer materials:			
Nitrogenous, crude and manufactured	r 102,140	78,751	West Germany 22,993; United States 12,733; Netherlands 12,594.
Phosphatic:			
Crude	6,968	11,187	All from United States.
Manufactured	54	85	West Germany 50; United States 35.
Potassic, crude and manufactured	r 6,671	8,128	France 2,765; West Germany 2,337; United States 1,771.
Other manufactured, mixed	9,667	7,642	United States 4,544; West Germany 2,636.
Ammonia	r 98	40	Mainly from United States.
Graphite, natural	62	40	Norway 15; United Kingdom 14.
Gypsum and plasters	509	282	Mainly from United States.
Magnesite	1,020	1,527	Do.
Mica, all forms	70	139	United States 85; Norway 40.
Salt	2,928	3,130	Mainly from Bahamas.
Sodium and potassium compounds	3,536	2,002	United Kingdom 1,026; West Germany 464; United States 277.
Stone, sand and gravel:			
Dimension stone	578	619	Mainly from Italy.
Dolomite	30	25	All from France.
Gravel and crushed rock	90	46	Italy 27; Belgium-Luxembourg 15.
Sand excluding metal bearing	4,239	3,085	Mainly from United States.
Quartz and quartzite	42	60	West Germany 26; Mexico 21.
Sulfur, elemental	5,663	1,069	Mainly from Bolivia.
Talc and steatite	683	802	Italy 263; United States 253; Norway 66; Netherlands 58.
Other	52	20	Mainly from Republic of South Africa.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	172	222	United Kingdom 96; Trinidad and Tobago 48; Spain 47.
Carbon black and gas carbon	2,921	3,581	United States 1,914; Colombia 1,477.
Coal including briquets, all grades	102	8,258	Canada 3,135; United States 2,640; United Kingdom 2,464.
Coke and semicoke	10,351	1,047	West Germany 713; United Kingdom 260.
Gas, hydrocarbon	34	12	Mainly from United States.

See footnotes at end of table.

Table 4.—Peru: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude and partly refined	340,249	436,018	Mainly from Venezuela.
Refinery products:			
Gasoline	270,268	27,759	Iran 16,597; Netherlands Antilles 11,158.
Kerosine and jet fuel	12,561	--	
Distillate fuel oil	408,522	304,941	Colombia 146,412; United States 116,767.
Lubricants	29,550	38,316	Mainly from United States.
Mineral jelly and wax	13,183	11,892	Indonesia 5,623; Japan 1,674; United States 1,575.
Other	434	3,902	Mainly from United States.
Mineral tar and other coal, petroleum, or gas derived crude chemicals	1,786	2,052	Do.

r Revised.

Source: Estadística del Comercio Exterior. Ministerio de Economia y Finanzas, Dirección General de Aduanas, Lima, Peru, 1968, 626 pp.; 1969, 519 pp.

COMMODITY REVIEW

METALS

Copper.—The most dramatic development in the mining industry was the recovery by the Government of the large undeveloped copper properties. During the last 5 months of the year, the Government skillfully imposed on foreign mining companies virtually impossible demands for immediate development and proof that the companies had arranged finances for their projects by December 31, 1971. The list below gives the principal properties on which concessions were annulled or otherwise lost by the former concessionaires:

Property	Former owner	Estimated reserves: Ore (million metric tons)	Estimated reserves: Percent copper	Investment required (million dollars)
Michiquillay	American Smelting and Refining Company	570	0.72	400
Antamina	Cerro de Pasco Corp	5.8	2.6	55
Tintaya	do	7	3.0	40
Chalcobamba	do	28	2.1	150
Ferrobamba	do	2	3.4	
Cerro Verde	The Anaconda Company	149	1.09	150
Berenguela	Charter Consolidated Ltd	12	1.2	NA
Quellaveco	Southern Peru Copper Corp	200	.94	200

NA Not available.

Loss of the preceding concession rights stem from Decree-Law 18368 of August 14, which was described at the beginning of the chapter. Implicit in the law, though not actually stated as a requirement, was the strong suggestion that the Peruvian Government should become a 51-percent owner. In each of the above instances, however, the companies were unable or unwilling to meet the Government's conditions for management control and majority equity position.

The principal copper producer continued to be Southern Peru Copper Corp. (SPCC) which at the beginning of 1970 held concessions to three mineral deposits, Toquepala, Cuajone, and Quellaveco, located about 75 miles inland from the southern port city of Ilo where the company also operated a smelter. Toquepala, a large, open pit mine containing low-grade copper and molybdenum ores, was the only property currently in production. The mine and concentrator were shutdown for 20 days because of three separate strikes, 17 days of which were in sympathy with strikes at other mining operations not connected with the company. Operations at the Ilo smelter were continuous throughout the year. Production of blister copper increased, and production of molybdenum concentrates improved during the year both in quantity and quality following the development of a process more suitable to the mineralogical characteristics of the Toquepala ore. Net earnings of SPCC, however, dropped about 43 percent owing to a lower average price received for copper and an increase from 54.5 percent to approximately 68 percent in the Peruvian income tax rate, which went into effect January 1, 1970.

The Cuajone deposit, estimated to be about 500 million tons of slightly over 1-percent copper ore, was being developed as an open pit mine, under an agreement signed on December 19, 1969, with the Government of Peru. Preliminary work at Cuajone is on schedule. A new access road was completed, and work was started on the railroad tunnels to link Cuajone with Toquepala, 17 air miles to the southeast. Stripping of the overburden began in November. During the year, several meetings were held with a group of European and Japanese mining and metal companies and with international financing institutions with the hope of arranging financing for the Cuajone project, which is estimated to cost about $400 million. No agreement had been reached at yearend.

The Quellaveco deposit, which has reserves estimated at approximately 200 million tons of 0.94-percent copper ores, became subject to the provisions of Decree 18368. No calendar for financing was filed for Quellaveco, since SPCC felt that Quellaveco and Cuajone made up a single economic unit and that engineering reasons dictated that Quellaveco should be developed after the Cuajone project was complete. In the absence of a financial calendar, the Peruvian Government cancelled the Quellaveco concession in early January 1971.

Salient statistics for SPCC operations for the years 1968–70 follow:

	1968	1969 r	1970
Ore and waste mined thousand metric tons	62,431	58,333	62,010
Ore treated do	13,056	11,980	13,896
Ore-to-waste ratio	1:3.8	1:3.9	1:3.5
Copper content of—			
Ore milled percent	1.21	1.18	1.14
Blister produced metric tons	134,010	121,774	129,631
Molybdenum concentrates do	1,426	295	1,049

r Revised.

Cerro de Pasco Corp. maintained its position as the second largest copper producer and the major producer of other nonferrous metals. Cerro presently operates six metal mines, six concentrators, and a smelting and refining complex, which is one of the most diverse and complex metallurgical treatment facilities in the world. As shown in the following tabulation from Cerro Corp.'s annual reports, production of copper, lead, zinc, and gold, declined somewhat and increases were reported for silver, tungsten, and bismuth. The decline in the principal metals produced was due primarily to a series of strikes in the latter part of 1970.

	1968	1969	1970
Copper metric tons	53,210	47,959	47,726
Lead do	86,346	77,539	71,960
Zinc:			
Refined do	65,873	62,359	68,791
In concentrates do	80,680	74,359	61,529
Bismuth do	792	652	763
Gold troy ounces	43,160	52,000	38,000
Silver thousand troy ounces	20,371	18,532	20,823

At the beginning of 1970, Cerro held concessions to develop four significant deposits—Antamina, Chalcobamba, Ferrobamba, and Tintaya. To protect its interests in these deposits, Cerro filed calendars of development on these concessions and assembled a consortium of European and Japanese mining companies to arrange a financing plan for mine development. Negotiations were begun with the Peruvian Government to reach an appropriate joint venture agreement regarding these four properties. While these negotiations were under way, the Government issued a decree which required filing by yearend of proof of financing for all affected development properties, including Cerro's. Near the end of August, the European members of the consortium withdrew because delays in negotiations made it unlikely that agreement on a joint venture could be reached in the time available. On October 29, the Peruvian Government issued resolutions terminating the four Cerro concessions and announced plans to develop the properties through a state-owned enterprise.

The Cía. Minera Condestable, S.A., owned jointly by Nippon Mining Co., Ltd., and Mitsui Mining and Smelting Co., completed expansion of the concentrating plant at its Condestable copper mine, located 94 kilometers south of Lima, in the Province of Cañete. The company began operating the Condestable mine in 1963. Initial capacity of the concentrating plant was 300 tons per day. It has now been increased to 600 tons per day, and the company expects to produce at least 15,000 tons of 24-percent copper concentrate per year, which will be exported to Japan. The mine employs 1,000 workers. In 1970 the company exported 2,884 metric tons of copper.

The Minas de Cobre de Chapi, S.A., located about 60 miles south of Arequipa, is also owned jointly by Nippon Mining and Mitsui Mining. The mine had been in production on a small scale for about 15 years before the Japanese group took it over and inaugurated a $5.5 million expansion plan. The underground ore body averages about 2.4 percent, and the mining rate is about 20,000 tons per month. Concentrates exported to Japan contained 2,940 metric tons of copper.

The Mitsubishi Metal Mining Co. Ltd. announced in Tokyo that it had begun copper prospecting at El Dorado, central Peru. Mitsubishi signed a 4-year prospecting contract with a Peruvian company, which owned mining rights over a 700-hectare area. The Japanese firm planned to spend about $100,000 during the year on a geological survey and preliminary drilling program.

Except for a brief interruption following the disastrous earthquake in May, operations at the Quiruvilca mine of Northern Peru Mining Corp., a wholly owned subsidiary of American Smelting and Refining Co., were at full capacity throughout the year. Earthquake damage to the mine, plant, and facilities was relatively minor. A total of 295,053 tons of ore was mined and milled to produce 20,433 tons of copper concentrate, 2,395 tons of lead concentrate, and 7,875 tons of zinc concentrate. These concentrates also contained 1,045,359 ounces of silver. Copper precipitated from mine drainage water amounted to 740 tons.

Iron Ore.—The Peruvian Government and the Marcona Mining Co. signed a contract in December for the expansion of the company's plant and installations to increase production of iron ore from 8.9 million to 10.7 million tons per year. The expansion called for an investment of US$25 million—$11 million from Marcona's own resources and an Export-Import Bank loan of $15 million—and is to be completed by December 17, 1971. Marcona had originally applied in 1968 to expand its installations because of the company's increased commitments to Japanese ore buyers; a contract has been under discussion with the present Government for the past 2 years. However, during this time, Marcona has had to expand its facilities without a contract and has reportedly spent about $10 million, which will be discounted from the $25 million. The contract specifically includes investments made since December 17, 1968.

The contract grants Marcona incentives allowed under Article 14, Decree-Law 18225 (the Normative Mining Law), including tax stability, accelerated depreciation, and availability of foreign exchange, all with reference to increases resulting from this new investment but only for the duration of the investment recovery period. The company will be able to import, free of duty, the machinery and equipment required for the expansion.

In general terms, the expansion will continue a program already under way, which involves the addition of more equipment for iron ore production and expansion of the treatment installations at San Nicolas. As part of the latter project, additional grinding, magnetic concentrating, and pelletizing capacity will be installed to increase the recovery of concentrate by 2 million tons per year and the production of pellets by 700,000 tons per year. Other improvements will include the addition of a third unit, with a capacity of 26,800 kilowatts, to the steam electric powerplant, an auxiliary 5,000-kilowatt diesel plant, and construction of a breakwater and dredging of the harbor to permit the handling of vessels up to 200,000 tons.

One of the clauses of the contract obligates the company to purchase all its electric power needs from the state owned Corporación de Energia Eléctrica del Mantaro, which is building the Mantaro hydroelectric plant in central Peru. The hydroelectric plant, whose first stage will produce 342,000 kilowatts, is due to go on stream in 1973. Present electric power facilities operated by Marcona will be kept on a standby basis.

The company is obligated to ship up to

50 percent of its production in Peruvian-flag vessels, as required by law. This also applies to imports of capital goods and supplies. Since no Peruvian shipping line presently has suitable bulk ore carriers—though these could be chartered and under the law called Peruvian-flag vessels—Marcona's affiliate company, San Juan Carriers, will presumably continue to carry the bulk of iron ore exports for the time being.

In 1970, Marcona Mining Co. established a new record in its 18 years of operating the Marcona mine by the shipment of 10,177,046 tons of iron ore. Of this tonnage, the quantity of pellets amounted to a high of 3,808,522 tons. The total shipments, which were loaded out in 150-vessel cargoes at the port of San Nicolas, comprised 10,050,146 tons for export and 126,900 tons for domestic consumption in Peru.

In September the Nippon Steel Corp. announced the signing of a 10-year contract with Cía. San Juan, S.A., for the import of 10 million tons of iron ore from Marcona Mining Co., apparently through the Marconaflo system by which the ore is transported in slurry form. San Juan, S.A., is Marcona's marketing and transport subsidiary. Ore shipment was to begin in April 1972 and continue for 10 years at the rate of 1 million tons per year.

Iron and Steel.—Production of pig iron and steel at Sociedad Siderúrgica de Chimbote, S.A. (SOGESA), the Government-owned steel company, was drastically reduced as a result of damage to the hydroelectric generating station and the steel mills at Chimbote caused by the earthquake of May 31.

Lead and Zinc.—Early in the year, the Homestake Mining Co. of San Francisco secured a $6.5 million financing contract from Marubeni Iida Co., a leading Japanese trading firm, to help develop the lead-zinc-copper mine controlled by Cía. Minera del Madrigal. The funds were to be used for construction of a concentrating plant to treat 500 tons of ore per day, a 2,500-kilowatt diesel electric plant, and a camp for personnel. Construction was to start by May 1, and at yearend the differential flotation mill was virtually completed. Cía. Minera del Madrigal is to supply Toho Zinc Co. Ltd. of Tokyo with 12,000 tons of lead concentrate, 14,000 tons of zinc concentrate, and 10,000 tons of copper concentrate over a 5-year term starting within 21 months from the signing of the contract.

Mitsui Mining and Smelting Co. of Japan doubled the capacity of its zinc, lead, and copper concentrator at the property of its Peruvian subsidiary, Santa Luisa, S.A. During the year, concentrates were produced containing 18,918 metric tons of zinc, 8,168 tons of lead, and 949 tons of copper. The lead and zinc concentrates were exported to Japan; while the small copper production was sold locally to Cerro de Pasco.

The Gran Bretañia mine, under option to the Toho Zinc Co., Ltd., of Japan, produced zinc concentrates containing 6,666 tons of zinc and 134 tons of manganese ore.

The Cía. Minera San Ignacio de Morococha completed installation of a concentrator to treat 700 tons per day of zinc ore at the new San Vicente mine in the Province of Tarma in central Peru. The mine has proven reserves of 1 million tons with a 20-percent grade. Initial production was at the rate of 200 tons of concentrate per day. The company planned to increase mine and mill capacity to 300 tons of concentrate per day by yearend. The concentrates are transported from the mine by truck to Oroya and by railway from Oroya to Callao at a total cost of $10 per ton. Distance from the mine to Callao is about 340 kilometers.

Cía. Minerales Santander, Inc., an affiliate of St. Joe Minerals Corp., produced 75,370 tons of zinc concentrate and 10,809 tons of lead concentrate from milling underground ore. Comparable tonnages for 1969 were 70,551 and 9,385, respectively.

Tungsten.—Mitsui Mining and Smelting Co. will invest $550,000 to build a 10-ton-per-day mill and equip the Acopalca mine in Ancash Province to produce about 120 tons per year of 65-percent WO_3 concentrate for shipment to Japan.

NONMETALS

Fertilizers.—At yearend, negotiations between the Government and the Cía. Minera Bayovar, S.A., a subsdiary of the Kaiser Aluminum & Chemical Corp., were still under way for development of the phosphate deposits in the Sechura Desert of northern Peru. At the beginning of the year, the Government had extended for

240 days a decision on the signing of a contract for developing the deposits. The decree extending the decision stated that the extension was for the purpose of deciding on the offer made by Kaiser Aluminum of transferring to the Government all or part of the shares owned by Kaiser and Cía. Minera Bayovar, S.A. In the second half of the year, the Government terminated negotiations with Minera Bayovar for the continuation of a tax agreement. Kaiser announced that although termination of the agreement would not cancel Minera Bayovar's claims, the event and the provisions of a new Peruvian law, aimed at accelerating the development of large mining projects in Peru, created questions as to the feasibility of Minera Bayovar's continuing to hold the claims. At that time, Kaiser Aluminum had invested approximately $10 million in the project.

At yearend, the managing director of Petróleos del Perú (Petroperu) announced that studies had been completed for the construction of a $40 million fertilizer plant to be erected just north of the Talara oil refinery. The fertilizer complex, which will produce up to 510 tons of urea per day, will be erected by the Japanese firm of Toyo Engineering Corp. and will incorporate the Toyo Koatzu system. The plant will consume 10 million cubic feet of natural gas per day to produce 300 metric tons of ammonia, which will be converted to urea. The complex will consist of an ammonia plant, a urea plant, a 2,000-kilowatt thermoelectric plant, and a plant for treating salt water. Over 20 firms participated in the original study for the fertilizer complex. Four final studies were chosen of which Toyo Engineering's was considered the most suitable. Studies by Petroperu indicated that domestic requirements for nitrogen fertilizers are estimated at 78,000 metric tons per year, 32,000 metric tons of which are produced locally. In 1968, Peru was estimated to have used 64,314 tons of nitrogen, 17,464 tons of phosphorus, and 4,411 tons of potassium in fertilizers.

MINERAL FUELS

Crude petroleum was produced at a rate of about 72,000 barrels per day. Some of this cannot be economically used by local refineries and is exported; this results in a net deficit of consumption over production of over 20,000 barrels per day. Imports of petroleum products to meet this deficit cost the country over $30 million per year. Current projections, based on production from currently producing fields, means that petroleum imports will be costing over $100 million per year in less than 10 years.

To rectify this situation, Petroperu, the State owned oil company, in August launched one of the largest oil exploration programs ever to be undertaken in the country. The new program will be concentrated on four areas, three in the jungle and one on the coast. Approximately $10 million per year for the next 3 years will be spent in the jungle areas and about $2 million marked for the northern coast zone, both onshore and offshore.

In the jungle, the program will have three phases. First, an aeromagnetic survey will be carried out along the Ecuadorean border area, but with some mileage being shot in Petroperu's Urubamba-Tambo reserved jungle area. Total area surveyed was to cover 9,000 linear kilometers and was scheduled to be done by a Canadian company, Geoterrex, Ltd., in September. The next stage involved seismic ground parties, the first of which started in November. The seismic studies will determine the geologic structures of the regions and give an indication of where drilling is most likely to succeed. These programs, depending on the area, will extend into mid-1973. Wildcat drilling is scheduled to begin in January 1971. Petroperu engineers say that four rigs will be used, and schedules will take the various programs through to the end of 1973.

Of the three jungle areas selected, about 70 percent of expenditures and effort will be concentrated on the Ecuadorean-frontier zone, geographically and geologically close to the major Gulf-Texaco oil discoveries made in the Ecuadorean and Colombian jungles in the past few years. Little previous exploration has been carried out in this area, which is populated only by Indians.

A smaller middle area known as San Alejandro, near Pucallpa, will be explored in a pool basis, though negotiations have yet to be completed between the three groups involved. These are Cerro de Pasco Petroleum Co., Cía. Peruana de Petróleos

"El Oriente", S.A., and Petroperu. El Oriente and Cerro Petroleum both have held concessions here for several years, and some exploration work, particularly by El Oriente, has already taken place. The first drilling will be in this area because any oil found can be quickly joined to the already existing pipeline of Cía. de Petróleo "Ganso Azul", Ltda., for processing at Ganso's Pucallpa refinery.

The third jungle area selected is in the upper Ucayali, in a sparsely inhabited region to which access is difficult. For both this region and the Ecuador frontier region, substantial reserves would have to be proved in order to make the cost of building pipelines across the Andes Mountains an economic proposition, as either pipeline would cost well over $150 million.

The other Petroperu program is for offshore exploration in an area north of Belco Petroleum Corp. of Peru's present operations; that is, from the Mancora Quebrada north to the Ecuadorean frontier. During November and December, a geophysical research vessel was scheduled to work in this area, and by 1972, Petroperu has scheduled two wildcat drilling platforms to be in operation. Onshore seismic studies will be carried out in the Talara area, for a 6-month period that began in November.

Exploration programs in the private sector also moved ahead. The Texas Petroleum Co. and Occidental Petroleum Corp. finally reached a settlement of law suits brought against each other as a result of Occidental's 1969 acquisition of large search concessions on Peru's outer Continental Shelf. As part of the settlement, Occidental will within 1 year begin drilling an exploratory well on one of the jointly held offshore concessions and will continue drilling at its own cost until either $1.5 million has been spent for actual drilling or the well reaches a depth of 12,000 feet or hits basement rock. Belco Petroleum Corp. announced plans to step up development of its offshore properties by a $20 million program over the next 2 years. It will drill six wells in deeper water near Talara, where Belco has drilled with reasonable success in the past. Belco continued development in 1970 with three fixed platforms equipped with slant derrick drilling units.

Exploration and exploitation concession holdings did not change during 1970 as Petroperu continued to hold 38,258,000 hectares, and private companies maintained 2,792,313 hectares. Sixty-thousand hectares in the coastal fields comprised the Lima concession, which is jointly held by Burmah Oil Co. and Petroperu. Continental Shelf concessions include 35,000 hectares under exploitation by Belco Petro-

Table 5.—Peru: Distribution of crude petroleum production by zone and company
(Thousand 42-gallon barrels)

Zone and company	Production 1969	Production 1970
CONTINENTAL SHELF		
Belco Petroleum Corp. of Perú	8,416	9,885
Petróleos del Perú	(1)	(1)
Total	8,416	9,885
COASTAL		
Belco Petroleum Corp. of Peru	41	42
Petróleos del Perú, Los Organos	1,574	871
Petróleos del Perú, Lima concession [2]	10,320	10,181
Petróleos del Perú, La Brea y Pariñas [3]	4,950	4,410
Petrolera Amotape, S.A.	2	--
Total	16,887	15,504
EASTERN		
Compañía de Petróleo "Ganso Azul", Ltda	621	469
Compañía Peruana de Petróleos "El Oriente", S.A	405	414
Total	1,026	883
Grand total	26,329	26,272

[1] Production figure included in "Los Organos."
[2] Jointly held by IPC and Burmah Oil Co. until July 1969 at which time the Peruvian Government confiscated IPC's interest and assigned the operation of the property to Petroperu.
[3] IPC until October 9, 1968; Peruvian Government agencies thereafter.

leum, and 800,000 hectares in two exploration concessions on the southern shelf granted to Occidental and Texaco.

A total of 30 party-months of surface geology, seismograph, and gravimeter work was carried out during the year. This was an increase of 67 percent from the 18 party-months of 1969.

All drilling was conducted in northwest Peru. Exploration drilling resulted in 28 completions—39 percent were successful with nine producing oil and two gas. Development drilling was carried out in both the coastal and offshore areas with 109 wells completed of which 95 were successful, 12 abandoned, and two suspended.

Production of crude petroleum decreased slightly from the 1969 quantity. Belco, the principal private producer, increased its production by 1,469,489 barrels over that of 1969. However, this was not enough to compensate for eight petroleum companies' production decline of 1,527,755 barrels. This decline was largely accounted for by two Petroperu oilfields, with 703,154 fewer barrels from the Los Organos concession and 539,844 fewer barrels from La Brea y Pariñas, a declining field for many years under International Petroleum Co.'s ownership. Contributions to the total supply were 59 percent from the coastal area, 38 percent from the Continental Shelf, and 3 percent from the eastern zone.

Although Peru has about 2.5 trillion cubic feet of natural gas reserves, the greater part lies on the eastern slope of the Andes Mountains or in the Amazon Basin, and therefore far from a large potential market. Petroperu accounted for about 69 percent of all the natural gas produced in Peru in 1970. La Brea y Pariñas together with the Lima concessions produced about 60 percent of Peru's gas. Practically all production came from the coastal and offshore areas. A tabulation of 1969–70 production and use of natural gas follow:

	1969	1970
Production of natural gas million cubic feet	74,452	75,183
Liquefied gas do	3,301	2,861
Used as fuel do	13,806	13,961
Used in gas-lift do	9,659	14,638
Returned to oilfield do	10,415	7,230
Flared or otherwise lost do	37,271	36,493
Utilization percent	49.9	51.5
Flared or otherwise lost do	50.1	48.5

Refinery output decreased slightly as increases at Petroperu's La Pampilla refinery and the Conchan-Chevron refinery (operated and half-owned by Standard Oil Co. of California) were insufficient to compensate for decreased production at Petroperu's Talara refinery. The following tabulation of refinery runs shows production for 1969 and 1970 in thousand 42-gallon barrels:

	Motor gasoline		Kerosine		Diesel		Residual fuel		Other (includes fuel)	
	1969	1970	1969	1970	1969	1970	1969	1970	1969	1970
Petróleos del Perú:										
Talara	6,155	5,902	2,921	3,448	5,503	4,759	4,498	4,561	1,673	1,153
La Pampilla	2,160	2,414	589	145	625	1,110	1,847	1,615	r 821	1,362
Iquitos	108	84	70	67	89	99	87	113	2	4
Refineria Conchan-Chevron, S.A	1,194	1,004	144	240	455	593	1,216	1,366	179	192
Cía. de Petróleo Ganso Azul, Ltda	127	119	68	63	151	158	118	110	1	1

r Revised.

Four refinery products accounted for 91 percent of the output as was the case in 1969. Output of these products in million barrels were as follows: motor gasoline, 9.5; residual fuel oil, 7.8; diesel oil, 6.7; and kerosine, 4.0.

Domestic consumption of petroleum products apparently has varied little compared with the previous 2 years. Preliminary figures show consumption of 10.2 million barrels of gasoline, 8.7 million barrels of fuel oil, 6.8 million barrels of diesel oil, and 4.1 million barrels of kerosine.

The Mineral Industry of the Philippines

By Brinton C. Brown [1]

In 1970 the mining industry of the Philippines established a record high production value of $281 million [2] or 4.7 percent of the gross national product (GNP). Measured in 1969 U.S. dollars, mine output value increased 17.2 percent in 1969 and 21.2 percent in 1970, whereas GNP gained only 6.2 percent and 5.0 percent, respectively. Following the trend of recent years, mining had steadily gained ground in the overall economy despite tight credit, inflation, a severe drought, three damaging typhoons, and a serious flood in 1970.

Copper improved its position as the premium mineral product of the Philippines, accounting for more than three-fifths of the 1970 mine output value. During the year, copper also became the country's number one export commodity, displacing logs and lumber. Copper output increased by nearly one-fourth, and further growth can be expected. Copper reserves reported by mining companies have been raised to 1.5 billion metric tons of better than 0.5 percent copper ore. Atlas Consolidated Mining & Development Corp. (Atlas Consolidated), the largest producer, is scheduled to increase output by 80 percent. Marcopper Mining Corp. (Marcopper) took over second position in its first year of full-scale operations. Many lesser copper projects were being implemented, and prospects were examined. Despite commitment of the bulk of the concentrates to Japanese buyers for many years to come, a 60,000-ton-per-year copper smelter reportedly was proposed for construction at San Fernando, La Union.

The nickel program moved ahead. Nickeliferous laterite reserves were raised to more than 3 billion tons, of which about 500 million tons averaging 1.3 percent nickel were under development or considered for development in 1970. Marinduque Mining and Industrial Corp. (Marinduque) secured financing from Japan and the United States to build a $190 million plant to produce 75 million pounds of nickel annually. Mine development and plant site preparation were started. Atlas Consolidated was considering production of 50 million pounds per year from one of its two large lateritic deposits. Acoje Mining Co. Inc. exported nickel-cobalt concentrates to Japan.

Although production was the highest since 1941, the gold industry continued to decline in relative importance. The subsidy on byproduct gold production ceased. There was a proposed amendment to the Gold Mining Assistance Act to withdraw the subsidy to primary gold producers in 3 years. Japanese ferrochrome producers made a request to Acoje Mining Co. to double shipment of metallurgical chrome concentrates to 240,000 tons per year starting in 1972 or 1973. Plans for building an integrated iron and steel plant were still not finalized. Reynolds Metals Co. in a joint venture with Republic Flour Mills, was scheduled to build the Philippines first aluminum plant with an annual capacity of 60,000 tons of ingot by 1973. The cement industry operated at one-half of its capacity in 1970. Imperial Chemical Industries, Ltd. of London was expected to place in operation the first explosives factory in the Philippines at Limay, Bataan, in 1971. The plant, which has a daily capacity of 5,000 tons, will produce a complete line of mining and industrial explosives.

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[1] Mining engineer, Division of Nonmetallic Minerals.

[2] Where necessary, values have been converted from Philippine pesos (PP) to U.S. dollars at the rate of PP6.40=US$1.00.

On February 21, 1970, the peso was released from the official rate of 3.90 pesos to US$1.00 and placed on a "free" market. This latter rate, although really not permitted to fluctuate freely, "floats" officially at about 6.40 pesos to US$1.00. Revenues of mining companies were favorably affected because mineral export contracts are in dollars. In May, the Philippine Congress passed an Export Tax Law to force the exporters to surrender a percentage of this gain. On the other hand, the cost of imported supplies and equipment increased. Most tariffs were raised by the amount of the devaluation.

Consumer and wholesale indices rose more than 21 percent in 1970. Inflation, coupled with restrictive credit, slowed down less essential production and curtailed investment in new industrial facilities. Unemployment increased under these depressed conditions. From a labor force of approximately 13 million, the unemployment rate was estimated at 8 to 9 perecnt. Meanwhile, the minimum wage was increased to $1.25 per day on July 1, 1970.

Expiration of the Laurel-Langley Agreement in July 1974 means that the United States would no longer have preferential treatment. This would make it more difficult for the United States to make additional investments. On the other hand, the Japanese without special rights have provided large sums of money to mining enterprises controlled by Philippine interests. Japanese participation in the local mining enterprise has been mainly in the form of loans, equipment, and technical assistance, rather than equity.

To comply with the constitutional requirement that corporations engaged in developing natural resources should be 60-percent owned by Philippine citizens after July 3, 1974, some American mining companies have started to disinvest. Atlas Consolidated made some progress by increasing Philippine ownership to 41 percent by yearend. On the other hand, Benguet Consolidated, Inc., was experiencing difficulty raising Philippine equity that originally was only 1.5 percent.

Private mining investments increased from $94 million in fiscal year 1960–61 to $156 million in 1969–70. The Investment Incentive Act, administered by the Board of Investments (BOI) to encourage Philippine and foreign investment in projects that will increase the national income, gives export-oriented industries first preference. The projects approved are also given tax exemptions, duty-free importation, and liberal credits. During 1968–69, more than half of the funds in mining came from foreign sources, divided almost equally between Japan and the United States.

A new mining act, which had been in the process of preparation for several years, was still not enacted into law. However, rules and regulations for prospecting, exploration, and exploitation of mineral areas within government reservations were issued in July. The rules require (1) application for prospecting permits; (2) application for exploration permits after discovery, on strong evidence of mineral deposits; (3) application for exclusion of mineral deposits from the reservation if found to be commercially exploitable; (4) comments and recommendation of the Bureau of Mines and the Secretary of Agriculture and Natural Resources, and (5) a proclamation by the President and concurrence by Congress if the application is meritorious.

The Oil Industry Commission Bill, first introduced in 1967, passed the Senate in 1970, but failed to pass the House by yearend. The Bill, which is expected to become law in 1971, would establish an independent commission with broad powers having supervision and jurisdiction over all aspects of the oil industry. Powers include the right to control prices, to regulate refinery capacities, to prevent monopolistic practices, to operate refineries in the national interest, and to review prices of crude oil imports.

PRODUCTION

Dominated by copper, base metals accounted for the bulk of the mine output value. The share of copper in 1970 was about 61 percent, followed by gold at 7 percent, iron ore at 4.5 percent, chromite at 3.5 percent, and mercury at 0.6 percent. The only nonmetallic mineral product of consequence was cement. Its value was about 10 percent of the total.

In addition to mine output value, the

value added by the processing of imported materials was a substantial figure. Petroleum headed the list, followed by iron and steel, and fertilizers and chemicals.

In terms of relative world significance, the Philippines ranked ninth in copper during 1970, about third in chromite (actually first in refractory chromite), seventh in gold, and 11th in mercury.

Table 1.—Philippines: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Cadmium mine output, metal content .... kilograms	1,675	--	--
Chromium, chromite, gross weight	439,177	469,431	566,443
Copper mine output, metal content	110,275	131,426	160,295
Gold .... troy ounces	527,355	571,145	602,715
Iron and steel:			
Iron ore and concentrate .... thousand tons	1,353	1,561	1,870
Ferroalloys	NA	904	720
Steel semimanufactures .... thousand tons	210	294	NA
Lead mine output, metal content	84	67	14
Manganese ore and concentrate, gross weight	66,043	20,002	5,121
Mercury mine output, metal content .... 76-pound flasks	3,544	3,478	4,648
Molybdenum mine output, metal content	43	16	32
Nickel, metal content	--	--	103
Palladium .... troy ounces	--	--	878
Platinum .... do	--	--	352
Silver mine output, metal content .... thousand troy ounces	1,575	1,561	1,702
Zinc mine output, metal content	2,243	3,286	3,191
NONMETALS			
Asbestos	32	45	1,213
Cement, hydraulic .... thousand tons	2,564	2,950	2,451
Clays:			
Bentonite	--	--	164
White		4,508	12,346
Rock	367,298	3,842	3,177
Other		165,515	240,515
Diatomite	NA	101	51
Feldspar	42,324	35,391	20,236
Fertilizer materials:			
Crude, phosphatic:			
Guano	656	15,236	1,480
Phosphate rock	521	--	1,400
Manufactured:			
Nitrogenous	r 7,488	9,731	NA
Mixed and unspecified	r 38,246	81,283	58,929
Gypsum and anhydrite, crude	r 7,898	37,013	17,458
Lime	105,293	215,545	161,902
Perlite	--	--	12,000
Pyrite and pyrrhotite (including cupreous):			
Gross weight	182,158	201,511	273,851
Sulfur content	86,360	94,509	127,012
Salt, marine	r 186,675	231,187	210,306
Stone, sand and gravel n.e.s.:			
Dimension stone, marble, unfinished	1,945	312	10,271
Sand, glass .... thousand tons	429	638	685
Stone:			
Dolomite	6,198	4,826	11,011
Limestone .... thousand tons	3,789	3,076	3,572
Tuff	NA	105,792	87,997
Coral, crushed .... thousand cubic meters		37	180
Cobbles and boulders, n.e.s .... do	2,998	167	245
Sand, gravel and earths, n.e.s .... do		4,308	4,619
Sulfur, elemental	42	32	41
Talc	872	942	1,590
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades	32,150	53,341	42,401
Petroleum refinery products:			
Gasoline .... thousand 42-gallon barrels	r 15,079	14,561	15,601
Jet fuel .... do	r 777	2,416	2,703
Kerosine .... do	r 3,812	3,328	3,371
Distillate fuel oil .... do	r 11,432	12,853	13,790
Residual fuel oil .... do	r 20,859	21,337	23,517
Other .... do	r 2,245	1,744	2,048
Refinery fuel and losses .... do	r 2,403	4,271	3,784
Total .... do	r 56,607	60,510	64,814

p Preliminary. r Revised. NA Not available.

TRADE

De facto devaluation of the peso helped to improve the balance of payments. Preliminary data show an increase in exports from $840.8 million in 1969 to $1,014.8 million in 1970, and a decrease in imports from $1,104.6 million in 1969 to $1,039.5 million in 1970. Among the mineral exports, copper was a big factor, contributing nearly 20 percent. Petroleum was the leading mineral import item, representing over 10 percent of the total imports. The depreciated exchange rate helped slow down imports from the United States, which declined from $320 million in 1969 to $305 million in 1970. On the other hand, Philippine imports from Japan rose from $337 million in 1969 to $432 million in 1970.

The U.S. share of the Philippine market was expected to decline further in the face of competition from Japan and elsewhere. The Australians were entering competition. The Philippines has exchanged trade missions with various Eastern European countries. For example, Romania offered to aid the Philippines in oil exploration, mining, and industrial development. Romania was also willing to accept Philippine commodities in payment for equipment and technical services with regard to building smelters and oil refineries.

Mineral exports were of great significance to the economy, and by far the bulk of the trade has been with Japan. The only important mine not shipping copper ores and concentrate to Japan is Lepanto Consolidated Mining Co., which sells to the Tacoma smelter in the United States. The gold of the Philippines was not traded, going almost entirely to the Central Bank of the Philippines. All of the metallurgical chromite went to Japan. However, the principal market for refractory chromite continued to be the United States. Philippine iron ore, pellets, and magnetic sands and mercury were shipped primarily to Japan. There was a surplus of cement, and about 50,000 tons was shipped to South Vietnam in 1970.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Chromite	281,268	501,251	United States 174,898; Japan 167,716; United Kingdom 93,469.
Copper:			
Ore and concentrate	430,077	502,161	Japan 485,589; United States 16,572.
Matte	825	1,325	All to Japan.
Scrap	2,260	3,966	Japan 1,900; Spain 1,131; West Germany 811.
Iron and steel:			
Iron ore ... thousand tons	1,536	1,625	Japan 1,614; United States 11.
Roasted pyrite	--	2,500	All to Japan.
Scrap	--	1,364	France 790; Japan 574.
Lead ore and concentrate	637	771	All to Belgium-Luxembourg.
Manganese ore and concentrate	36,198	31,444	Japan 29,140; United States 2,304.
Mercury ... 76-pound flasks	2,698	2,233	All to Japan.
Nickel ore and concentrate	--	72	All to Canada.
Silver and silver-bearing concentrates, ores and wastes ... value, thousands	--	$528	All to United States.
Zinc ore and concentrate	3,069	6,624	All to Japan.
Other ore and concentrate	45	[2] 2,071	Italy 2,024; United Kingdom 47.
Metal bearing nonferrous wastes	1,408	[3] 1,395	All to Japan.
NONMETALS			
Pyrites, unroasted	4,198	35,500	Do.
Crude nonmetals not further described	28,934	44,879	Do.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products, residual:			
Fuel oil ... thousand 42-gallon barrels	748	1,904	Do.

[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.
[2] Includes 2,024 tons of titanium ores and concentrates received by Italy.
[3] Includes 1,242 tons of ash and residue for the extraction of zinc received by Japan.

Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 5–Far East, 1968 and 1969 editions. Walker and Company, New York, 1970 and 1971.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	102	--
Metal including alloys:		
Scrap	--	116
Unwrought and semimanufactures	9,520	5,913
Copper including alloys, all forms	6,498	6,212
Iron and steel:		
Scrap	17,330	18,177
Pig iron including cast iron, powder and shot	15,441	14,993
Ferroalloys	3,524	2,220
Steel, primary forms	195,457	325,613
Semimanufactures:		
Bars, rods, angles, shapes, sections	85,960	56,782
Universals, plates, and sheets	401,022	531,746
Hoop and strip	40,831	25,122
Rails and accessories	2,589	2,352
Wire	5,691	2,635
Castings and forgings, rough	1,351	2,358
Lead including alloys, all forms	5,836	5,673
Manganese oxides	213	265
Nickel including alloys, all forms	41	24
Silver and platinum including alloys ... value, thousands	$92	$91
Tin including alloys, all forms	9	51
Titanium oxides	1,301	1,269
Zinc:		
Oxide	465	612
Metal including alloys:		
Scrap	156	113
Unwrought and semimanufactures	21,891	21,447
Other:		
Ore and concentrate of nonferrous metals n.e.s	19	10
Metals including alloys, n.e.s., all forms:		
Metalloids	--	19
Base metals	93	133
NONMETALS		
Abrasives:		
Grinding stones	276	267
Other	136	100
Asbestos	980	1,397
Boron oxide and acid	208	269
Cement	89,394	14,531
Clays and products:		
Crude n.e.s	16,304	16,342
Products:		
Refractory ... value, thousands	$1,020	$3,597
Nonrefractory ... do	$336	$374
Diamond:		
Gem not set or strung ... do	$34	NA
Industrial ... do	$29	NA
Diatomite	1,998	2,017
Feldspar and fluorspar	NA	550
Fertilizer materials:		
Crude, phosphatic	135,882	165,952
Manufactured:		
Nitrogenous	108,876	92,785
Phosphatic	1,325	753
Potassic	55,638	49,792
Mixed	16,703	10,701
Ammonia	32,712	14,779
Gypsum and plasters	56,832	NA
Magnesite	195	NA
Pigments, iron oxides processed	1,237	1,127
Salt	1,202	2,274
Sodium compounds, caustic soda	6,331	10,209
Stone and sand:		
Dimension worked	207	153
Dolomite	2,095	2,466
Sand excluding metal bearing	2,525	5,496
Sulfur, elemental:		
Other than collidal	2,770	9,374
Collidal	3,022	NA
Talc, natural steatite	901	496
Other n.e.s.:		
Crude	2,193	1,612
Oxides and hydroxides of magnesium, strontium, and barium	245	329
Building materials of asbestos and fiber cement, and unfired nonmetals n.e.s	2,551	NA

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	5,642	2,581
Coal, coke and briquets	10,100	8,740
Petroleum: [3]		
Crude ... thousand 42-gallon barrels	58,660	60,589
Refinery products:		
Gasoline:		
Aviation ... do	99	63
Motor ... do	20	137
Kerosine and jet fuel ... do	11	119
Distillate fuel oil ... do	61	--
Residual fuel oil ... do	117	32
Lubricants (including grease) ... do	759	607
Other ... do	122	260
Total ... do	1,189	1,218

NA Not available.
[1] Source: Except as noted, Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 5 (Far East), 1968 and 1969 editions. Walker and Company, New York, 1970 and 1971.
[2] Data represent the reported exports to the Philippines of the following 24 countries: Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, Germany (West), Greece, Iceland, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, the United States, and Yugoslavia. Thus, the data are incomplete (including no exports by other countries) and are not strictly comparable to actual imports as reported by the Philippines.
[3] Source: U.S. Department of State airgrams.

COMMODITY REVIEW

METALS

Aluminum.—Reynolds Metals Co., and Republic Flour Mills, made plans for the first aluminum smelting plant in the Philippines, which will be located near Iligan City and the Maria Cristina Power Plant, in Mindanao. Production is scheduled for 1973, with an initial capacity of 60,000 metric tons of aluminum ingot. Bauxite would be imported. Nearly 26,500 tons will be for consumption in the Philippines, half of the aluminum would be exported to Japan for 20 years, and the remaining 3,500 tons would be available for export.

Cadmium.—Benguet Exploration, produced 10,991 pounds of cadmium as a byproduct from zinc and copper concentrates in 1970. In 1970 ore mined at camp 6, Tuba, Mountain Province, contained 0.01 percent cadmium.

Chromite.—Production of chromite increased 21 percent and exports gained 7.1 percent in 1970. Although metallurgical-grade chromite production decreased 10 percent and shipments declined 18 percent, refractory-grade chromite production rose nearly 33 percent and exports gained 15 percent. Total production was 566,443 metric tons, the highest total since 1961. The price of chromite also increased in 1970. The total value of exports was $10.9 million.

Refractory chromite was mined at the Consolidated Mines, Inc., Coto Mine in Masinloc, Zambales. Production of lump ore and fines increased to 466,510 metric tons. Shipments to foreign consumers (table 4) were 437,949 tons valued at $8,344,864. Benguet's chromite ore reserves were reported to be 7.7 million tons.

Acoje Mining Co., Santa Cruz, Zambales, the country's only producer of metallurgical-grade chromite, produced 99,933 metric tons. Of this total, 98,975 tons valued at $2,555,525 were exported to Japan.

Japanese ferrochrome producers were negotiating with Acoje to increase exports of metallurgical-grade chromite to Japan. Present exports to Japan are 100,000 to 150,000 tons of chromite per year. Japanese firms hope to increase imports to 200,000 to 250,000 tons, and if possible to 300,000 tons per year. Acoje's chromite ore reserves were nearly 2 million metric tons.

Palawan Consolidated Mining Co., Inc., was inactive because it lacked funds to repair damages caused by typhoons in 1969. An 800-ton shipment of chromite fines from the company stockpile at Puerto Princesa was made in January 1970.

Table 4.—Philippines: Production and exports of chromite

	1969		1970	
	Metric tons	Value, US dollars	Metric tons	Value, US dollars
Production:				
Refractory: Consolidated Mines, Inc	357,256	--	466,510	--
Metallurgical: Acoje Mining Co., Inc	112,175	--	99,933	--
Total	469,431	--	566,443	--
Exports:				
Refractory:				
Argentina	3,980	$81,700	4,810	$106,841
Australia	10,383	208,087	14,428	289,921
Belgium	1,837	36,831	--	--
Brazil	6,122	122,769	14,024	265,069
Canada	27,551	514,230	14,225	282,181
Italy	8,010	159,892	10,445	221,933
Japan	46,837	907,805	46,221	945,235
Netherlands	3,214	55,149	4,583	91,136
United Kingdom	93,469	1,555,096	86,482	1,587,586
United States	174,898	3,051,784	234,211	4,380,960
Venezuela	4,071	83,790	8,520	174,002
Total	380,372	6,777,133	437,949	8,344,864
Metallurgical: Japan	120,879	2,894,550	98,975	2,555,525
Total exports	501,251	9,671,683	536,924	10,900,389

Copper.—By mid-1970 copper became the premier export commodity, displacing logs and lumber as the principal dollar earner. Although the world price fluctuated, rising to a high of 80 cents per pound and then dropping to 47 cents, copper production reached an alltime high of 160,295 metric tons, valued at $174 million. Production, which comprised 638,770 tons of concentrate averaging about 23 percent copper, and 51,720 tons of direct shipping ore averaging about 10 percent copper, was exported mostly to Japan, with some shipments to the United States (Tacoma smelter) and Italy.

Mine copper production for major producers is shown in the following tabulation table 5.

During 1970 many copper companies were completing expansion projects and were planning additional expansion programs.

With widespread occurrence of deposits throughout the islands, copper reserves reported by mining companies are 1.5 billion metric tons, averaging slightly more than 0.5 percent copper.

Atlas Consolidated operating the Toledo Mine on Cebu, retained its position as the leading copper producer in the Far East,

Table 5.—Philippines: Copper production by major producers

(Dry metric tons)

Company	1969			1970		
	Concentrate	Direct shipping ore	Copper content	Concentrate	Direct shipping ore	Copper content
Acoje Mining Co., Inc	--	10,688	1,313	--	7,505	712
Atlas Consolidated Mining & Development Corp	165,896	--	46,267	153,637	--	43,445
Benguet Consolidated, Inc	--	125,389	4,405	--	4,494	297
Benguet Exploration, Inc	825	--	133	782	--	146
Black Mountain, Inc. (Kennon)	5,047	--	1,358	9,494	--	2,344
Consolidated Mines, Inc	12,390	--	2,841	23,826	--	4,984
Itogon-Suyoc Mines, Inc	661	--	103	--	--	123
Lepanto Consolidated Mining Co	84,373	--	25,871	91,295	--	26,330
Marcopper Mining Corp	25,317	--	7,142	132,424	--	33,881
Marinduque Mining and Industrial Corp.						
Bagacay	61,976	40,908	10,383	56,637	31,466	9,468
Sipalay	69,753	--	18,084	92,845	8,255	19,778
Philex Mining Corp	49,583	--	12,281	68,746	--	16,797
Inco Mining Co., (Masara)	5,267	--	1,169	9,084	--	1,990
Total	481,088	176,985	131,350	638,770	51,720	160,295

despite a severe drought that curtailed mill production in the first half of the year. The Lutopan mill, with the capacity to treat 35,000 tons of ore per day, produced 153,637 tons of concentrates containing 94.4 million pounds of copper. Leaching waste dumps produced another 1.3 million pounds of cement copper. Gold, silver, magnetite concentrate, and pyrite concentrate were also recovered. With the completion of the Malubog Dam, the company can now impound 2.5 billion gallons of water, or 5 months supply of mill water. Atlas reports ore reserves at 620 million tons, which contain an average grade of 0.50-percent copper. Mill feed at the start of 1970 comprised about 81 percent underground ore from 13 active caving blocks, and 19 percent from open pits. An expansion project was started in 1970 to increase milling capacity 80 percent to process ore from the Biga and Barot ore bodies. The new flotation mill, with a daily capacity of 28,000 tons, is expected to be in full production by the last quarter of 1971. Mitsubishi Metal Mining Co. Ltd. has a 15-year contract to purchase concentrates to smelt 80,000 tons of copper metal per year from Atlas Consolidated starting in mid-1971.

In its first full year of operation, Marcopper milled 5,508,460 tons of ore averaging 0.78 percent copper, and produced about 72 million pounds of copper, 39,142 ounces of gold, and 169,202 ounces of silver. An additional 3.6 million pounds of cement copper were produced from leaching operations, which made Marcopper the second largest copper producer in the Philippines. The open pit mine is located on the slope of Mt. Tapain near Santa Cruz, Marinduque. At the present milling rate of 15,000 tons per day, the proven ore reserves are reported to permit operation for another 20 years. Marcopper has a 10-year contract to supply Nippon Mining Co. Ltd. Japan with copper.

Lepanto Consolidated, the third largest copper producer and second largest gold producer, established a company record high in 1970, with the production of 91,295 tons of concentrate, containing about 58 million pounds of copper from milling 1,145,916 tons of ore, averaging 2.66 percent copper, 0.152 ounce of gold per ton, and 0.44 ounce of silver per ton. In January 1971, ore reserves at the mine near Mankayan, Mountain Province, were 9.2 million tons, which averaged 2.9 percent copper and 0.129 ounce of gold per ton. In 1970, the Lednickey Tunnel was started in order to drain the lower levels of the mine. When completed, the drainage tunnel will be 5 kilometers long.

Marinduque operated two large copper deposits. The Sipalay mill in Negros Occidental increased capacity from 9,500 to 14,500 metric tons per day in 1970; treating ore averaged 0.8 percent copper from the open pit mine. Ore reserves in 1970 were nearly 60 million tons, averaging 0.808 percent copper. Gold, silver, and molybdenum concentrate were recovered at the flotation mill. At Bagacay, Samar, direct shipping ore (8 to 14 percent copper) and mill concentrates were produced from the open pit operation. A 1,000-ton-per-day pyrite beneficiation plant was completed to treat copper flotation tailings. Ore reserves in 1970 comprised 265,000 tons of direct shipping ore averaging 10 percent copper and 1.8 million tons averaging 2.6 percent copper.

Block caving at the Philex Mining Corp. underground mine in Pacdal near Tuba, Mountain Province, supplied ore to the new 6,000-ton-per-day Banget mill and the 4,000-ton-per-day Santa Tomas II mill. Additional equipment was installed increasing mill capacity to 16,000 tons per day. Flotation tailings were treated by magnetic separation to produce a magnetite concentrate. In 1970 ore reserves were estimated at 74 million tons, averaging 0.63 percent copper and .025 ounce of gold per ton.

Benguet Consolidated, produced cement copper from heap leaching operations at its open pit mine on Balabac Island, Palawan. Consolidated Mines, Inc., increased mill capacity from 500 to 1,000 tons per day at Mogpog, Marinduque. In 1970 ore reserves were more than 65 million tons, averaging 0.65 percent copper. Black Mountain, Inc., operated the Kennon Mine in Mountain Province owned by Benguet Exploration. Because of the soft nature of the ore produced by block caving, the 1,500-ton-per-day mill was able to process 2,200 to 2,400 tons per day. Ore reserves totaled 21.5 million tons, averaging 0.47 percent copper. Acoje Mining produced shipping-grade ore from its Barlo copper deposit near Mabini, Pangasinan. A 500-ton-per-day mill was under construction to treat ore reserves estimated at 2.2 million tons. Itogon-Suyoc Mines, Inc., produced copper concentrates from the Suyoc Mine near Mankayan, Mountain Province. Inco Mining Co. increased mill capacity from 1,000 to 1,500 tons per day, producing about 400,000 pounds of copper monthly at the Masara Copper Project owned by Samar Mining Co., Inc. near Mabini, Davao. Ore reserves are 10 million tons, averaging 0.5 percent copper.

Philippine Iron Mines (PIM) has recovered 700 tons of copper concentrates since June 1970 by scavenging tailings at the iron concentrator. PIM reported copper-molybdenum-pyrite reserves near Larap Camarines Norte to be 51.5 million tons. Demmag Philippine Inc., shipped 2,000 tons of high-grade copper ore to Japan in March 1970 from the Sipalay-Cauayan area in Negros Occidental. The company had a commitment to start monthly shipments to Italy in July. Omico Mining and Industrial Corp. installed a 250,000-ton-per-90-day leaching plant at its Macawiwili Copper Project in Itogon, Mountain Province. Operation of the new 100-ton-per-day mill started at the end of December. Ore reserves are estimated at 25 million tons, averaging about 0.56 percent copper. Minerva Mines, Inc., exported direct-shipping ore averaging 11.14 percent copper from its mine at Patnongon, Antique.

Copper exploration programs were conducted by virtually every major mining company in the Philippines and numerous neophyte corporations. Copper deposits were drilled from Northern Luzon to Southern Mindanao and from Surigao on the east to Palawan on the west.

Benguet Consolidated, announced installation of a 200-ton-per-day mill to start operations in 1971 on 560,000 tons of 3-percent copper found at lower levels of the Antamok Mine, Itogon, Mountain Province. Copper Belt Mining Corp. drilled its Balete deposit near Suyoc, the sixth known porphyry deposit in Mountain Province. Shallow drilling to 450 feet indicated 10 million tons at 0.45 percent copper. Jel Mining and Development Corp. reports reserves of 120 million tons averaging 0.5 percent copper adjoining Atlas Consolidated at Toledo, Cebu.

Nippon Mining Co. of Tokyo, announced plans for a joint mining venture with Dizon Copper-Silver Mines, Inc., at the latter's copper deposits near Botolan, Zambales. Nippon will invest $40.2 million to acquire 40-percent equity. Drilling confirmed at least 75 million tons of reserves averaging 0.5 percent copper. Production from an open cut mine is expected within 2 years. Flotation mill capacity will be 10,000 tons per day. Nippon also proposes to finance a copper project at the Batong Buhay Mine in Kalinga, Mountain Province. Mill capacity is anticipated to be 10,000 tons per day. Itogen-Suyoc Mines was negotiating with Nippon to finance a copper project in Boneng, Mountain Province. Nippon Mining Co. would purchase copper concentrates from all three mills. Inco Mining was reported negotiating with Nippon Mining Co. to explore its Kalinga-Apayao Copper project.

Pentagon Mines, Inc., was exploring copper deposits in Camarines Norte. Abra Mining and Industrial Corp. was exploring its Capcapo copper deposits near Licuan and Baay, Abra. Drilling will be necessary to prove an estimated 40 million tons of ore reserves.

President Marcos created an advisory committee to study the feasibility of building a copper smelter in the Philippines, most likely at San Fernando, La Union. The minimum-size smelter would need at least 200,000 metric tons of concentrates containing 25 percent copper to produce 60,000 metric tons of blister copper. One problem is the supply of copper concentrates to the smelter because the major Philippine producers have their production committed to Japan for the next 6 to 15 years. The smelter would cost about $54 million. In addition to the copper, the byproduct sulfuric acid produced must be sold, to make a 7-percent return on the investment. The Philippines consumes only 6 percent of its present annual copper production.

Gold.—Philippine gold production, ranking seventh in the world, was derived from six primary mines, and as a byproduct of copper production. Total production increased to 602,715 ounces, the highest since 1941. The value was $20,367,103.

Fourteen mines received benefits exceeding $31 million during the period 1967–69 through the Gold Mining Assistance Act of 1961. All gold delivered to the Central Bank after February 21, 1970, was paid for at the floating rate for the peso. The Central Bank ceased its subsidy on byproduct gold production but continued to pay the subsidy to primary producers. However, the buying price remained the same at $36 per ounce. The devaluation of the peso reduced the subsidy from $14.61 to $3.13 per ounce. Proposed amendments to the Gold Mining Assistance Act would increase the subsidy about 35 percent, then withdraw the subsidy after 3 years. The bill had not passed by yearend. Benguet Consolidated, the largest primary gold producer, served notice to its employees at the Acupan and Balatoc mines that about 600 workers would be discharged early in 1971 because of the high cost of production which was caused by the floating exchange rate and the new minimum-wage law. Passage of the Gold Subsidy Bill may alter the company's decision. Benguet's Antamok and Acupan mines are reported to have 2 million tons of reserves averaging 0.27 ounce of gold per ton.

Lepanto Consolidated joined the primary producers with the operation of a separate 180-ton-per-day gold mill. The firm produced a total of 137,385 ounces of gold, however, 65 percent of the total was byproduct gold recovered in its copper mill.

Itogon-Suyoc, Benguet Exploration, Atok-Big Wedge Mining Co., and Paracale-Gumaus Consolidated Mining Co. were also primary gold producers. All of the primary producers are in Mountain Province, with the exception of Paracale-Gumaus which is in Camarines Norte.

Byproduct gold production from copper operations increased in 1970. Marcopper produced 39,142 ounces of gold. Philex and Atlas also recovered large quantities of byproduct gold, and the other copper deposits—Masara, Bagacay, Sipalay, and Kennon—yielded smaller quantities.

In August 1970 Lepanto started erection of a 200-ton-per-day gold mill in Cabadbaran, Agusan. Completion was expected after July 1971.

Iron Ore.—Despite competition from Australian producers, Philippine iron ore and pellet shipments, mostly to Japan, rose to a record high of 1,644,096 metric tons because of increased production of magnetite concentrates from beach sands and magnetic separation treatment of copper flotation tailings. The value increased to $16,869,767. In addition to exports, some iron ore production was used for domestic consumption by the cement industry. Total iron ore production was 1,869,877 metric tons, valued at about $18 million.

PIM Larap, Camarines Norte, continued to be the largest producer of iron ore from open pit and underground mines. All of the ore was pelletized and shipped to Japan. Production decreased from the previous year to 721,877 metric tons and was valued at $5,269,288. PIM recovered 700 tons of byproduct-copper concentrate from iron-concentrator scavenger tailings by using a new flotation circuit, which has been in operation since June 23, 1970.

Iron ore mined at the Samar Mining Sibuguey Mine, Zamboanga del Sur, by Zambales Base Metals, Inc., ranged from 15,000 to 20,000 metric tons per month.

Beach sands processed by FILMAG, Inc., at Aringay, La Union yielded 655,300 metric tons of magnetite worth $4,169,062. FILMAG, reported acquiring the right to mine a deposit of beach sand containing magnetite along the coast at Narvacan, Ilocos Sur, and will ship the magnetite to Japan. Maraveni Consolidated Mines, Inc., experienced difficulty producing magnetite from beach sands at Aurora, Quezon, and ceased operations because of excessive gravel in the deposit. Inco Mining erected a plant at Tolosa, Leyte, in 1970 to process 360,000 dry metric tons per year of magnetite-bearing sands. Operations started in July. Shipments to the United States totaling 82,115 tons were valued at $589,344.

Anglo-Philippine Oil and Mining Corp. signed a contract in May 1970 to sell magnetite concentrates to Irimaro Co., Ltd., of Japan from its beach sand placer claims in La Union. Reserves are reported adequate to produce 7.4 million metric tons of magnetite concentrate. The planned annual production rate is 200,000 tons of concentrate.

Japanese and Australians reportedly are interested in the Republic Resources and Development Corp. (Redeco) magnetite sand deposits at Silago, Hinunangan, and Hinundayan in southeastern Leyte.

Atlas Consolidated exported 98,582 metric tons of byproduct magnetite concentrates averaging 65 percent iron from copper flotation tailings at Toledo, Cebu. Shipments valued at $781,179 went to Japan. Philex Mining also produced byproduct magnetite concentrates averaging 65 percent iron at its Santo Tomas II copper project in Mountain Province, Luzon. In 1970 Philex treated copper flotation tailings by magnetic separation and exported 661,751 tons of magnetite pellet feed to Japan, valued at $661,751.

Iron and Steel.—The Philippine iron

and steel industry comprises three small steel mills. Iligan Integrated Steel Mills Inc., at Iligan, Mindanao, completed construction of a 65,000-ton-per-year hot strip mill, the first among the steel manufacturers in the Philippines. This will be an addition to the present facilities comprising a 100,000-ton-per-year electrolytic tinplating line and a 400,000-ton-per-year cold rolling mill. Iligan Integrated Steel Mills started using locally made charcoal briquets in place of imported coke for carbon in making steel in its 25-ton-per-charge electric arc furnace. Charcoal requirements are 120 metric tons per month. The final phase of transforming the small steelworks into a modern integrated steel plant was pending U.S. Export-Import Bank financing to install a blast furnace and steel furnace. The company announced that construction work to install soaking pits was in progress.

Elizalde Iron and Steel Corporation and Elizalde Steel Rolling Mills, Inc., located in Taguig, Rizal, proposed building a blast furnace and steel furnace in the Philippines on a cooperative basis, calling for participation by most "end users."

The Presidential Economic Staff issued orders banning exportation of scrap iron and steel to protect the three small steel mills.

Lead.—Paracale-Gumaus Consolidated Mining Co., Inc., produced 14 metric tons of lead in 1970 from its mine at Paracale, Camarines Norte. Exported to Japan and Belgium, the value was $3,849.

Manganese.—Acoje Mining Co. shipped the last load of manganese in December 1969 after 6 years of operation at its Sierra Madre Mine, Palanan, Isabela. Gregorio T. Lluch Mining Co. continued to ship manganese from its Gabu Mine, Titay, Zamboanga del Sur, to Japan. Between January and June 1970, 18,362 metric tons of manganese were produced.

Mercury.—Palawan Quicksilver Mines, Inc., produced a record high of 4,648 flasks (76-pound) of mercury, with a value of $1,669,690, at its plant in Tagburos, Palawan, despite a sharp price decline in 1970. Most of the quicksilver was exported to Japan; smaller shipments went to India, Taiwan, and Australia. The country's only producer, now operating with a fifth kiln, has the capacity to process more than 13,000 short tons per month. The furnace feed averaged 2.5 pounds of mercury per ton. A pilot beneficiation plant is proposed to determine an economical process for treating low-grade ore below 2 pounds per ton.

Two Australian companies announced a joint exploration and drilling program to develop quicksilver deposits on Palawan. Perpetual Mining Co., another new company, ordered equipment for producing mercury from its claims at Bacungan, about 24 kilometers north of Puerto Princesa, Palawan.

Molybdenum.—Marinduque produced 32 metric tons of molybdenum concentrates as a byproduct from its copper mine at Sipalay, Negros Occidental. Exported to Italy and England, the value of the shipments were $71,378. PIM plans to install a flotation circuit to recover molybdenum from the iron concentrator at Larap, Camarines Norte.

Nickel.—On December 10, 1970, the Philippines became a world producer and exporter of nickel concentrates when Acoje Mining Co., one of the world's major metallurgical-grade chromite producers, shipped 608 metric tons of nickel-cobalt concentrates worth $258,962 to Japan. The company's new 400-ton-per-day beneficiation plant at Santa Cruz, Zambales, commenced operations in May 1970, treating dunite ore adjacent to its underground chromite deposit. Averaging 0.7 percent nickel, the dunite ore was processed by flotation to produce a concentrate estimated to contain 15 percent nickel plus cobalt, 1.4 ounces per ton of platinum, 2.8 ounces per ton of palladium, 0.20 ounce per ton of gold, 1.0 ounce per ton of silver and 3.0 percent copper.

Nickel resources in the Philippines, estimated to exceed 3 billion metric tons of nickeliferous laterite, are among the largest in the world. About 500 million tons averaging 1.3 percent nickel were under development or considered for development in 1970.

Considerable exploration work was conducted on lateritic nickel deposits on Palawan, southern Mindanao and Luzon. Exploration programs were also conducted on known lateritic nickel deposits in the government-owned Surigao Mineral Reservation on the northeastern tip of Mindanao, and adjacent small islands. In 1968 Marinduque was granted exploitation rights for 25 years on Parcel II (40,000 hectares), of the Surigao Mineral Reservation. Ore reserves exceeding 110 million tons, mostly on Nonoc Island, but also on Dinagat, Hiantuan, and other small islands, average about 1.2 percent nickel and 38 percent iron.

Using a modified reduction roast-ammonium carbonate leach process developed by the Sherritt Gordon Mines Ltd., Marinduque proposes to build a plant with a capacity to treat 3.5 million dry metric tons of ore per year to produce 75 million pounds of nickel. Financing, including developing the mine and erecting the plant, will require about $190 million. Marinduque announced that the Philippine Government has agreed to guarantee to creditors repayment of up to $120 million in financing which is expected to consist of $60 million in suppliers' credits from Kobe Steel Ltd. of Japan, and $54 million in loans for equipment from the Export-Import Bank of the United States. Mine development and plant site preparation began in 1970; project completion is scheduled for 1973.

Atlas Consolidated drilled two lateritic nickel deposits on Mindinao and Palawan. The deposit on Pujada Peninsula, southeastern Davao, contains more than 167 million tons, averaging about 1.3 percent nickel and 0.061 percent cobalt with high iron content. At Long Point, west central Palawan, the ore reserves are reported to be 183 million tons, averaging about 1.4 percent nickel and 0.118 percent cobalt with lower iron content.

Benguet Consolidated, Inc., explored laterite deposits north of its chromite mine at Coto, Zambales. The tonnage has not been determined, but samples indicate 1.3 to 1.6 percent nickel varying in thickness to 355 feet near the surface. Global Marine, Inc., is reported to have explored a lateritic deposit that indicates 1.3 percent nickel near the Benguet Consolidated deposits. Pentagon Mines, reports a nickel deposit near Iligan City, Mindanao. Mineral Integrated Development Services Corp. announced location of nickel sulfide deposits near Palauig, Zambales, and nickeliferous laterite at their Katian project in the northwestern Zambales range. Astro Minerals and Oil Corp. is reported to be exploring lateritic nickel deposits near the Atlas deposit on Palawan. Universal Oil Products Co. jointly with Rio Tuba Mining Co. is also reported to have discovered a nickel laterite deposit on Palawan.

Platinum and Palladium.—An estimated 1.4 ounces of platinum and 2.8 ounces of palladium were recovered in each ton of nickel-cobalt concentrate produced by Acoje Mining and comprised about 30 percent of the value of the concentrate. The 608 tons of concentrate shipped to Japan in December 1970 had a total value of $258,962. Palladium recovered was 878 ounces with a value of $22,246 and 352 ounces of platinum were recovered, valued at $47,659.

Silver.—Silver production reached a record high of 1,701,899 ounces in 1970. The value was $2.4 million. Silver was exported to the United States, Japan, Peru, the Republic of Korea, Switzerland, and the United Kingdom. Lepanto Consolidated, the leading silver producer, recovered 408,596 ounces of silver. Marinduque's Bagacay mine and Benguet Consolidated were also large silver producers. Marcopper recovered 169,202 ounces of silver. Other silver recoveries were made at Atlas Consolidated, Sipalay, Philex Mining, Benguet Exploration, Itogon-Suyoc Mines, Masara, Kennon, Atok-Big Wedge Mining, and Paracale-Gumaus Consolidated.

Zinc.—Benguet Exploration, Inc. produced 3,191 metric tons of zinc in 1970, valued at $656,933, from its 75-ton-per-day mill at camp 6, Tuba, Mountain Province. Additional flotation cells, agitators, thickeners, and a ball mill added in 1970 were expected to increase the mill capacity to 120 tons per day. The zinc was exported to Japan.

NONMETALS

Asbestos.—Production in 1970 was 1,213 tons valued at $37,975. Short-fiber-tremolite asbestos was mined by one operator near Libona, Bukidnon, not far from the Misamis Oriental border.

Cement.—The Philippine portland cement industry continued to expand production capacity (39 percent in 1970) despite a depressed market brought about in part by existing excess production capacity. Nevertheless, cement led all nonmetallic minerals in total value even though prices dropped from $0.78 to $0.36 per bag. In October the Price Control Council set the price at $0.67 per bag.

Cement production was 14.3 million barrels (376-pound), less than one-half of the reported 29.25 million barrels annual rated capacity. However, the value of cement shipments, mostly for domestic consumption, was $27,664,030, second to copper in mineral production value.

Marinduque started up a second rotary kiln at its Island Cement Plant, Antipolo, Rizal. The annual capacity was doubled from 2.25 to 4.5 million barrels making it the country's largest cement plant. Northern Cement Co. started production in 1970 at its plant in Sison, Pangasinan. It has an annual capacity of 3.75 million barrels. In May, Fortune Cement Corp. inaugurated its plant at Taysan, Batangas. This is the 15th plant in the Philippines and has an annual capacity of 2.25 million barrels. Expected to be in operation in 1971, were four more plants under construction including Iligan Cement Co. at Iligan, Lanao, with 2.25 million barrels annual capacity; Midland (Quezon) at Tanay, Rizal, with 3 million barrels annual capacity; Floro at Lugait, Misamis Oriental, with 2.7 million barrels annual capacity; and Continental at Norzagaray, Bulacan with 2.6 million barrels annual capacity.

Three other cement plants were reported in an advanced stage of finance negotiation to be completed in 1972 or 1973 are as follows: Tayabas, Calatrava, Negros Occidental; Builders, Samboan, Cebu; and Mabuhay, Montalban, Rizal. An additional 20 proposed cement plants were registered with the Securities and Exchange Commission.

Apo Cement Co. at Naga City, Cebu, the Philippines oldest cement plant with an annual capacity of 600,000 barrels, suspended operations in June.

Republic Cement Corp., at Norzagaray, Bulacan, with an annual capacity of 3.75 million barrels, exported cement to South Vietnam. Northern Cement Co. also obtained exporter status through registration with the Board of Investments and will be eligible to receive benefits provided by the Investments Incentives Act.

Other cement plants producing in 1970 include Bacnotan Consolidated Industries, Inc., operating plants at Bacnotan, La Union, and Davao, Mindanao; Rizal Cement Co. at Binangonan, Rizal; Universal Cement Corp. at Danao, Cebu; Filipinas Cement Corp. at Teresa, Rizal; Hi Cement Corp. at Norzagaray, Bulacan; Pacific Cement Corp. in Surigao del Norte; Mindanao Portland Cement Co. at Iligan, Lanao; Luzon Cement Co. at San Ildefonso, Bulacan; and Philippine Portland Cement Co. at Guimaras Island, Iloilo.

The Cement Association of the Philippines shifted to the metric system of weights, and replaced the 94-pound (1-cubic-foot) bag with a new 50-kilo bag on June 1st.[3]

Clays.—In most of the larger Provinces, clay was produced in small quantities for tile, bricks, ceramics, and industrial uses. More than 256,000 tons of clay, including 164 tons of bentonite, with a value of $298,094, were reported to be mined mostly in Bulacan and Rizal Provinces. An undetermined quantity of clay was produced for making tile and pottery. The value of these products exceeded $2.5 million.

Feldspar.—Feldspar production was 20,236 tons valued at $93,648. Most of the production came from Pampanga, and smaller quantities were produced in Bulacan, Ilocos Norte, Rizal, and Nueva Ecija.

Fertilizers.—Phosphate rock production was 1,400 metric tons, valued at $12,922. Bohol was the major source of phosphate rock production. Production of 58,929 tons of mixed fertilizers was valued at $3,247,731.

Atlas Consolidated at its copper mine in Cebu, produced about 210,474 tons of pyrite-flotation concentrates averaging nearly 47 percent sulfur. The concentrates were sold to local fertilizer plants. Marinduque produced about 87,000 tons of pyrite concentrates, averaging about 46½ percent sulfur, as a byproduct from the Bagacay copper mill in Samar. Capacity of the mill was being increased to produce 1,000 tons of pyrite concentrates per day. Marinduque has a contract to supply the Esso fertilizer plant with 180,000 tons of pyrite concentrates per year at a price of $0.167 per unit of sulfur content f.o.b. San Julian, Samar. Benguet Consolidated, produced pyrite concentrates averaging about 44½ percent sulfur.

The new Esso Standard Fertilizer & Chemical Co. Inc. fertilizer plant, located next to its Bataan Refinery, commenced operation with a capacity of 390,000 metric tons per year. The plant has six process units which includes a 200-ton-per-day urea unit, a 300-ton-per-day ammonia unit, a sulfuric acid unit that produces 700 tons per day from pyrites and H_2S gas, a 200-

[3] One metric ton comprises 5.863 barrels of cement. Four 94-pound bags make 1 barrel of cement. Twenty 50-kilo bags make 1 metric ton.

ton-per-day phosphoric acid unit, a 900-ton-per-day granulation unit, and facilities for superphosphate fertilizer production.

Atlas Fertilizer Corp. at Sañgi Beach, near its copper mine in Cebu, operated a 240-ton-per-day sulfuric acid plant and a 480-ton-per-day ammonium sulfate plant that produces a complete line of mixed fertilizers and byproduct gypsum.

Gem Stones.—A Philippine jewelry exporter was the first to export tektite, a black gem, reported to be a variety of billitonites found in Indonesia and australites in Australia. Philippine jade was sent to Bangkok, Thailand, for cutting and polishing.

Gypsum.—Gypsum production was 17,458 metric tons, valued at $130,484. Crude gypsum mined in Batangas accounted for about 30 percent of the production. Byproduct gypsum was produced from phosphoric acid and superphosphate fertilizer production. Byproduct gypsum operations were in Cebu, and Bataan. The cement industry used more than 31,000 metric tons of gypsum, including some byproduct gypsum and some imported gypsum.

Lime.—Combined production of quicklime and hydrated lime was 161,902 metric tons valued at $742,457. Quicklime was produced in Quezon, Benguet, Batanes, and Lanao. Hydrated lime was also produced in Quezon.

Perlite.—About 12,000 metric tons of perlite was produced and was valued at about $4,063. Trinity Lodge Mining Corp. reported mining perlite near Legaspi, Albay, in May and proposed to process it in a plant at San Pedro, Laguna, scheduled to be in operation by mid-1971. Vinnel Belvoir Construction Co., Makati, Rizal, also reported mining perlite.

Quartz.—Quartz produced as silica sand for glassmaking amounted to 684,614 metric tons and was valued at $1,343,937. Most of the silica sand was produced in Bulacan and Rizal Provinces. Smaller production took place in the following provinces: Benguet (Mountain Province), Palawan, Pampanga, Quezon, and Surigao.

Salt.—Salt recovered from sea water evaporation in 15 provinces totaled 210,306 metric tons, valued at $4,142,711. The main production came from the following Provinces: Mindoro Occidental, Bulacan, Rizal, Pangasinan and Cavite. Production of salt is dependent upon weather conditions for evaporation. Typhoons and excessive rains reduce production.

Sand and Gravel.—Sand and gravel and crushed rock production was 4,799,250 cubic meters valued at $4,003,969. Sand and gravel was produced in most of the Provinces with the largest production in Rizal, Bulacan, Cotobato, Pampanga, and Quezon.

Stone.—Limestone mined for manufacturing cement totaled 3,566,723 metric tons. Agricultural limestone production was 15,636 metric tons valued at $56,870. Bulacan, Lanao, and Rizal were among the leading producers of agricultural limestone. Production of dolomite, mostly from Cebu, was 11,011 metric tons valued at $72,265. Unfinished marble production was 10,271 metric tons valued at $226,798. In addition, 20,598 square meters of finished marble was produced, valued at $188,473. In Rizal tuff production was 87,997 metric tons valued at $1,995. Unclassified stone production reported in most of the large Provinces was 245,459 cubic meters, valued at $251,261. Cotobato was the leading producer.

Sulfur.—Elemental sulfur produced in Cagayan was 41 metric tons valued at $1,811.

Benguet Consolidated, was developing its elemental sulfur deposit of volcanic origin about 25 kilometers northwest of Dumaguete, Negros Oriental. The deposit reportedly contains more than 30 million tons of ore, averaging 30 percent elemental sulfur. The open pit mine and 2,000-ton-per-day plant are scheduled for operation in 1971. Production is expected to reach 162,000 tons of 99.5 percent sulfur per year.

Talc.—Production of talc was 1,590 metric tons, valued at $32,541. Talc was produced in Occidental, Mindoro, Rizal, and Zambales.

Other Nonmetals.—Leyte Base Metals Co. extracted and processed ochre and burnt sienna from its mines in Negros Oriental. Less than 100 tons of diatomite was produced in Camarines Norte.

MINERAL FUELS

Coal and Coke.—Production of coal was 42,401 metric tons, valued at $177,112. All of the coal was produced on the Island of Cebu. International Metallurgical Corp. announced plans for a plant at Bataan, Albay, to convert low-grade carbon and coal into metallurgical-grade coke briquets. The plant, expected to be completed in 1971, will have an annual capacity of 1 million tons of coke. Cassava or sugar, which will be used as a binder, will comprise about 10 percent of the briquets.

Petroleum.—More than 233 wells have been drilled to date but no commercially exploitable oil has been found in the Philippines. However, geologists remained convinced that a commercial reservoir will be found, most probably offshore. Renewed interest in oil exploration was evidenced by the Secretary of Agriculture and Natural Resources awarding 21 natural gas and petroleum exploration concessions covering 2.4 million hectares offshore and 2.0 million hectares onshore. The area covers a long stretch of offshore waters extending from the Sulu Sea, north of Palawan to Mountain Province, in northern Luzon. Eleven concessions were in the Sulu region and the rest were divided between the Isabela area in the north, and Cotobato and Cebu in the south. Interest was spurred by the findings of the United Nations survey of offshore exploration conducted in 1969, near Palawan.

Redeco and Cletom drilled two wells near Alegria, Cebu. Pacificia, Inc., moved a drill onto Badian Island west of Cebu. Philippine Overseas Drilling and Oil Corp. drilled near Tabuk, Mountain Province. Several exploration companies plan to start drilling in 1971.

Production from the four refineries in the Philippines, which have a total crude distillation capacity of about 180,000 barrels per day, is shown in table 1. Bataan Refinery Corp. started construction to increase refining capacity from 63,000 to 108,000 barrels per day by 1972. Two other companies propose to expand their refineries in the near future.

All crude petroleum was imported. The Philippines spent more than $100 million foreign exchange to acquire this vital commodity. In 1970 crude petroleum imported amounted to 9,166,994 metric tons. Of this total, 72 percent was imported from Iran, Indonesia, and Kuwait. The remainder was imported from Sarawak, Saudi Arabia, and the United States. An additional 176,795 tons of refined products also was imported.

Refinery products exported to Singapore, Japan, and Hong Kong totaled 1,098,321 metric tons. These comprised mostly petroleum pitch and coke, gas oil bunker fuel, and fuel oil not elsewhere specified.

The Mineral Industry of Poland

By Bernadette Michalski [1]

The mineral industry, using both domestic and imported raw materials, was a major factor in Polish economic development. The industry contributed significantly to the nation's mineral requirements and afforded an avenue to foreign currency earnings. In addition to exports of minerals and mineral products, Poland has developed an export market for mineral related technology, with the sales of mining and manufacturing equipment as well as complete industrial units, particularly sulfuric acid plants.

The Government policy stressing development of those industrial sectors that can improve the nation's foreign exchange posture, was supported by increased production of coal, copper, iron and steel, and sulfur.

In 1970 overall industrial production increased 8.3 percent over the previous year. Expanded mineral industry output was largely responsible for this increase. The mineral industry, including processing through semimanufactures, contributed about 30 percent of the total value of industrial production. Other sectors of industry, particularly food processing, did not meet production goals, but gains in mineral commodity output more than compensated for these failures, as expressed in the overall industrial growth rate.

PRODUCTION

The Polish press reported notable increases in 1970 production of natural gas, mine and electrolytic copper, elemental sulfur, and hard coal. The expanded output resulted from industrial investments undertaken during the 1966–70 5-year plan. These investments included funds for: Exploration and development of gas wells in central and southern Poland; development of the Legnica copper basin with expansion of the Legnica electrolytic copper refinery and construction of the Zukowice electrolytic copper refinery; development of the Machów open pit sulfur mine; the development of Frasch sulfur recovery at the Grzybów and Jeziorko mines; and concentrated development and mechanization efforts at coal mines. During 1970, those industries based principally on imported raw materials; namely, the petroleum refining, and iron and steel and aluminum industries reported significant to limited production increases.

[1] Foreign mineral specialist, Division of Fossil Fuels.

Table 1.—Poland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum, primary	93,500	96,800	98,800
Cadmium, primary [e]	415	420	450
Copper:			
Mine output, metal content [e]	26,600	48,300	72,000
Metal:			
Blister	28,000	50,000	52,000
Refined including secondary	43,600	54,700	72,200
Iron and steel:			
Iron ore and concentrate ... thousand tons	3,050	2,822	2,553
Pig iron including blast furnace ferroalloys ... do	6,839	7,028	7,296
Steel, crude ... do	11,007	11,291	11,792
Steel semimanufactures:			
Rolled excluding pipe ... do	7,327	7,655	8,134
Pipe ... do	638	662	711
Lead:			
Mine output, metal content	48,000	54,400	[e] 60,500
Metal including secondary, refined	42,000	50,700	54,500
Nickel mine output, metal content [e]	1,500	1,500	1,500
Silver [e] ... thousand troy ounces	160	165	180
Zinc:			
Mine output, metal content	164,100	170,800	[e] 189,900
Metal, refined including secondary	202,500	207,500	209,000
NONMETALS			
Barite [e]	47,000	50,000	50,000
Cement, hydraulic ... thousand tons	11,600	11,830	12,180
Clays, bentonite	NA	NA	50,000
Feldspar [e]	28,000	29,000	30,000
Fertilizer materials:			
Crude phosphatic, phosphate rock [e]	95,000	100,000	100,000
Manufactured:			
Nitrogenous:			
Gross weight ... thousand tons	2,506	2,941	[e] 3,240
Nitrogen content ... do	759	938	1,031
Phosphatic:			
Gross weight ... do	2,415	2,688	[e] 3,200
P_2O_5 content ... do	474	534	600
Gypsum and anhydrite:			
Calcined ... do	167	210	[e] 230
Crude [e] ... do	790	810	825
Lime (quicklime and hydrated lime) ... do	2,293	2,228	3,515
Magnesite, crude [e]	45,000	45,000	50,000
Pyrite and pyrrhotite (including cupreous):			
Gross weight [e] ... thousand tons	225	225	225
Sulfur content [e] ... do	88	88	88
Salt:			
Rock ... do	969	1,166	1,224
Other ... do	1,665	1,651	1,680
Stone, limestone, crushed and broken ... do	7,483	7,469	NA
Sulfur:			
Elemental:			
Frasch process ... do	842	1,321	[e] 1,600
Other native ... do	495	660	[e] 1,084
Total ... do	1,337	1,981	2,684
Sulfuric acid ... do	1,314	1,516	1,917
MINERAL FUELS AND RELATED MATERIALS [2]			
Coal:			
Bituminous ... thousand tons	[r] 128,640	135,010	140,101
Lignite and brown ... do	[r] 26,880	30,065	32,766
Coke:			
Blast furnace ... do	[e] 7,337	7,657	[e] 7,775
Other ... do	[e] 8,274	8,511	[e] 8,768
Total ... do	15,611	16,168	16,543
Fuel briquets, all grades ... do	931	1,578	1,600
Gas:			
Manufactured:			
Town gas ... million cubic feet	32,207	33,584	42,377
Coke oven gas ... do	200,198	202,529	207,331
Natural, marketed ... do	90,264	138,503	183,014
Natural gas liquids, natural gasoline ... thousand 42-gallon barrels	207	214	NA
Peat ... thousand tons	28	22	[e] 20

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
MINERAL FUELS AND RELATED MATERIALS [2]—Continued			
Petroleum:			
Crude:			
As reported thousand tons	475	439	424
Converted thousand 42-gallon barrels	3,524	3,257	3,146
Refinery products:			
Gasoline do	12,580	12,742	13,796
Kerosine do	326	953	NA
Distillate fuel oil do	12,592	14,480	16,494
Residual fuel oil do	11,688	13,626	NA
Lubricating oil do	1,232	1,260	NA
Grease do	20	20	NA
Paraffin do	11	12	NA
Bitumen do	2,472	2,945	NA
Total [3] do	40,921	46,038	NA

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

[1] In addition to the commodities listed, antimony, cobalt, germanium, gold, and a variety of crude nonmetallic construction materials 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] Previous editions of this chapter have reported natural asphalt and bitumen; the quantities reported under this descriptive title apparently are petroleum refinery products, and are included under the latter heading in this edition.

[3] Total is of listed commodities only, excluding products not reported individually in official sources as well as refinery fuels and losses.

TRADE

Polish overall foreign trade in 1969 was essentially in balance, with exports reported at $3,142 million [2] and imports at $3,210 million. During this period, mineral exports were reported at $945 million and mineral commodity imports at $790 million. Included among the imports were iron and steel, valued at $355 million, and petroleum valued at $185 million. Solid fuels, Poland's dominant mineral export commodity, accounted for more than one-third of the nation's total mineral export value, or $361 million.

Nearly three-quarters by value of the 1969 total mineral trade was reportedly conducted with other Communist Economy (Comecon) nations. This figure, however, only indicates a general order of magnitude, because many commodities entering Comecon trade channels are not valued in accordance with world market prices.

Trade agreements signed for the 1971–75 period portend increasing imports of crude petroleum, iron ore, pig iron, and aluminum from the U.S.S.R.

[2] Where necessary, values have been converted from Polish zloty (ZL) to U.S. dollars at the official exchange rate of ZL1=US$0.25.

Table 2.—Poland: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Cadmium, all forms	289	278	U.S.S.R. 173; United Kingdom 48; West Germany 28.
Chromium trioxide	488	546	United States 385; Netherlands 31.
Copper unwrought and wire	175	2,983	Czechoslovakia 1,346; West Germany 807; United Kingdom 552.
Iron and steel:			
Iron ore and concentrate	7,000	2,000	NA.
Scrap	152,494	230,009	Italy 83,864; Switzerland 71,193; West Germany 54,469.
Pig iron including cast iron	445,020	464,441	Japan 339,694; United Kingdom 44,000; Netherlands 25,418.
Ferroalloys	1,059	2,313	West Germany 1,093; Austria 810.
Steel ingots	160,176	140,204	Yugoslavia 64,674; West Germany 20,060; Argentina 17,989.
Semimanufactures thousand tons	1,412	1,453	U.S.S.R. 270; Yugoslavia 164; Romania 138.
Lead ore and concentrates	9,238	6,492	All to West Germany.
Zinc:			
Oxide	2,460	1,759	East Germany 300; Italy 282; Hungary 250; Sweden 180.
Metal including alloys, unwrought and semimanufactures	99,279	108,892	U.S.S.R. 39,810; Czechoslovakia 11,765; United States 9,687.
Other:			
Nonferrous ores and concentrates, n.e.s	27	6,357	United Kingdom 6,337.
Metal, nonferrous, n.e.s.:			
Scrap	16,321	24,430	Austria 8,577; Sweden 6,605; Belgium-Luxembourg 5,288.
Semimanufactures	5	660	Czechoslovakia 596.
NONMETALS			
Cement	225,383	57,931	West Germany 34,486; Brazil 10,385.
Clays and clay products:			
Crude:			
Bentonite	649	985	East Germany 938.
Refractory	61,800	65,512	Italy 22,285; Hungary 21,613.
Products:			
Fire clay manufactures	4,506	10,324	Hungary 3,724; Greece 1,760.
Silica manufactures	656	2,144	Bulgaria 1,204; West Germany 413; Turkey 358.
Fertilizer materials manufactured, nitrogenous thousand tons	159	324	India 115; East Germany 62.
Gypsum and plasters:			
Gypsum do	512	506	Sweden 181; Denmark 113; Norway 96.
Plasters do	29	20	Finland 16.
Lime	66,869	145,591	Czechoslovakia 104,519; Netherlands 22,729.
Magnesite manufactures	878	344	United Arab Republic 165; Finland 92.
Mineral pigments, iron oxide	583	411	Yugoslavia 190; Australia 55; United Arab Republic 50.
Pyrite	37,055	--	
Salt excluding brines thousand tons	119	138	Hungary 42; Czechoslovakia 40; Sweden 27.
Stone:			
Dolomite	3,094	NA	NA.
Granite	27,219	24,170	Netherlands 22,950.
Marble	535	600	Netherlands 460.
Pavement stone	19,957	22,330	West Germany 19,314.
Sulfur:			
Elemental [1] thousand tons	965	1,451	Czechoslovakia 201; France 181; United Kingdom 164; Italy 84; Greece 82; Sweden 46; West Germany 30.
Sulfuric acid	--	14,986	Switzerland 10,465; Czechoslovakia 2,606.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	952	130	Switzerland 105.
Coal and briquets:			
Anthracite and bituminous thousand tons	26,002	26,374	U.S.S.R. 7,218; Denmark 2,972; Italy 2,223.
Lignite and lignite briquets do	4,002	4,381	East Germany 4,040.
Coke do	2,410	2,327	East Germany 805; U.S.S.R. 652; Hungary 266.
Gas, manufactured coke oven million cubic feet	351	281	All to East Germany.
Natural gas liquids	7,980	14,684	East Germany 7,672; Hungary 7,012.
Petroleum refinery products thousand tons	1,473	1,695	West Germany 391; Austria 360; Sweden 322; Denmark 198; United Kingdom 134.
Rare gasses, argon	--	94	NA.

NA Not available.
[1] Sources: Total from Sulfur, No. 92, Jan.–Feb. 1971. London p. 14; detail on destinations derived from trade returns of countries listed.

Source: Unless otherwise noted, data are from official Polish trade returns.

Table 3.—Poland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	112,255	96,544	All from Hungary.
Oxide and hydroxide	196,298	195,986	Hungary 140,150; United Kingdom 3,610.
Powdered metal	625	590	Austria 438; West Germany 77.
Arsenic trioxide	589	NA	
Bismuth including alloys, unwrought	121	133	United Kingdom 118; France 15.
Chromium ore and concentrate	136,971	162,461	U.S.S.R. 83,205; Albania 47,472; Pakistan 22,170.
Copper:			
Ore and concentrate	17,331	14,657	Peru 4,961; United States 3,043; Belgium 3,011.
Metal including alloys, unwrought and wire	35,446	26,278	United Kingdom 16,767; U.S.S.R. 3,866; Belgium 3,699.
Iron and steel:			
Ore and concentrate..thousand tons	11,106	11,575	U.S.S.R. 9,994; Sweden 499.
Pig iron including cast iron....do	949	1,221	U.S.S.R. 1,207.
Iron powder	3,792	4,452	Sweden 3,023.
Ferroalloys	7,964	10,407	U.S.S.R. 3,627; Norway 2,701; Bulgaria 1,805.
Semimanufactures....thousand tons	984	1,321	U.S.S.R. 710; Czechoslovakia 161.
Lead including alloys, unwrought	18,677	14,904	Yugoslavia 5,585; U.S.S.R. 4,504; North Korea 1,342.
Magnesium including alloys, all forms	400	692	U.S.S.R. 552; Norway 75.
Manganese:			
Ore and concentrate	351,075	393,842	U.S.S.R. 361,577; Cuba 15,546.
Oxides	5,718	3,841	U.S.S.R. 1,977; Morocco 965.
Mercury.........76-pound flasks	6,700	664	United Kingdom 336; Italy 179.
Molybdenum ore and concentrate	444	600	United Kingdom 200; France 197; Canada 102.
Tin including alloys, all forms...long tons	3,246	3,925	United Kingdom 2,291; Malaysia 1,048.
Titanium oxide	10,639	10,245	United Kingdom 7,057; Italy 1,165; Finland 1,001.
Tungsten ore and concentrate	3,250	2,920	United Kingdom 2,341; West Germany 405.
Zinc ore and concentrate	85,861	83,601	Ireland 17,036; Norway 13,247; Czechoslovakia 11,281; Sweden 8,953; Hungary 6,639.
Other:			
Nonferrous ores and concentrates	5,593	6,013	United Kingdom 5,415.
Nonferrous metal scrap	300	--	
Nonferrous semimanufactures n.e.s	12,237	20,326	U.S.S.R. 7,861; Yugoslavia 3,113; Czechoslovakia 1,894.
NONMETALS			
Asbestos	42,241	57,055	U.S.S.R. 28,076; Canada 13,844; United Kingdom 6,814.
Barite	12,392	17,145	Belgium 11,288; mainland China 4,471.
Cement	319,534	640,496	U.S.S.R. 372,315; Romania 133,923.
Clays and clay products:			
Crude:			
Bentonite	4,881	5,409	Hungary 2,850; Yugoslavia 2,556.
Fullers earth	2,831	6,527	Czechoslovakia 2,780; Romania 2,581.
Kaolin (china)	79,047	91,071	Czechoslovakia 43,955; United Kingdom 15,688.
Refractory clays and burnt slate	16,868	21,462	U.S.S.R. 10,457; East Germany 6,789.
Products:			
Fire clay manufactures	3,914	2,830	West Germany 960; U.S.S.R. 853; East Germany 654.
Silica manufactures	266	8,396	U.S.S.R. 8,316.
Cryolite	4,276	3,598	France 1,899; U.S.S.R. 1,620.
Diatomite	1,441	1,500	United States 721; Belgium 597.
Feldspar	13,106	13,028	Finland 8,210; Norway 4,299.
Fertilizer materials:			
Crude:			
Phosphatic, apatite concentrate thousand tons	532	596	All from the U.S.S.R.
Manufactured:			
Nitrogenous.........do	52	--	
Phosphatic.........do	r 19,889	28,500	Belgium 21,743; Sweden 5,419.
Potassic.........do	1,796	1,897	East Germany 1,127.
Fluorspar	33,349	27,518	Mainland China 17,522; East Germany 9,995.
Graphite, natural	11,569	10,661	Austria 7,178; U.S.S.R. 2,523.
Magnesite:			
Crude	152,757	136,819	North Korea 61,250; Czechoslovakia 59,102.
Bricks	25,560	23,627	Austria 8,835; U.S.S.R. 6,165; Czechoslovakia 5,624.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Mica	1,126	1,189	India 1,102.
Pyrite	--	18,259	All from the U.S.S.R.
Stone, dimension and marble	149	1,396	Bulgaria 1,009.
Talc	17,547	23,220	North Korea 8,344; Austria 5,575; Czechoslovakia 3,854.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous coal thousand tons	1,289	1,113	U.S.S.R. 814; East Germany 299.
Lignite and lignite briquets do	136	301	All from East Germany.
Gas, hydrocarbon:			
Natural million cubic feet	35,304	35,096	All from the U.S.S.R.
Manufactured do	113	126	All from East Germany.
Petroleum:			
Crude thousand tons	5,582	6,510	All from the U.S.S.R.
Refinery products do	2,535	2,397	U.S.S.R. 1,523; Romania 300; Hungary 184; Albania 105; East Germany 105.

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—During 1970, the Skawina and Konin aluminum refineries each operated near capacity of 55,000 metric tons per year. Aluminum hydroxide imports, totaling 213,000 metric tons in 1970, supplied the feedstock for the Polish aluminum industry, which satisfied about 65 percent of the nation's aluminum requirements. Polish sources have periodically announced plans to increase annual capacity at Konin to 100,000 tons; however, trade agreements calling for an increase in aluminum imports from the U.S.S.R. during 1971–75 suggest that the Konin aluminum ingot capacity may not be expanded in the next 5-year plan.

Copper.—The accelerated development of the Legnica copper basin resulted in appreciable increases in copper ore production. Ore production from the basin was reported at 4.6 million tons, or 70 percent of the nation's 1970 total copper ore production. By mid-year, the 40,000-metric-ton annual capacity Zukowice electrolytic copper refinery was in production, bringing Poland's annual copper refining capacity to approximately 100,000 tons.

The intense activity in the copper industry was the result of a national policy channeling investment funds to those industries that show the greatest potential for improving the nation's foreign exchange position. Poland, historically an importer of copper concentrates, metal, and semimanufactures, has, in spite of growing domestic consumption, reduced copper imports from 42,000 tons in 1966 to 28,000 tons in 1970. The development of domestic copper resources at the Legnica basin should reverse Poland's copper supply position to that of a net exporter by 1980.

Iron and Steel.—The Poles have announced the discovery of a new iron ore deposit near Suwalki, in the northeast corner of Poland; no information as to quality or reserve size was reported. Historically, the nation's iron ores have been of poor quality, and as yet there is no indication that the new deposit will have any significant position in the nation's iron ore supply program. With domestic iron ore output reported at a little over 2.5 million tons, the bulk of iron ore requirements, or nearly 12 million tons of ore, was imported in 1970. Trade agreements for 1971–75 were signed with the U.S.S.R. arranging for imports of 30 million tons of iron ore and with Trafik AB Grängesberg-Oxelösund of Sweden for 1.3 million tons of Grangcold iron pellets.

Expansion or modernization activities were conducted in all of the nation's major steelworks. Installation of additional oxygen furnace capacity by mid-year at the Lenin Iron and Steel plant contributed to the 500,000 ton increase in crude steel production for 1970. The 5-year plan for 1971–75 has programed a 50 percent increase in ferrous metal production, presumably placing output of crude steel at nearly 18 million tons by 1975 and bringing downline processing capacity in line with crude steel.

Lead and Zinc.—Ore production approached 4.7 million tons in 1970, with mining activities centered near Katowice, in Southern Poland. Development work was underway on the Dabrowka Wielka mine during 1970. The mine is to be developed by inclined drifts, and, when it enters production in 1972, the Poles anticipate it will be among the most highly mechanized mines in Europe. At least part of the mine output will be delivered to Miasteczko Slaskie for Imperial Smelter Furnace processing.

NONMETALS

Fertilizers and Fertilizer Materials.—During the 1966–70 5-year plan, construction of nitrogenous and phosphatic fertilizer production facilities was accelerated, resulting in a peak year of mineral fertilizer production in 1970. Nitrogenous fertilizers were produced from domestic and imported natural gas and domestic coke. Quantities produced were equivalent to 46.1 kilograms of nitrogen per hectare of arable land. Quantities of phosphatic fertilizers manufactured from imported phosphate rock and apatite were equal to 36.2 kilograms of phosphorous pentoxide (P_2O_5) per hectare of arable land. Potassic fertilizer imports represented 58.4 kilograms of K_2O per arable hectare. By 1975, the Poles have planned an approximate 30-percent increase in fertilizer availability in terms of kilograms of nutrient components per hectare of agricultural land. Construction and capacity expansion activities for ammonia production are centered at Pulawy, Wloclawek, Kedzierzyn, Tarnów, and Chorzów. The latter three plants reportedly will undergo conversion from a coke raw material base to a natural gas base, with an anticipated 35-percent reduction in ammonia production costs.

Expansion of domestic phosphorous fertilizer materials production is expected by 1973—the target date for completion of the Police Chemical Plant. By 1975, nearly half of the P_2O_5 production, (500,000 tons) is scheduled to be absorbed in the manufacture of complex fertilizers.

Although potassium salt deposits discovered near Gdansk, in northern Poland, appear promising, long-term trade agreements have committed Poland to supplies from East Germany and the U.S.S.R. Potassic fertilizer imports were 2.2 million tons in 1970.

Sulfur.—About 60 percent of Poland's native sulfur production was recovered by the Frasch process from the Grzybów mine at Kielce and the Jeziorko mine at Rzeszów, each yielding an estimated 800,000 tons of sulfur. Open pit mining operations at Tarnobrzeg produced more than 4 million tons of ore, from which 1.1 million tons of elemental sulfur was recovered. The bulk of open pit sulfur production was derived from the Machów pit, on the east bank of the Wisla River. The pit produced an estimated 750,000 tons of sulfur in 1970, the first full year of operation. Production from the Piaseczno pit, on the west bank of the Wisla River, reached an estimated 350,000 tons of sulfur by mid-1970, when the west bank mining operation phase out was completed, and all open pit mining activities were transferred to the opposite river bank at Machów.

Because most of the elemental sulfur output is destined for export, storage and handling facilities were under construction at the port of Gdańsk to accommodate increased shipments of liquid sulfur. Exports in 1970 were estimated at nearly 2 million tons; the principal markets were Czechoslovakia and the European Economic Community. There was limited penetration into Asian and African markets.

Byproduct sulfur as recovered from sulfide ores and fuels is unreported, but byproduct sulfur, as well as native sulfur, is undoubtedly utilized in the manufacture of sulfuric acid.

MINERAL FUELS

Coal.—At the end of the 1966–70 5-year plan, aggregate coal output exceeded planned production for the period. For the 5-year plan period, bituminous output totaled 650 million tons (Plan—634 million), including 152 million tons of coking coal (Plan—145 million). Coal exports during the 5 years totaled 128 million tons (Plan—110 million). The major factor influencing increased coal production was automation, mechanization, and widespread use of more economical mining techniques. In 1970, the coal industry operated 1,940 production faces, 80 percent of which were mined by the long wall system. Underground output per man per shift reached

3,072 kilograms. Of the total 1970 bituminous coal output of 140.1 million tons, industrial and power units consumed 83 million tons, households consumed 23 million tons, and 28.8 million tons were exported.

Natural Gas.—Discoveries near Poznañ in central Poland, and in the Carpathian lowlands of the southwest increased Polish proven natural gas reserves from 1,624 billion cubic feet in 1967 to 4,415 billion cubic feet in 1970. Natural gas accounted for nearly 5 percent of the energy consumption in 1970. Domestic production of 183,014 million cubic feet represented a 32-percent increase over the previous year's production level and more than a 100-percent increase over the 1968 level. Increased availability of domestic natural gas has not only cut down on imported natural gas from the U.S.S.R., but reportedly released for export coal valued at $12 million in 1970.

Petroleum.—During 1969–70 extensive exploratory drilling operations continued with the assistance of the U.S.S.R. An oilfield was reportedly discovered during 1969 at Rzeszów, but domestic crude petroleum output remained insignificant, contributing less than 6 percent of the refinery throughput for 1970, which was reported at nearly 55 million barrels. The Soviet Union delivered 51.4 million barrels of crude petroleum via the Druzba pipeline in 1970, enabling Polish refineries to supply about 85 percent of the nation's petroleum product requirements. The bulk of product output is obtained from the Plock refinery, where crude throughput was recorded at 41.9 million barrels in 1970. By 1975, the Plock refinery is scheduled for expansion to a 200,000-barrel-per-day capacity. Two refineries, each having a 120,000-barrel-per-day capacity, have been proposed for construction in the late 1970's in Upper Silesia and at the Port of Gdañsk. Although the U.S.S.R. will continue to be Poland's major crude petroleum supplier, with agreements calling for delivery of 345 million barrels of crude petroleum in the 1971–75 5-year plan, at least one of the proposed new 120,000-barrel-per-day refineries will process Middle East crude oil.

The Mineral Industry of Portugal

By Frank L. Fisher [1] and Horace T. Reno [1]

The Portuguese mineral industry continued to maintain the upward trend which began in 1969. Imports increased 22 percent, resulting in a deficit balance of trade. Severe storms at the beginning of 1970 resulted in heavy material damage to mineral industry facilities and curtailed some of the year's output. The emphasis in Portuguese resource development was focused on the petroleum industry. The potential of offshore petroleum was under preliminary investigation, and a second refinery began operations. Among the numerous prospective mineral deposits examined in 1970, those containing pyrites, wolframite, scheelite, and clays showed the most promise. With a new government regime taking over after the passing of Dr. Salazar, an accelerated period of mineral resource development became evident.

PRODUCTION

Production of Portuguese metals and minerals was slightly higher than in 1970, with the major gain in quantity and value registered by the petroleum refining industry. In the nonmetals, increases were registered for clays, salt, cement, diatomite, feldspar, nitrogenous fertilizers, and talc. Phosphatic fertilizers showed a decline. In metals, those with increases in production in 1970 were refined copper, rolled steel products, zinc concentrates, and titanium. Petroleum refinery output was up sharply from 15,504,000 barrels in 1969 to 27,470,000 barrels in 1970 with a value of $106.4 million.[2]

[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from Portugal Escudo (Esc) to U.S. dollars at the rate of PE's 28.75=US$1.00.

Table 1.—Portugal: Production of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Antimony mine output, metal content	r 50	45	e 45
Arsenic, white	r 188	247	e 250
Beryl concentrate, gross weight	128	r 29	14
Columbite-tantalite concentrates, gross weight	12	7	3
Copper:			
Mine output, metal content:			
In cupreous pyrites	4,279	r 3,825	4,758
In other ore and concentrate	188	r 180	209
In precipitate	54	r 69	52
Total	4,521	r 4,074	5,019
Metal refined, primary	r 3,890	3,690	4,008
Gold:			
Mine output, metal content troy ounces	17,394	17,758	16,187
Metal	22,666	18,101	e 17,000
Iron and steel:			
Iron ore and concentrate:			
Hematite and magnetite thousand tons	r 147	r 107	72
Manganiferous do	r 53	56	54
Pig iron do	281	335	308

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS—Continued			
Iron and steel—Continued			
Ferroalloys excluding blast furnace products:			
Ferromanganese	813	1,623	e 1,600
Ferrosilicon	6,307	8,714	e 9,000
Ferrotungsten	r 300	r 374	307
Steel ingots thousand tons	302	r 389	371
Steel semimanufactures do	280	r 324	351
Lead:			
Mine output, metal content	r 2,287	r 1,802	1,463
Metal refined	1,227	r 1,129	568
Manganese ore and concentrate, gross weight	r 9,665	r 6,928	5,518
Silver:			
Mine output, metal content troy ounces	r 327,262	338,765	e 300,000
Metal including secondary do	296,365	319,096	e 320,000
Tin:			
Mine output, metal content long tons	668	r 489	400
Metal do	r 638	r 501	390
Titanium (ilmenite concentrate), gross weight	604	r 206	230
Tungsten mine output, metal content	1,383	r 1,331	1,785
Uranium oxide (U_3O_8) produced e	95	95	95
Zinc mine output, metal content	361	r 1,091	1,955
NONMETALS			
Asbestos	85	203	182
Barite	320	108	430
Cement, hydraulic thousand tons	1,861	2,036	2,332
Clays:			
Kaolin	41,408	r 44,830	49,917
Other	r 46,257	66,146	NA
Diatomite	3,512	r 2,805	3,079
Feldspar	r 20,665	r 24,079	29,656
Fertilizer materials manufactured:			
Nitrogenous, gross weight thousand tons	579	473	501
Phosphatic, gross weight do	489	451	373
Mixed and unspecified do	165	195	208
Total do	1,233	1,119	1,082
Gypsum and anhydrite do	106	95	e 95
Lime (quicklime and hydrated) do	192	199	e 200
Mica, all grades	2,116	1,167	e 1,200
Pyrite and pyrrhotite (including cupreous), gross weight:			
Noncupreous thousand tons	128	531	476
Cupreous do	433		
Total do	561	531	476
Sulfur content do	r 258	239	209
Quartz:			
Common quartz	54,318	90,909	128,816
Quartzite	r 190,432	190,084	NA
Salt:			
Rock thousand tons	151	166	194
Marine do	263	142	e 200
Stone, sand and gravel, n.e.s:			
Stone:			
Calcareous:			
Dolomite	12,196	2,900	3,079
Limestone including marl and calcite thousand tons	3,427	3,354	NA
Marble do	163	202	NA
Other:			
Granite do	1,553	1,965	NA
Slate do	70	56	NA
Other do	436	290	NA
Gravel do	160	48	NA
Sand not further described do	835	964	NA
Sulfur, elemental including sublimed	3,762	8,339	e 8,500
Talc	1,460	r 1,200	1,807
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Anthracite thousand tons	397	361	271
Lignite do	31	8	e 8
Coke, gas do	e 10	e 10	e 10
Fuel briquets, all grades do	30	29	39
Gas manufactured million cubic feet	3,810	4,031	NA
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	3,401	3,647	4,420
Kerosine do	1,535	1,604	1,550
Jet fuel do	536	488	1,464
Distillate fuel oil do	2,842	3,245	5,573
Residual fuel oil do	3,523	4,116	8,258
Other do	622	669	2,828
Refinery fuel and losses do	823	1,735	3,377
Total do	13,282	15,504	27,470

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

TRADE

The Governments' new economic expansion policy, exemplified by foreign trade in all commodities, had a particularly notable effect on trade in mineral and metal products. The quantity and value of total imports increased 22 and 27 percent, respectively compared with 1969 figures, and the quantity and value of exports increased 24 and 15 percent, respectively. Mineral product imports increased 27 percent in quantity and 37 percent in value, while exports increased 70 percent in quantity and 62 percent in value compared with 1969 figures.

The expanding economy required appreciably more supplementary mineral products than it was able to produce. However, mineral product sales to foreign countries added substantially to the national income. Stone, slate, marble, and other nonmetallic minerals were the principal mineral export products, measured by both quantity and value. There was little change in the quantity and nature of metallic products exported. The tungsten concentrates went principally to the United Kingdom, and the pyrites went to Belgium, the Netherlands, and Luxembourg.

Crude petroleum led the list of increased import trade items, increasing more than 80 percent in quantity and almost doubling in value compared with 1969. Iraq supplied more than half of the total, followed by Bahrain and Saudi Arabia. Imports of pig iron and semifinished steel increased 40 percent in quantity and 52 percent in value; West Germany, Belgium, the Netherlands, Luxembourg, Japan, the United Kingdom, and the United States were the principal suppliers. Copper imports increased more than 50 percent in quantity and almost 70 percent in value; Canada, Belgium, the Netherlands, and Luxembourg were the principal suppliers. Imports of aluminum bars and shapes increased 40 percent in quantity and almost 50 percent in value; Germany, Sweden, Spain, Canada, Belgium, the Netherlands, and Luxembourg were the principal suppliers. Aluminum sheets were imported from Austria.

Table 2.—Portugal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	538	710
Arsenic trioxide, pentoxide, and acids	107	126
Beryl ore and concentrate	52	59
Columbium and tantalum, tantalum ore and concentrate	10	----
Copper:		
Ore and concentrate	31	20
Metal including alloys, all forms	r 919	1,553
Gold troy ounces	111	235
Iron and steel:		
Ore and concentrate including roasted pyrite	41	5,036
Metal:		
Scrap	35,959	14,945
Pig iron, ferroalloys, and similar materials	6,729	8,818
Steel, primary forms	9,121	15,653
Semimanufactures:		
Bars, rods, angles, shapes, sections	10,423	15,552
Universals, plates and sheets	3,190	2,726
Rails and accessories	130	35
Wire	23,508	13,375
Tubes, pipes and fittings	15,639	12,851
Castings and forgings, rough	414	1,851
Lead:		
Ore and concentrate	3,674	3,500
Oxides	94	89
Metal including alloys, all forms	234	368
Magnesium metal including alloys	14	9
Manganese ore and concentrate	5,795	9,260
Nickel metal including alloys, all forms	41	41
Platinum group and silver:		
Platinum metal including alloys troy ounces	1,597	202,009
Waste and sweepings [1] do	2,027,809	4,274,535
Silver worked and partly worked do	7,732	1,590
Tin metal including alloys, all forms long tons	287	106
Tungsten ore and concentrate	1,791	1,718
Zinc:		
Ore and concentrate	(2)	2,457
Oxide	119	123
Metal including alloys, all forms	172	261

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS—Continued		
Other:		
Ore and concentrate, molybdenum, titanium, vanadium, and zirconium	850	500
Ash and residues containing nonferrous metals	939	992
NONMETALS		
Abrasives, natural n.e.s:		
Pumice, emery, natural corundum, diatomite, etc	276	1,826
Grinding and polishing wheels and stones	106	181
Asbestos	10	74
Barite and witherite	10	--
Cement	33,961	37,944
Chalk	161	98
Clays and products (including all refractory brick):		
Crude n.e.s.:		
Kaolin	436	907
Other	1,553	2,795
Products:		
Refractory (including nonclay brick)	3,639	2,959
Nonrefractory	10,575	17,886
Diamond:		
Gem not set or strung ... value, thousands	r $38,663	$58,983
Industrial ... do	r $604	$713
Diatomite and other infusorial earths	254	238
Feldspar, leucite, naphthalene, etc	9,063	13,338
Fertilizer materials natural and manufactured:		
Nitrogenous	64,534	75,694
Phosphatic	98,479	44,868
Potassic	327	928
Other including mixed	23,415	18,432
Gypsum and plasters	203	239
Lime	2,265	2,789
Mica, crude including splittings and waste	1,622	1,424
Pigments, mineral:		
Natural crude	95	103
Iron oxides processed	40	56
Pyrite (gross weight)	269,616	250,690
Salt	61	244
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Marble and other calcareous	93,751	111,186
Slate	8,133	7,918
Granite and other	24,669	52,611
Worked:		
Slate	7,617	7,932
Paving and flagstone	127,957	115,562
Marble and other	18,562	20,845
Gravel and crushed rock	1,874	2,607
Quartz and quartzite	53,402	65,009
Sand not metal bearing	29,337	17,882
Sodium compounds	684	714
Sulfur, elemental, all forms	422	780
Talc and steatite	43	34
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	75	10
Coal and coke including briquets	266	143
Petroleum refinery products: [3]		
Gasoline (including natural) ... thousand 42-gallon barrels	200	166
Kerosine and jet fuel ... do	760	931
Distillate fuel oil ... do	82	104
Residual fuel oil ... do	27	107
Lubricants ... do	77	98
Liquefied petroleum gases ... do	9	11
Mineral jelly and wax ... do	(2)	(2)
Other ... do	1	8

r Revised.
[1] Including silver.
[2] Less than ½ unit.
[3] Excluding bunkers.
Source: Instituto Nacional de Estatistica. Estatisticas do Comercio Externo, 1968 and 1969. V. I, Lisbon, 543 pp.

Table 3.—Portugal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	1,430	610
Oxide and hydroxide	1,424	1,543
Metal including alloys:		
Scrap	23	35
Unwrought	734	802
Semimanufactures	8,490	9,855
Chromium:		
Chromite	79	--
Oxide and hydroxide	95	120
Copper metal including alloys:		
Scrap	221	684
Unwrought:		
Blister	1,948	1,348
Refined unalloyed	r 2,755	3,999
Master alloys	30	38
Semimanufactures	6,866	8,087
Gold metal unworked or partly worked ... troy ounces	1,292	659
Iron and steel:		
Ore and concentrate including roasted pyrite	101,596	148,375
Metal:		
Scrap	3,734	5,101
Pig iron, ferroalloys, and similar materials	3,394	5,968
Steel, primary forms	8,443	9,119
Semimanufactures:		
Bars, rods, angles, shapes, sections	37,286	39,891
Universals, plates and sheets:		
Heavy, medium, and light plates and sheets uncoated	127,860	144,840
Tinned plates and sheets	52,422	62,472
Other coated plates and sheets	12,012	22,487
Hoop and strip	29,117	35,516
Rails and accessories	6,186	8,437
Wire	15,315	9,291
Tubes, pipes, and fittings	24,229	16,484
Castings and forgings, rough	528	753
Lead:		
Oxides	5	28
Metal including alloys:		
Scrap	45	69
Unwrought and semimanufactures	7,649	9,064
Magnesium metal including alloys, all forms	r 5	9
Manganese:		
Ore and concentrate	555	515
Oxides	45	84
Mercury ... 76-pound flasks	232	841
Molybdenum metal including alloys, all forms ... kilograms	r 2,300	2,600
Nickel metal including alloys, all forms	387	390
Platinum group and silver including alloys:		
Platinum group ... troy ounces	152,447	3,051
Silver ... thousand troy ounces	r 628	669
Tin:		
Oxides ... long tons	r 11	12
Metal including alloys, all forms ... do	r 44	119
Titanium:		
Rutile concentrate	266	116
Oxides	3,113	3,554
Zinc:		
Oxides	234	233
Metals including alloys:		
Scrap	102	113
Unwrought	r 6,097	8,055
Semimanufactures	r 692	652
Other ores and concentrates:		
Of titanium (except rutile), vanadium, and zirconium	466	380
Unspecified nonferrous	2	15
NONMETALS		
Abrasives, natural n.e.s.:		
Pumice, emery, natural corundum	473	657
Dust and powder of precious and semiprecious stones (including diamond) ... kilograms	4	8
Grinding and polishing wheels and stones	285	309
Asbestos	4,269	3,473
Barite and witherite	208	299
Cement	1,995	1,754
Chalk	2,884	3,180
Clays and products (including all refractory brick):		
Crude n.e.s.:		
Bentonite	2,639	3,123
Kaolin (china)	2,290	3,596
Other	r 2,528	5,348

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Clays and products (including all refractory brick):—Continued		
Products:		
Refractory (including nonclay bricks)	r 7,470	5,478
Nonrefractory	r 1,003	1,952
Cryolite and chiolite	48	50
Diamond, except powder and dust:		
Gem not set or strung ..... carats	783	2,664
Industrial ..... do	32	22
Unspecified ..... thousand carats	1,754	1,776
Diatomite and other infusorial earths	2,322	2,516
Feldspar, leucite, nepheline, etc	1,346	1,647
Fertilizer materials:		
Crude:		
Nitrogenous	3,600	4,030
Phosphatic	299,726	303,073
Manufactured:		
Nitrogenous	r 1,277	1,860
Phosphatic	r 11,528	13,440
Potassic	r 28,226	32,625
Other including mixed	36,392	43,111
Graphite, natural	188	145
Gypsum and plasters	16,325	21,448
Magnesite	476	442
Mica crude and worked	r 134	153
Pigments, mineral:		
Natural crude	56	80
Iron oxides processed	1,511	1,698
Salt and brines	3,915	1,060
Stone, sand and gravel:		
Dimension stone crude and worked	r 616	1,142
Dolomite, chiefly refractory grade	3,243	3,783
Flint and crushed rock	934	926
Quartz and quartzite	515	165
Sand excluding metal bearing	3,214	2,500
Sulfur:		
Elemental, all forms	r 20,959	27,282
Sulfur dioxide	234	283
Sulfuric acid	71	46
Talc, steatite, soapstone, and pyrophyllite	2,642	2,667
Other nonmetals, crude n.e.s	7,833	12,538
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	1,974	1,167
Carbon black	5,140	6,247
Coal including briquets, all grades ..... thousand tons	392	341
Coke and semicoke ..... do	231	346
Petroleum:		
Crude and partly refined ..... thousand 42-gallon barrels	13,255	16,672
Refinery products:		
Gasoline ..... do	1,659	1,990
Kerosine and jet fuel ..... do	2,032	2,336
Distillate fuel oil ..... do	3,536	3,230
Residual fuel oil ..... do	4,562	4,069
Lubricants ..... do	427	462
Other ..... do	2,235	2,628
Total ..... do	14,451	14,715
Mineral tar and other coal, petroleum or gas-derived crude chemicals	10,750	12,664

r Revised.

COMMODITY REVIEW

METALS

Gold and Silver.—The Mouros mine of Minas de Jalles, Ltd., Portugal's only gold producer, introduced a sand fill system which considerably reduced nonproductive time and hand labor for filling in the stopes. Measured in tons per man, the new system proved 2.5 to 3.5 times superior to the old one. Minas de Terramonte Ltd., reported ore reserves of about 300,000 tons to a depth of 390 meters. Its ore mined in 1970 contained 1.94 percent lead, 2.07 percent zinc, and 3.3 ounces of silver per ton.[3]

Iron and Steel.—The expansion program at the Sexial steelworks of Siderurgia Nacional Sarl continued approximately on schedule. However, arrangements were not yet completed for exploiting the Moncorvo iron ore deposits in northeast Portugal.

[3] World Mining. Catalog Survey and Directory Number, 1971. June 25, 1971, p. 141.

Tungsten and Tin.—Beralt Tin and Wolfram, Ltd., continued to experience difficulty obtaining skilled labor to support its mechanization expansion program, which was near completion at year end. The company reported developed ore reserves as sufficient for 3 to 4 years' production at 1,800 to 2,000 tons of concentrates per year. In 1970 it produced 1,634 metric tons of tin-tungsten concentrates and continued development of its newly opened Ribeira mine.

NONMETALS

Cement and Other Construction Materials.—In general, the production of nonmetallic minerals, cement, and fertilizer materials reflected Portugal's overall increase in industrial activities. Compared with 1969, the increase in production of cement was 15 percent; dolomite 6 percent; feldspar 23 percent; and diatomite 10 percent. The Government announced plans to expand nonmetals production by building two new cement plants in central Portugal with capacities up to 1 million and 300, 000 tons per year, an ammonium nitrate factory with annual capacity of 26,000 tons at Estarreja, and compound fertilizer and nitric acid plants with annual capacities of 75,000 and 110,000 tons.

Pyrite and Sulfur.—Companhia União Fabril Sarl (CUF) has begun construction of a large new sulfuric acid plant at its Barreiro complex near Lisbon. The plant, scheduled for completion in mid-1971, will have a rated capacity of 625 tons per day. Raw material will be domestic pyrites. Sociedade Mineira de Santiago is planning to invest $122 million in exploration and development of pyrite deposits in the Aljustrel region.

Stone.—The ornamental stone industry continued its high rate of activity of the last few years. Quartz and marble were sold in 18 countries in all parts of the world including Sweden, the Republic of South Africa, the United States, Canada, the Republic of Panamá, Japan, and Hong Kong.

MINERAL FUELS

Coal and Coke.—Siderurgia Nacional announced plans to purchase French coking equipment having capacity to produce 1.2 million tons of coke per year.

Petroleum.—The Government granted Ball and Collins (Oil and Gas), Ltd., an 18-month concession to prospect for and the exclusive right to develop and exploit natural hydrocarbon deposits in liquid and gaseous forms on the land area of São Tomé and Principe islands and on the Continental Shelf of each up to a depth of 300 meters. The concession was to be activated through a newly formed Portuguese company. The Government also announced terms for expansion of existing refineries, construction of a new refinery in southern Portugal, and establishment of petrochemical industries in conjunction with refinery expansions. Sociedade Anónima Concessionária da Refinação de Petrólos em Portugal (SACOR) was authorized to double the capacity of its Porto refinery to handle a minimum of 4 million tons of crude oil annually by adding new fuels and aromatic product units. Port and storage facilities are to be expanded to handle 120,000-ton-capacity tankers. Financing and construction are to be completed within 24 months. Concurrent with the refining expansion, a petrochemical complex is to be constructed in Estarreja and operated as a joint venture by SACOR, CUF, and Amoniaco Portugues Sarl. Authorization was to be granted to construct and operate a 300,000-ton-capacity refinery in southern Portugal by a public company having initial capitalization of $17.5 million. The entity to build the refinery was to be selected on the basis of the best proposals submitted, and was to provide part of the stock issue to the Government free of charge. Furthermore, the concern selected would be bound to request authorization to construct and operate a complementary petrochemical industry with equal financing arrangements. When the foregoing plans materialize, the Portuguese petroleum industry capacity will be increased 265 percent.

The Mineral Industry of Romania

By Joseph B. Huvos [1]

Petroleum maintained its position as Romania's most important contribution to world mineral supplies in 1970. In 1969 Romanian petroleum output contributed 0.7 percent to the world's total crude oil supply. Among European producers, it ranked second after the U.S.S.R. Besides crude oil Romania produced bauxite, aluminum, iron ore, iron and steel, cement, pyrites, and salt, but only in quantities important to the domestic economy.

Since recent Romanian crude oil output was essentially unchanged, efforts were made to supplement it with imports. The petrochemical and fertilizer industries which are based on crude oil and natural gas, progressed rapidly with the openings of a fertilizer complex at the chemical combine in Craiova and the petrochemical plant in Iaşi which produces polyester fiber. Progress in the iron and steel industry was marked by the startup of a slabbing mill at the iron and steel combine in Galati. There was a partial startup of the Iron Gate hydroelectric powerplant, and a 420-megawatt thermal powerplant at Mintia-Deva was put on stream.

The supply-demand situation for the more important minerals remained basically unchanged. Extensive oil and gas exploration continued in the offshore areas of the Danube delta and the Black Sea. Development of lignite mines in the Jiu and Motru Valley areas continued. By world standards, only the export in 1969 of the about 5.1 million tons of petroleum products was significant.

Soviet trade accounted for 27.4 percent of Romania's total trade while trade with Communist-bloc countries amounted to 55.1 percent. New technological processes were purchased from both Communist and non-Communist countries, and efforts were made to set up joint ventures with industrially developed countries. In 1970 the mineral industry contributed about one-fifth of the value of the social product of Romania.[2]

PRODUCTION

Romanian production of all commodities increased by 12 percent to 296.7 billion lei [3] which corresponds to a 100.6-percent fulfillment of the 1970 production plan.

The year's growth in the minerals industry was as follows:

	Percent of growth
Electric and thermal energy	12
Fuels	8
Coal	15
Petroleum	6
Ferrous metallurgy, including mining	13
Nonferrous metallurgy, including mining	8
Building materials	13

Significant increases were reported in the production of bauxite, aluminum, barite, pig iron, and crude steel. With new capacities that went on stream, production of petroleum products, petrochemicals, fertilizers, and sulfuric acid also increased. In the spring of 1970 catastrophic floods caused a setback in some areas of production. Plan figures for 1971 were boosted to make up for losses.

[1] Foreign mineral specialist, Division of Fossil Fuels.

[2] As in other Communist countries of East Europe, Romania does not report its gross national product (value of all final goods and services produced) but rather publishes a figure for the social product which generally excludes the value of services and defense.

[3] Values have not been converted from Romanian currency units (lei) to U.S. dollars, owing to the wide variation between the official exchange rate (lei 6 = US$1.00) and those actually used for some transactions.

Table 1.—Romania: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity[1]	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite e	20,000	50,000	304,300
Alumina e	145,000	170,000	210,000
Ingot (including alloys)	76,274	89,650	101,283
Bismuth e	60	80	80
Cadmium e	50	60	80
Copper:			
Mine, metal content e 2	5,000	5,000	6,000
Smelter e	5,000	5,000	6,000
Gold e ... troy ounces	60,000	60,000	60,000
Iron and steel:			
Iron ore ... thousand tons	2,747	2,999	3,206
Pig iron and blast furnace ferroalloys ... do	3,006	3,486	4,211
Crude steel ... do	4,751	5,540	6,517
Semimanufactures:			
Casting and forgings, finished ... do	NA	494	NA
Rolled products ... do	3,393	3,816	4,504
Pipes and tubes ... do	706	756	767
Lead:			
Mine, metal content e 2	30,000	40,000	38,000
Smelter e	35,000	35,000	36,000
Manganese ore:			
Gross weight	e 127,000	127,000	e 127,000
Manganese content	28,000	e 28,000	e 28,000
Silver, mine, metal content e ... thousand troy ounces	800	800	800
Zinc:			
Mine, metal content e 2	25,000	30,000	39,800
Smelter e	25,000	30,000	39,800
NONMETALS			
Barite e	55,000	100,000	116,500
Cement, hydraulic ... thousand tons	7,026	7,515	8,127
Clays:			
Bentonite	120,000	120,000	120,000
Kaolin e	50,000	50,000	50,000
Fertilizer materials manufactured:			
Nitrogenous, nitrogen content	420,714	493,636	e 627,000
Phosphatic, phosphorous pentoxide content	181,834	221,418	e 268,000
Graphite	NA	NA	6,019
Lime ... thousand tons	1,706	1,918	e 2,000
Pyrites:			
Gross weight ... do	e 360	e 360	807
Sulfur content e ... do	140	140	346
Salt ... do	2,368	e 2,400	2,862
Sulfuric acid (monohydrate) ... do	773	838	994
Talc	e 50,000	e 50,000	56,728
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	54,873	56,432	72,474
Coal:			
Run of mine:			
Anthracite and bituminous ... thousand tons	7,184	7,534	NA
Brown ... do	690	700	NA
Lignite ... do	9,146	10,918	NA
Total ... do	17,020	19,152	22,835
Salable (produced from above):			
For coke and semicoke production (washed) ... do	1,212	1,176	NA
Lignite ... do	8,690	10,451	NA
Other (unspecified) ... do	4,901	5,349	NA
Total ... do	14,803	16,976	20,500
Coke, metallurgical ... do	1,133	939	1,070
Gas:			
Manufactured ... million cubic feet	20,129	16,432	e 23,131
Natural:			
Associated ... do	166,280	177,314	178,689
Nonassociated ... do	601,338	665,750	696,754
Total ... do	r 767,618	843,064	875,443

See footnotes at end of table.

Table 1.—Romania: Production of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity[1]	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude:			
As reported ---- thousand tons	13,285	13,246	13,377
Converted e ---- thousand 42-gallon barrels	101,059	101,067	102,067
Refinery products:			
Gasoline ---- do	22,406	22,268	23,682
Kerosine ---- do	7,357	7,777	7,509
Distillate fuel oil ---- do	32,583	34,265	37,667
Residual fuel oil ---- do	24,133	26,072	28,296
Lubricants ---- do	4,162	4,186	4,242
Asphalt ---- do	2,654	3,066	NA
Petroleum coke e ---- do	330	440	550
Liquefied petroleum gas ---- do	2,053	2,158	NA
Total ---- do	95,678	100,232	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 insufficient to make reliable estimates of output levels.

[2] Recoverable.

TRADE

In 1969 Romanian exports of all goods were valued at 9,798.7 million lei, and imports were 10,442.9 million. In 1970 estimated exports were 11,400 million lei (the plan was 11,800 million). Plans for 1971 call for an increase of 18 percent, to 13,500 million lei.

Principal trading partners in 1969 were as follows:

	Percent of total trade
U.S.S.R.	27.40
West Germany	8.65
Czechoslovakia	7.15
East Germany	6.06
Italy	5.90
United Kingdom	4.46
France	4.36
Poland	3.84

Trade with Communist-bloc countries was 11,197.3 million lei, or 55.1 percent of the total. Exports and imports by major commodity groups were as follows:

	Million lei	Percent of total
Exports:		
Equipment of production	2,121.9	21.7
Fuels, minerals, and metals	2,019.9	20.6
Petroleum products	712.5	7.3
Chemicals, fertilizers, and rubber	693.1	7.1
Building materials	260.4	2.7
Imports:		
Production equipment	4,624.2	44.3
Fuels, minerals, and metals	2,964.3	28.4
Chemicals, fertilizers, and rubber	702.4	6.7
Building materials	208.9	2.0

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum and alloys:			
Scrap	3,455	3,072	West Germany 2,682; Italy 390.
Unwrought and semimanufactures	33,240	37,614	United Kingdom 14,389; West Germany 10,697; Japan 3,435.
Copper and alloys, unwrought and semimanufactures	2,733	2,986	West Germany 2,953.
Iron and steel:			
Scrap	1,761	252	All to West Germany.
Pig iron and ferroalloys	180,281	88,972	Japan 79,123; Italy 9,849.
Steel:			
Primary forms	128,044	2,345	All to Austria.
Semimanufactures:			
Bars, rods, angles, shapes, sections	34,887	75,267	U.S.S.R. 31,400; Poland 26,462; Italy 15,056.
Plates and sheets	277,686	368,779	U.S.S.R. 198,500; West Germany 49,436; Italy 48,803.
Hoop and strip	255	16,114	All to Yugoslavia.
Wire	--------	1,216	Italy 705; West Germany 511.
Pipe, tubes, and fittings	185,962	189,884	U.S.S.R. 151,200; Poland 27,053; West Germany 9,145.
Castings and forgings	411	2,503	Poland 2,297; West Germany 206.
Total	[2] 499,201	[2] 653,763	

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Lead:			
Oxides	445	--------	
Metal and alloys, unwrought and semimanufactures	5,184	3,112	Italy 1,424; Netherlands 1,107.
Manganese ore	[3] 66,600	[3] 48,100	Japan 5,857; Belgium-Luxembourg 4,094.
Platinum-group metals, all forms value, thousands	--------	$540	All to United Kingdom.
Silver:			
Waste and sweepings do	$2,310	$1,044	Italy $600; United Kingdom $218; West Germany $183.
Metal, crude and worked do	--------	$2,374	France $1,312; West Germany $1,062.
Zinc:			
Ore and concentrate	332	--------	
Metal and alloys, unwrought and semimanufactures	10,207	5,780	Switzerland 2,227; United Kingdom 1,885; West Germany 1,153.
Other, nonferrous scrap n.e.s	NA	2,810	West Germany 2,632.
NONMETALS			
Barite	10,300	29,700	All to U.S.S.R.
Cement thousand tons	[3] 1,208	[3] 1,182	Yugoslavia 300; Poland 134; Spain 95.
Clays and clay products:			
Crude, bleaching	680	1,051	All to Poland.
Products, nonrefractory	--------	1,399	All to Yugoslavia.
Fertilizer materials manufactured:			
Nitrogenous	31,224	156,926	France 113,718; Greece 20,054; Spain 19,669.
Phosphatic	2,420	2,460	All to West Germany.
Mixed	300	--------	
Pyrite, unroasted	108,901	48,335	All to West Germany.
Salt	[3] 484,700	[3] 524,700	Yugoslavia 108,532; Greece 43,362.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	29,294	30,896	U.S.S.R. 29,800; Turkey 1,096.
Soda ash	37,800	39,100	All to U.S.S.R.
Stone:			
Dimension, worked	2,956	12,839	Japan 11,043; Austria 1,796.
Other	4,060	9,734	West Germany 8,300; Japan 1,434.
Talc	501	1,051	All to Poland.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	2,375	1,486	All to Yugoslavia.
Carbon black	[3] 31,900	[3] 29,400	Italy 503; Turkey 238.
Coal briquets	400	600	All to Italy.
Gas, natural and manufactured million cubic feet	[3] 8,048	[3] 7,063	Mainly to Greece.
Peat and briquets	2,161	4,448	Italy 1,855; Austria 1,613; West Germany 980.
Petroleum:			
Crude thousand 42-gallon barrels	384	--------	
Refinery products:[4]			
Gasoline do	[3] 8,404	[3] 7,247	West Germany 1,460; France 961; Greece 370.
Kerosine do	[3] 1,397	[3] 1,562	Sweden 31; West Germany 30; Yugoslavia 26.
Distillate fuel oil do	[3] 17,076	[3] 16,114	France 3,740; West Germany 2,532; Yugoslavia 934.
Residual fuel oil do	[3] 11,175	[3] 9,324	United States 1,432; Finland 1,356; Italy 945.
Lubricants do	[3] 2,504	[3] 2,658	Yugoslavia 84; Turkey 74; Belgium-Luxembourg 21.
Mineral jelly and wax do	[3] 175	[3] 143	Italy 19; Yugoslavia 12; France 11.
Nonlubricating oil n.e.s. do	8	7	All to Yugoslavia.
Petroleum coke do	[3] 227	[3] 296	NA.
Total do	40,966	37,351	
Crude chemicals from coal, gas, and oil distillation	7,953	14,999	West Germany 5,014; Netherlands 4,005; France 2,001.

NA Not available.

[1] Compiled from official Romanian export statistics and from import data of selected trading partners.

[2] Official export statistics indicate that exports of rolled products and pipe totaled 681,600 tons in 1968 and 925,100 tons in 1969 but do not give details on specific shapes included or on destination of these exports.

[3] Data from official Romanian export statistics.

[4] Details on destinations exclude figures for the U.S.S.R. and Poland, which do not report their receipts by individual product. In 1969 the U.S.S.R. received a total of 621,200 tons (approximately 4,350,000 barrels), while Poland received a total of 299,445 tons (approximately 2,096,000 barrels) of products.

Source: Official trade returns of Romania, Poland, and the U.S.S.R. and the 1968 and 1969 editions of Supplement to the World Trade Annual, Statistical Office of The United Nations, New York: Walker and Company, 1970 and 1971.

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

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	110,109	165,213	Yugoslavia 140,503; Greece 24,710.
Alumina	12,337	4,032	Greece 3,000; West Germany 992.
Metal including alloys, unwrought and semimanufactures	5,863	9,685	Italy 2,991; U.S.S.R. 2,900; West Germany 1,742.
Chromium, chromite	23,180	4,200	All from Turkey.
Copper including alloys, unwrought and semimanufactures	14,501	15,661	U.S.S.R. 5,800; Italy 2,800; West Germany 1,942.
Iron and steel:			
Iron ore thousand tons	[2] 4,546	[2] 5,389	U.S.S.R. 3,832; Yugoslavia 151.
Pig iron, sponge iron, powder and shot do	503	518	U.S.S.R. 517.
Ferroalloys do	[2] 76	[2] 90	NA.
Steel:			
Primary forms do	388	322	U.S.S.R. 274; West Germany 15.
Bars, rods, angles, shapes, sections do	151	97	U.S.S.R. 46; Poland 21; Yugoslavia 11.
Plates and sheets do	417	467	U.S.S.R. 118; Poland 71; United States 61; Japan 59.
Hoop and strip do	28	28	Poland 12; West Germany 7; Austria 3.
Rails and accessories do	12	73	Austria 34; Poland 20.
Wire do	49	171	U.S.S.R. 155; West Germany 8.
Pipes, tubes, and fittings do	71	67	West Germany 29; France 10; U.S.S.R. 7.
Total do	[3] 728	[3] 903	
Lead oxides	1,490	453	All from Japan.
Manganese oxides	462	626	Do.
Nickel including alloys, unwrought and semimanufactures	202	363	United Kingdom 113; France 54; Switzerland 53; Sweden 51.
Platinum-group metals, unwrought and semimanufactures value, thousands	$35	$816	United Kingdom $562; Italy $152; Austria $47.
Silver, unwrought and semimanufactures do	$99	$139	France $108.
Tin including alloys, unwrought and semimanufactures long tons	1,259	1,201	United Kingdom 841; Netherlands 321.
Titanium oxides	1,495	1,142	Italy 985; West Germany 157.
Tungsten metal, all forms	4	3	All from France.
Zinc:			
Ore and concentrate	10,027	--------	
Blue powder	1,557	940	All from Italy.
Oxides	1,453	776	Yugoslavia 526; Poland 250.
Metal including alloys, all forms	1,260	1,367	Bulgaria 1,276; United Kingdom 91.
NONMETALS			
Asbestos	10,367	14,571	U.S.S.R. 12,000; Canada 2,571.
Barite and witherite	3,550	2,380	West Germany 1,780; Italy 600.
Borates, natural, crude	3,904	3,500	All from Turkey.
Clays and clay products:			
Crude, n.e.s	13,596	9,384	Greece 8,778.
Products:			
Refractory	53,991	45,532	Yugoslavia 16,241; U.S.S.R. 10,100; West Germany 6,123; Italy 3,755.
Nonrefractory	1,233	196	All from Italy.
Cryolite	500	500	All from U.S.S.R.
Diamond:			
Gem value, thousands	$33	--------	
Industrial do	$33	$48	France $32.
Feldspar and fluorspar	--------	3,067	Spain 1,850; West Germany 707; Italy 510.
Fertilizer materials:			
Nitrogenous, nitrogen content	[2] 1,800	[2] 3,900	NA.
Phosphatic, apatite concentrate, P_2O_5 content	[2] 205,600	[2] 308,700	Mainly from the U.S.S.R.[4]
Potassic, K_2O equivalent	[2] 11,100	[2] 33,700	NA.
Graphite	86	96	All from West Germany.
Mica, worked	11	14	Switzerland 8; Austria 6.
Pigments, mineral, iron oxide	480	337	All from West Germany.
Potash, caustic	301	--------	
Stone:			
Dolomite	--------	552	All from West Germany.
Quartz and quartzite	--------	831	Do.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Sulfur, elemental (including colloidal)	4,582	10,849	U.S.S.R. 7,400; Greece 2,700; West Germany 749.
Sulfuric acid	28,528	67,510	U.S.S.R. 40,700; Bulgaria 26,810.
Talc	--------	359	All from Italy.
Other, crude	8,810	667	United Kingdom 560; West Germany 67.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	153	220	France 121; West Germany 99.
Coal thousand tons	[2] 706	[2] 633	U.S.S.R. 343; United States 65; West Germany 34.
Coke do	1,570	2,096	U.S.S.R. 783; Italy 166; Austria 123; United States 117.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	9	--------	
Lubricants do	7	9	West Germany 3; Netherlands 3; France 2.
Other products do	(5)	29	Yugoslavia 12; West Germany 9; Italy 6.
Unspecified, possibly including crude oil do	12	21	Poland 13; U.S.S.R. 8.
Crude chemicals from coal, gas, or oil distillation	124	189	All from West Germany.

NA Not available.
[1] Compiled from official import statistics of Romania and from export statistics of selected trading partners.
[2] Data from official Romanian import statistics.
[3] Official Romanian sources indicate that imports of rolled steel totaled 1,472,000 tons in 1968 and 1,343,000 tons in 1969 but do not give details on specific shapes included or on origin of these imports.
[4] Not reported in U.S.S.R. export statistics on a comparable basis.
[5] Less than ½ unit.
Source: Official trade returns of Romania, Bulgaria, Poland, and the U.S.S.R. and the 1968 and 1969 editions of Supplement to the World Trade Annual, Statistical Office of the United Nations, New York: Walker and Company, 1970 and 1971.

COMMODITY REVIEW

METALS

Aluminum.—In 1970 increased bauxite production supplied only about three quarters of domestic demand; the rest came from imports. It was reported that important high-quality bauxite deposits were discovered at Ohaba-Ponor in the Strei Valley.

In 1970 alumina production at the Oradea plant reached full capacity for processing domestic and imported bauxite. The following table shows the increases in alumina output since 1965:

Year	Thousand metric tons
1965	120
1967	180
1969	200
1970	210

Work has started at Tulcea, near the Danube delta, on a second alumina plant with a capacity of 250,000 metric tons per year. Design and technology is by Aluterv, the engineering company of the Hungarian Aluminum Trust; equipment will be built by Hungarian and Romanian companies. At this plant the Bayer process was slightly altered, because of the varying bauxite grades that will be used. Startup is planned for 1973.

According to the current 5-year plan (1971–75) the capacity of the Slatina aluminum smelter is to be doubled to over 200,000 tons per year by the end of 1975. The plant was built mainly with the aid of the French Péchiney Company, but 80 percent of the equipment is domestic in origin. Slatina is a junction for the national power grid and provides inexpensive electric power for the aluminum smelter. The plant uses prebaked anodes for economy of electric power. There are four potlines in the plant with 69 kiloampere cells, each with 24 anodes. Crust breaking and alumina charging are mechanized, and fluorine gases are captured in wet absorbtion towers.

Prebaked anodes are produced in Slatina, and the available anode-producing capacity is sufficient to take care of the planned smelter expansion. The cells to be built will be of the 80-kiloampere type. The aluminum produced is cast at the adjacent foundry in original or alloyed form into ingots, shapes, and Properzi-type wire.

American Metal Climax Inc., announced receiving a $10 million contract to provide manufacturing technology and design and construction know-how for an aluminum sheet-rolling plant to be built at Slatina. It will be part of a major fabricating facility with extrusion and drawing capabilities. In the plant's first stage, when it goes on stream in 1972, it will have a production capacity of 21,000 tons per year of sheet and foil. A second stage (1973–74) which will consist mainly of hot rolling will have a capacity of 113,000 tons per year. Eurodollar financing of $7.5 million was arranged through Manufacturers Hanover Ltd. and Moscow Narodny Bank, Ltd., London. Construction started on a new cable plant near Slatina, and in 1972 over 20,000 kilometers of industrial aluminum cable and about 10,000 tons of drawn aluminum conductor will be produced.

Cadmium.—A cadmium refining plant was built at the Copşa Mică Imperial Smelting Process plant. The Copşa Mică Imperial process furnace is a standard 185-square-foot type and reportedly was operated with an average 6.5 percent copper in the lead bullion which increases sometimes to 12 to 13 percent.

Copper.—According to the current 5-year plan, metallic copper production is to increase by 36 percent and copper ore production by more than 50 percent over that produced during the previous 5-year period (1966–70). Copper ores (sulfide and oxide type) from the Leşul Ursuli mine have been processed since 1965 at the Tarnita concentrator. Capacity is about 65 tons per hour processing ores of the following three types:

Ore	Content					Percent, oxidized
	SiO_2	S	Cu	Pb	Zn	
Copper ore with pyrite and chalcopyrite	60	28–34	1	-----	-----	2–3
Copper complex ore with lead	45	20	.5	2	3.3	5 percent Zn 20 percent Cu
Copper complex ore with lead and chalcopyrite	45	-------	1.4	1.6	-----	20 percent Pb 5 percent Cu 5 percent Zn

Recovery of copper in the flotation plant is 80 percent in chalcopyrite concentrate and 28 to 33 percent in the complex ores. From 65 to 70 percent of the lead, and 78 to 82 percent of the zinc in the complex ores is also recovered.

The completion of a railroad tunnel between Baia Sprie and Cavnic, has made possible the rail transport of complex ores from the Cavnic region to the Baia Mare Processing plant. The Glacier Metal Company Ltd. of the United Kingdom has contracted with the Romanian Industrial-Import Foreign Trade Enterprize to supply a continuous casting plant for the production of 33,000 tons per year of oxygen free copper for the Baia Mare Chemico-Metallurgical Combine.

Chile and Romania have signed an agreement to build in both countries copper refineries which would be jointly owned by both Governments. Production capacity for each plant will be about 35,000 to 40,000 tons annually. Chile will provide Romania with blister copper for refining and sale. Each country will hold a 51-percent interest in the plant located within its territory. An earlier agreement provided for installation of a copper smelter in the Province of Antofagasta, Chile, and feasibility studies are being made for a plant having a capacity of 75,000 tons per year. Necessary equipment will be built domestically in both countries; this will double Romania's mining equipment output in the next 5 years.

Iron and Steel.—Major iron and steel production was in part below target levels in 1970. Despite this fact Romania showed some sizable expansion in its iron and steel industry. During the 1966–70 plan period raw steel output increased by 90 percent, including a 115-percent increase in alloy steel output to 414,400 tons (1965:192,800 tons); 92-percent increase in rolling mill products, and a 109-percent increase in pig iron output. Only the steel tube sector grew modestly with a 31-percent increase from 586,100 to 767,200 tons. Overall ferrous metal production rose 77 percent as compared with a 75-percent increase for Romanian industry as a whole.

In 1975 steel output is targeted at 10 to 10.5 million tons annually; alloy steels at 1 to 1.1 million tons; rolling mill products at 7.2 to 7.5 million tons; and steel tube output 1 to 1.1 million tons. Major projects underway include the expansion of ferrous capacities at Galati which will produce two-thirds of the domestically produced steel. A cold-band rolling mill producing 450,000 tons per year recently became operational there, and an expansion to 1 million tons per year is planned. Also projected for Galati are two new large blast furnaces, the second phase of an oxygen converter plant, new hot-rolling facilities, a specialty steel plant, a 300,000-ton-per-year coke plant, to be on stream in 1972, and a heavy sheet mill for the rolling of alloyed steel. At Reşita expansion of the light- and medium-profile rolling mills is planned. At the Hunedoara steelworks a third blast furnace of 1,000-cubic-meter capacity is to come on stream in the third quarter of 1971, and steel capacity will be about 3.4 million tons by 1975. Work started at Tîrgovişte on 600,000-ton-per-year alloy plant to be commissioned in 1973. In 1970, the U.S.S.R. agreed to continue to supply iron ore and coke to Romania for the 1972–90 period. Romania will in turn deliver to the U.S.S.R. railroad cars for transferring ore, ferrous metals, steel piping, chemical products, and consumer goods. This assistance will cover the cost of delivered iron ore, valued at 11 billion lei. Shipments will be 4.5 million metric tons in 1972 and 8 million tons in 1975, with the deliveries consisting of increasingly higher quality ore. India's Minerals and Metals Trading Corp. is negotiating the export of 1.7 million tons of iron ore to Romania. The contract is part of a 23.4-million-ton export agreement concluded in 1969. A new mine at Mahmudia in the Dobruja has started to deliver limestone to the Galati iron and steel combine at a rate of 1.7 million tons per year.

Lead and Zinc.—According to the goals set by the 1971–75 plan, lead-zinc ore output will double in comparison with that of the previous 5-year period. Ores from several mines in the Baia Mare region are processed in a centralized processing plant in Baia Mare. When the equipment was built in 1962, it had a capacity of 2,500 tons per 24 hours; present capacity is 6,000 tons per 24 hours. Three complex ores, a gold ore, and two types of smelter slags are processed by flotation. First, complex ores are floated collectively for lead-copper concentrate; then they are floated selectively for sphalerite and pyrite. Composition of the raw complex ore was reported as follows:

Element	Content	
Lead	1.5–2.0	percent
Zinc	2.0–3.0	percent
Sulfur	7.0–14.0	percent
Copper	0.2–0.4	percent
Gold	1–2	grams per ton
Silver	50–80	grams per ton

The content of the concentrate and the percentage of the metal recovered from the ores processed were reported as follows:

Concentrate type and element	Content	Recovery, percent
Lead:		
Lead	55–60 percent	93.5
Copper	4–6 percent	75–82
Gold	30 grams per ton	NA
Silver	1,700 grams per ton	NA
Zinc:		
Zinc	50–55 percent	90
Iron	6–12 percent	NA
Pyrite:		
Sulfur	45–48 percent	60

NA Not available.

The gold ore produced contains 4 to 5 grams of gold and 50 to 60 grams of silver per ton, and the concentrate recovered therefrom contains 60 grams of gold and 600 grams of silver per ton with recoveries averaging 80 percent for gold and 75 percent for silver. One thousand tons of smelter slag with 0.7 percent copper is floated every 24 hours producing a concentrate containing 18 percent copper with 60 to 66 percent metal recovery.

NONMETALS

Barite.—Ostra is one of the major barite processing plants in Romania with an estimated barite concentrate production of 80,000 tons in 1970. Composition of the flotation concentrate is as follows:

$BaSO_4$	91–93 percent
Whiteness	90 percent
Specific gravity	4.3
Recovery	70 percent

Some pyrite concentrate containing 40 to 50 percent sulfur, 20 grams per ton gold, and 600 grams per ton of silver is also produced.

Cement and Lime.—Construction of a building-materials combine was started at Aleşd, Bihor County. Final planned capacity is 2 million tons of cement and 200,000 tons of lime per year. In nearby Chiscani a plant is being built to produce 72 million square feet of asbestos cement sheet.

Clays.—*Kaolin.*—During 1970, the Aghiresu kaolin processing plant reached its design capacity of 15,000 tons per year of kaolin suitable for paper and porcelain purposes.

Fertilizer.—In 1970 the plan target of 947,000 tons of total active substance was not reached; production was short by about 5 percent while agricultural consumption was 775,000 tons of active substance. The target for the end of the current 5-year plan (1971–75) is 2 to 2.4 million tons of active substance.[4]

Nitrogenous Fertilizer.—Work started at Tirgu Mureş to expand the nitrogen fertilizer combine with the addition of a Grande-Paroisse type ammonia plant, a nitric acid plant, an $8-million plant that will produce 300,000 tons of urea annually using the Stamicarbon process, and an ammonium nitrate plant. The project will raise fertilizer production at the plant by 50 percent to more than 1 million tons.

At Piatra Neamt, construction has started on an ammonia plant which will have an annual output capacity of 270,000 tons in terms of contained nitrogen and a urea plant with a 132,700 ton annual capacity. Contract for construction of the Foster Wheeler Française/Ammonia Casale process type plant, based on natural gas feedstock was awarded to Salzgitter Industriebau G.m.b.H. The urea plant will be built by the Romanian Chemical Ministry and will utilize the Stamicarbon process. Special loading equipment will be delivered by the Bochum Chemie und Handelskontor (Bochako) Frankfurt on Main and Evence Coopée et Cie. A German consortium and the Romanian State Bank will finance the $21.5 million plant which is scheduled for completion in 1973.

A complex fertilizer plant using a nitric-acid attack process is reportedly planned at Făgăraş. At Slobozia, Humphreys and Glasgow Ltd. have completed the first stages of construction on plants with the following annual capacities:

	Tons of nitrogen
Ammonia plant	246,900
Urea plant	300,000
Prilled ammonium nitrate plant	300,000
Nitric acid plant	240,000

The plants are due to become operational in 1972. The plants will operate using processes of the Imperial Chemical Industries (ICI), Stamicarbon, Kaltenbach, and Grande-Paroisse, respectively. Natural gas will be used as feedstock in the ammonia plant. The nitric acid is to be produced as 56 percent HNO_3 under medium high pressure.

ICI has signed a long term agreement with the Romanian Government covering the manufacture of ICI-designed converter cartridges, for the ammonia synthesis process and providing training for Romanian engineers. Two cartridges will be used at the Slobozia plant, and export of cartridges is also planned.

Phosphoric Fertilizers and Sulfuric Acid.—The bulk of phosphate imports orginated in the U.S.S.R. An agreement was signed with Jordan that provided for the delivery of 30,000 tons of phosphate rock to Romania in 1970 and up to 100,000 tons per year for the following 5 years. A 3-year Israeli trade agreement was extended for an additional 5 years and covered imports of unspecified amounts of phosphates.

Romania decided to develop its fertilizer industry on the basis of Romanian phosphoric acid and is constructing several large plants for this purpose. This is unlike Hungary and East Germany which show more interest in the nitrophosphate route for compound fertilizer manufacture, and thus avoid large-scale consumption of phosphoric acid.

The chemical works in Năvodari are being expanded. A third sulfuric acid plant with a 200,000-ton-annual capacity went on stream. Modernization of the 120,000-ton-per-year superphosphate granulating plant will be completed in 1971. The plant is being converted to produce 300,000 tons per year of triple superphosphate. A single superphosphate plant was completed in 1970 at Năvodari. A further extension of this site's phosphoric acid production capacity is also scheduled for completion in 1971 when two new St.

[4] Journal of Commerce (New York). V. 303, No. 22183, Mar. 4, 1970.

Gobain/UCB type units will be operational; they will produce 60,000 tons P_2O_5 per year.

The phosphoric-acid capacity at Valea Calugareasca is to be expanded by 55,000 more tons of P_2O_5 per year utilizing the St. Gobain process. Completion is scheduled for 1972. A triple superphosphate plant producing 150,000 tons per year is also being designed for this site, with completion set for 1972.

Plans have been announced for the construction of an NPK-complex fertilizer plant at Făgăraş. At present Făgăraş is the site of a plant producing 450 tons per day of 38.8 percent of ammonium nitrate.

In 1970 Romania built two granulated superphosphate plants with a 220,000-ton-annual capacity in Elazig, Turkey, and a sulfuric acid plant with a 215,000-ton capacity at Samsun, Turkey. Romania's installed surfuric-acid capacity exceeded 1 million tons per year in 1970. With the help of Lurgi Gesellschaft of Frankfurt on Main, capacity was increased by construction of a new 200,000-ton-per-year plant and modernization of an existing plant which now produces 100,000 tons per year, at an unstated location.

Potassic Fertilizers.—Romanian potash requirements were covered in 1970 chiefly by imports from East Germany (24,500 tons), while the U.S.S.R. supplied the balance.

MINERAL FUELS

Coal.—According to the plans for the 1971–75 period, increases in coal production will continue at an accelerated rate from the present level of about 20.5 million tons to 36 to 38 million tons in 1975. In 1970 production increased 21 percent. The sharp increase in lignite production was due to increased demand by power stations. The somewhat smaller increase in hard coal production reflects the difficult geological and mining conditions. In 1970 total sales of solid fuels increased an average of 20 percent. Sales to powerplants, households, and other industries increased 55, 8, and 25 percent, respectively, whereas sales to the transportation industry declined 11 percent.

In 1971 total consumption is expected to increase only 2.4 percent (hard coal plus 6.5 percent, and lignite practically unchanged), because no important new consumers will enter the market. In 1970 a patent fuel plant with a capacity of 600,000 tons per year started production.

A new mining unit commissioned in the Rovinari basin, northern Chovasna, will yield more than 1 million tons of lignite for powerplants (caloric value, 1,600 to 2,000 kilocalories per kilogram) this year. The Betergea opencast coal mine in the Rovinari basin was also commissioned in 1970. The two 800-cubic-meter-per-hour excavators used there deliver 1.5 million tons per year. With this additional capacity, the Rovinari basin will produce 4.2 million tons of lignite in 1971 and 5 million tons in 1972. An 1,800-cubic-meter-per-hour excavator unit was assembled at the Tismana opencast mine in the same basin and will supply 3.5 million tons of coal to the Rogojelul thermal powerplant which is being built nearby. In the Motru Valley the Roşiuta mine is being expanded to 1 million tons per year.

Natural Gas.—Romania has important reserves of natural gas which form the basis for its highly developed petrochemical industry. Fully warranted further expansion is expected to double production in the next decade.[5] Natural gas is used for making ammonia, but it is also used in the manufacture of fertilizer, acetylene, methanol, and hydrocyanic acid. Only 16 percent of natural gas was used in the manufacture of carbon black in 1970, because most carbon black was made from oil products.

Petroleum.—Despite efforts to the contrary crude oil production in 1970 was practically stabilized with only insignificant increases. Total domestic crude reserves were estimated at 116 million tons (867 million barrels), about 14 million tons less than in 1969. The bulk of crude production came mainly from 60 producing horizons located in southeast Romania where proven reserves were estimated at 20 million tons. Here oil occurs mainly in the upper and lower Pannonian strata, at depths of 4,596 to 5,906 feet. Average daily per-well production in these areas is 10 to 15 tons (74 to 111 barrels).[6] About 15 percent of Romanian production is a viscous crude from secondary recovery proj-

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[5] Oil and Gas International. V. 11, No. 2, March 1970, p. 100.
[6] World Oil. V. 171, No. 7, Aug 15, 1970, p. 128.

ects of the fireflood or steam injection type. Fifty percent of drilling is by turbine drills. Crude is of low sulfur content (0.2 to 0.4 percent) which makes possible the export of low-sulfur (0.5 percent) residual fuel oils to the United States.

In 1971 Romania plans to import about 15 million tons of crude [7] in order to satisfy its rapidly increasing needs; the balance will be reexported in the form of petroleum products. Interestingly enough, substantial crude imports planned in recent years apparently did not materalize.

In looking for additional sources of crude, Romania formed a government organization called Petrom which is oriented towards production and refining. Through Petrom, Romania seeks association with western oil companies for exploration and drilling. Seismic exploration of the Danube delta and the Black Sea coast was completed. Exploratory drilling has started in the offshore area between Sulina and Sf. Gheorge and further south at Cape Midia and Constanta.

Romania, an oil drilling equipment exporter, can manufacture all the equipment necessary for drilling except floating platform jackup mechanisms. Romania was seeking cooperation with the West to obtain methods for better oil recovery in the Videle oilfield, for storage of liquid petroleum gas and ethylene in underground salt domes, for production of high-sulfur content gas in the Carpathian area, and for constructing marine terminals. More oil from Saudi Arabia is to come to Romania. A 3 and one-half year contract was signed in 1968 covering imports of 9 million tons of imported crude, valued at $100 million. Mideastern oil is pumped through a pipeline that stretches from Constanta to Ploieşti.

Romanian geologists were working on petroleum site exploration in Morocco. Romania is also planning to cooperate in the possible exploitation of Peruvian oil.

Romanian refining and petrochemical capacity was also greatly expanded in 1970 with numerous plants reaching production stage. In Borzeşti, additional crude oil processing and hydrorefining capacity was in the planning stage, by Industrialimport. A 2,250-barrel-per-day hydro-refined gasoline plant was being designed for a Bucharest site by the Lurgi company. At Buzău a new refinery is in the planning stage. In Piteşti where a modern refinery is being built, a hydrotreater unit started test operations. Engineering was by Eurotechnica, and the contractors were Bonaldi and Eurotechnica.

At the Brazi oil refinery a new 100,000-ton-per-year petroleum coke installation started test operations. Petro-chemical products are going through a period of spectacular growth as shown by the following forecasted capacities:

Product	Output (metric tons)				
	Actual		Projected		
	1968	1969	1970	1975	1980
Fertilizers	417,000	632,000	---------	2,200,000	--------
Polyethylene	---------	84,000	---------	168,000	252,000
Plastics	129,530	169,530	200,000	420,000	--------
Synthetic rubber	54,000	---------	56,000	130,000	--------
Benzene	85,000	---------	107,000	175,000	--------
o-Xylene	---------	9,000	13,000	26,000	--------
p-Xylene	---------	6,700	---------	---------	--------
Synthetic fibers	9,549	---------	22,750	130,000	--------

Source: Oil and Gas International. V. 10, No. 3, March 1970, p. 100.

Power.—Installed generating capacity was 7,600 megawatts in 1970 of which 14 percent was hydroelectric. Three 163-megawatt units of the 2,000-megawatt Iron Gate hydro electric power complex were started, and the Mintia-Deva thermal powerplant went on stream. Plans for 1975 include the installation of another 5,400 to 5,800 megawatts capacity, one third of which is hydro electric power. Romania is the only East European country in which petroleum's share of expanding domestic energy demand is decreasing; this is because of the development of water and atomic power. In 1971 petroleum's share of energy will

[7] Journal of Commerce. V. 306, No. 22236, Nov. 25, 1970, p. 8.

be 75 percent; in 1975, 71 percent; and in 1980, only 65 percent.

According to the official program, 1,000 megawatts of nuclear-generating capacity is to be installed by 1975 and 2,400 megawatts by 1980. An agreement was signed with the U.S.S.R. which provided for delivery and installation of an enriched uranium-type nuclear powerplant. At the same time negotiations were conducted with Western countries on the possible purchase of a natural uranium and a heavy water type nuclear reactor. Romania's uranium ores are of limited quantity.

The Mineral Industry of Sierra Leone

E. Shekarchi [1]

The mining industry of Sierra Leone accounted for nearly 75 percent of the value of the country's total exports. Diamond, the most important mineral mined, provided approximately 60 percent of the total. Revenue from the diamond industry, including that from mining and polishing, is, on the average, 20 percent of the Government's total income. Other minerals such as bauxite, iron ore, and rutile were produced in the country for export during the year.

In June 1970 the Government announced formation of the Commercial and Industrial Corporation of Sierra Leone (COMINCOR), a joint-venture company in which the Government holds 55 percent of the stock and Lanrho Ltd. of Great Britain holds 45 percent. The main function of the company will be to establish new industrial and commercial projects and to promote and develop all known commercial mineral resources of the country. It will take a special interest in developing the Tonlsolili iron ore deposits.

Periodic cement shortages, which have occurred with increasing regularity, caused the Government to give up its monopoly on imports. Selected Sierra Leone businessmen are now allowed to import cement and distribute it to other concerns.

The addition of four berths to the Port of Freetown was completed during the year, at a cost of $17 million,[2] and was opened for operation. This expansion makes the port one of the most modern and well equipped in the country.

Although most of Sierra Leone's people are farmers, the mainstay of the cash economy is diamond. An estimated 50,000 persons are engaged in diamond mining, either legally or illegally.

PRODUCTION AND TRADE

The available data on mineral production and trade are given in the following tables:

Table 1.—Sierra Leone: Production of mineral commodities

Commodity [1]	1968	1969	1970
Bauxite thousand metric tons	r 470	454	440
Cement do	44	e 36	e 36
Diamond:			
Gem e thousand carats	560	736	723
Industrial e do	962	1,253	1,232
Total do	1,522	1,989	1,955
Iron ore thousand metric tons	r 2,496	2,374	2,295
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	--------	320	360
Kerosine and jet fuel do	--------	163	245
Distillate fuel oil do	--------	376	525
Residual fuel oil do	--------	813	803
Other do	--------	242	--------
Refinery fuel and losses do	--------	133	82
Total do	--------	2,047	2,015
Titanium minerals, rutile metric tons	5,719	28,467	44,083

e Estimate. r Revised.
[1] In addition to commodities listed, a variety of crude construction materials are undoubtedly produced for local use, but no data on such production are available.

[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from Leones (Le) to U.S. dollars at the rate of Le1=US$1.20.

Table 2.—Sierra Leone: Exports of selected mineral commodities

Commodity	1967	1968	1969
Aluminum, bauxite ... thousand metric tons	334	470	442
Diamond:			
Uncut and unworked ... thousand carats	1,160	2,426	1,852
Cut and polished ... do	NA	7	12
Iron ore:			
Concentrate ... thousand metric tons	2,094	2,471	NA
Fines ... do	56	65	NA
Ferromax [1] ... do	1	1	NA
Total ... do	2,151	2,537	2,417
Rutile ... metric tons	15,930	5,719	16,094

NA Not available.
[1] Trade name for specularite, largely for pigment use.

Table 3.—Sierra Leone: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum including alloys, all forms	167	299
Copper including alloys, all forms	29	48
Iron and steel semimanufactures	r 20,431	15,910
Lead including alloys, all forms	63	27
Silver:		
Wastes and sweepings ... troy ounces	--------	3,266
Metal, all forms ... do	--------	1,449
Tin including alloys, all forms ... long tons	1,036	5
Zinc including alloys, all forms	18	40
Other nonferrous n.e.s	2	4
NONMETALS		
Abrasives:		
Natural, crude	101	3
Grinding and polishing wheels and stones	(1)	40
Cement	12,715	14,909
Clay products (including refractory brick)	230	228
Diamond, uncut and unworked ... carats	--------	9,199
Fertilizer and fertilizer materials, natural and manufactured	r 1,248	1,516
Gypsum and plasters	1	5,886
Lime	218	276
Mica, worked	--------	(2)
Salt	9,441	8,990
Sodium hydroxide	116	160
Stone, sand and gravel (including dimension limestone)	r 39,067	15,395
Sulfur, sulfuric acid	72	61
Other nonmetallic n.e.s	2	4
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	110	81
Coal, coke, and briquets	21,584	305
Gas, hydrocarbon (including butane)	276	338
Petroleum and refinery products:		
Petroleum, crude and partly refined ... 42-gallon barrels	25	2
Refinery products:		
Gasoline ... thousand 42-gallon barrels	193	339
Kerosine ... do	116	213
Jet fuel ... do	17	(2)
Distillate fuel oil ... do	978	376
Residual fuel oil ... do	94	169
Lubricating oils ... do	23	34
Mineral tar	143	227

r Revised.
[1] Unspecified quantity valued at $13,531.
[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Bauxite.—Production of bauxite decreased during 1970 by 3 percent, compared with 1969. A planned expansion program, designed to double Sierra Leone's bauxite production capacity, did not materialize even though the equipment was ordered in the latter part of 1969. These new facilities were expected to be operative in mid-1971.

Iron Ore.—The iron ore production goal of Sierra Leone Development Co. Ltd.

(DELCO) remained at 3 million tons per year. Major modifications to increase production capacity at DELCO's Marampa plant continued to run behind schedule, but the capacity of Pepel port was increased so that ore carriers of 100,000 tons could be loaded easily. The Ghafal ore body was linked to the Marampa mine concentrator by a 3-mile conveyor system in 1970 to increase production capacity from that deposit. However, owing to DELCO's technical problems, production in 1970 was 79,000 metric tons below that of 1969.

Titanium Minerals.—Sherbro Minerals Ltd., a joint venture of PPG Industries, Inc. of the United States and British Titan Products Ltd., increased rutile production by 54 percent during 1970. This increase did not, however, bring the separation plant erected in 1969 to its rated capacity.

The West German firm, Preussag AG of Hanover, together with Bayer AG Chemical Industry, carried out a feasibility study in the Bonthe-Sheuge area of the southern provinces, with a view to establishing another rutile mining operation. In October,[3] the Government granted these companies a prospecting license, that covers 3,000 square miles of onshore and offshore area.

NONMETALS

Diamond.—As a part of the program to nationalize the mineral industry, the Sierra Leone Government and Sierra Leone Selection Trust (SLST) agreed in September 1970 to organize a new company called the National Diamond Mining Company (Sierra Leone) Ltd. (DIMINCO). The agreement, which was ratified by the parliament on December 3, 1970, gives 51 shares to the Government and 49 shares to SLST.

The Board of DIMINCO consists of 11 directors; six, including the chairman, to be appointed by the Government and five to be appointed by SLST. The Government transferred its 51-percent interest in the fixed assets to DIMINCO in exchange for 51 percent of that company's shares, whereas SLST transferred the remaining 49 percent interest of it's fixed assets owned on June 30, 1970, to DIMINCO in exchange for 49 percent of that company's shares. The constitution of the joint company contains safeguards for the protection of SLST as a minority shareholder. The Government announced that it will pay for its portion of the fixed assets of the business by issuing negotiable sterling bonds. The principal will be repayable in 16 equal, semiannual installments, and the bonds will carry interest at a rate equivalent to 5½ percent after payment of Sierra Leone tax. SLST has been appointed as manager of DIMINCO.

Production of diamond decreased 1.7 percent in 1970, compared with 1969. The depressed world diamond market and consequent lower prices to dealers and miners, and the depletion of the more accessible diamond deposits in the country accounted for the drop in production.

Production at the Freetown diamond polishing factory was also less in 1970, compared with 1969 because of the drop in world demand for polished stones. The polishing factory is owned jointly by the Sierra Leone Government, SLST and the Diamond Corporation of Templesman of New York, which provides management.

MINERAL FUELS

The Sierra Leone Petroleum Refinery Co.'s oil refinery at Kissy, about 4 miles from Freetown, was officially opened in May 1970. The Government has a 50-percent interest in the company. The remainder is held by the following five major international oil companies: British Petroleum Ltd., 7 percent; Shell Oil Corp., 16 percent; Mobil Oil Corp., 11 percent; Texaco, Inc., 11 percent; and Agip, Inc., 5 percent. The refinery has a crude throughput capacity of 450,000 tons per year.

Crude oil was imported from Nigeria for the first time in 1970 and comprised approximately 60 percent of the processed total. Exploration licenses in the territorial waters and Continental Shelf of Sierra Leone were issued to two American Companies, Clinton International Oil and Interocean Oil (in partnership with Union Carbide Corp.). Under the terms of the licenses, each firm was given exclusive right to drill 50 percent of the area encompassed.

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[3] Standard Bank Review. December 1970, p. 22.

The Mineral Industry of the Republic of South Africa

By Walter C. Woodmansee [1] and Roderick G. Murchison [2]

The South African mineral industry again achieved a record high in mineral production in line with general economic growth. The value of total mineral production, including gold and diamond sales, was estimated at nearly $2.2 billion.[3] The gross national product (GNP) was an estimated $16.7 billion at current prices.[4] Growth of the mineral industry was about 5 percent during 1970, a rate substantially below that recorded in 1969, owing mainly to decreased premium gold and diamond sales. Also, weakness in prices of certain major metals during the latter part of the year had some effect on earnings.

In the metals sector, the Republic's first aluminum smelter neared completion. New copper and copper-zinc mine development was underway. Gold production continued to expand, but a number of older mines fell into the submarginal category and came under the Gold Mines Assistance Plan. The South African Iron and Steel Industrial Corp. (ISCOR), the quasi-Governmental agency dominating the iron and steel industry, and several private steel companies were under expansion. Highveld Steel and Vanadium Corp. Ltd. completed its first full year of operation and neared its full, rated capacity. Increased platinum operations continued until late in the year, when oversupply caused a price softening and reduced expansion plans. Refined nickel, a byproduct of platinum, was becoming increasingly important. Uranium recovery, largely a byproduct of gold, continued high, although supplies were added to stocks because of weak world demand.

Among the nonmetals, demand was high for asbestos, and companies prospered. Most cement producers were undergoing expansion. As the building boom continued, shortages developed in cement and other construction materials. Diamond operations remained strong, although world sales were depressed, and diamond stocks accumulated. The fertilizer and chemical companies also were undergoing expansion; many were diversifying activities into new fields. New pyrite mines were under development as sources of sulfur for sulfuric acid.

In the fuels sector, coal mining operations were growing to provide fuel for new electric power generation and anthracite and coking coal for the export market. Petroleum refineries were undergoing or had recently completed expansion programs, and a new refinery at Sasolburg, the first inland refinery in the country, neared completion.

The high rate of economic growth caused an extremely tight labor market, and serious shortages of skilled and semiskilled workers were experienced in the mineral industry. Operating costs accelerated with increases in wages, supplies, and equipment during a year of strong inflationary pressures. New industrial agreements, resulting from protracted negotiations, resulted in a 12-percent increase in labor costs in the metals sector. About 2,000 white, skilled mine workers were needed. Technical personnel were in short supply at all levels of mining. Africans were attracted to the secondary industries, where wages, opportunities, and

[1] Physical scientist, Division of Nonferrous Metals.

[2] Regional Minerals Officer, U.S. Consulate General, Johannesburg, Republic of South Africa.

[3] Where necessary, values have been converted from South African Rands (R) to U.S. dollars at the rate of R1 = $1.40.

[4] U.S. Embassy, Pretoria. Semi-Annual Economic Trends Report. State Department Despatch A-120, June 10, 1971, 7 pp.

working conditions were considered better. Business and financial leaders urged the Government to permit wider use of nonwhite labor.

The Government acted to encourage further industrial development in Homeland areas (reserved for Africans). Bantu Investment Corp. was formed with a 5-year, $150 million development plan. The Government provided assurances for compensation if any Homeland industry suffered because of the political action of the Homeland's Government after its independence. Bantu Mining Corp., established in 1968 to promote mining development in the Homeland areas, announced its first mining operations in the Tswana chromite area, Rustenburg district, and in a quarrying operation in the Mashangana area, eastern Transvaal. The Minister of Bantu Administration and Development announced that prospecting and mining leases granted in Homeland areas totaled 120.

The extension of a platinum mine into a Bantu Homeland triggered a lengthy controversy over the policy of job reservation for white miners. The Industrial Conciliation Act, which provided for the appointment of an industrial tribunal concerned with job reservation, was suspended in keeping with the Government's policy of nonapplication in the Homeland. The announcement of no ceiling on nonwhite advancement in Homeland mines resulted in a threatened strike by white miners.

Expansion programs in rail and port facilities had a pronounced effect on the mineral industry. Development of Richards Bay as a major port for offloading crude oil progressed during the year. Saldanha Bay, on the Atlantic coast, apparently was favored by the Government as a port for large-scale shipments of iron ore. Negotiations were conducted with Japanese and other companies for sales of iron ore, manganese, and coal. The continuing problem of limited rail facilities brought producers into conflict with South African Railways and Harbors, the Government-owned transport service.

Nonwhites comprised 89 percent of the total mine labor force of 636,000 in 1970; white workers accounted for 9 percent; and "Colored" and Asians made up the balance. Of 373,000 nonwhites in the gold mines, 116,000, or 31 percent, were recruited within South Africa; the remainder were from Lesotho, Botswana, and Swaziland (85,000), East Africa including Mozambique (95,000), and Central Africa (77,000).

PRODUCTION

Mineral production continued an upward trend, reaching a record $2,188 million in 1970, a 5-percent increase over 1969.[5] The failure to equal the 1969 increase of nearly 9 percent was attributed to a decline in premiums from private-market gold sales and a marked falloff in diamond sales.

In terms of quantity, output of most mineral commodities showed increases during the year, particularly for chromite, copper, gold, steel ingots and semimanufactures, manganese, nickel, platinum, uranium, vanadium, electrolytic zinc, coal, asbestos, diamond, and a number of other nonmetallic minerals. The most significant falloff was in output of iron ore. Value of gold output increased to $1,162 million, although premiums from private sales were substantially reduced. The highest private market price was about $38 per ounce, compared with as much as $43.42 in 1969. Although diamond production was higher, actual sales were somewhat depressed, dropping more than 27 percent. Platinum and byproduct nickel were in high demand most of the year, and production was expanded.

[5] Personal communication, South African Dept. of Mines, Johannesburg, May 15, 1971.

Table 1.—Republic of South Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969 [1]	1970 [p]
METALS			
Antimony concentrate:			
Gross weight	27,372	29,615	28,759
Metal content	16,796	18,216	17,370
Beryllium, beryl concentrate, 11 to 12 percent BeO	308	313	322
Bismuth concentrate:			
Gross weight kilograms	3,629	18	--
Metal content do	1,815	9	--
Chromium, chromite, gross weight:			
More than 48 percent Cr_2O_3	69,485	102,811	97,116
44 to 48 percent Cr_2O_3	758,477	800,761	934,901
Less than 44 percent Cr_2O_3	324,768	294,098	395,242
Total	1,152,730	1,197,670	1,427,259
Columbium-tantalum concentrate [2]	18	4	3
Copper:			
Mine output, metal content	128,232	126,186	149,205
Metal:			
Smelter	136,700	127,300	137,300
Refined	62,600	61,100	66,000
Gold, primary thousand troy ounces	r 31,094	31,281	32,146
Iron and steel:			
Iron ore and concentrate thousand tons	8,233	8,788	7,354
Pig iron do	3,775	3,931	3,930
Ferroalloys do	349	424	420
Steel:			
Ingots and castings do	4,308	4,829	4,964
Semimanufactures do	2,423	e 2,500	2,698
Manganese ore and concentrate, gross weight:			
Metallurgical:			
Over 48 percent Mn	259,840	517,663	663,936
Over 45 to 48 percent Mn	177,190	132,101	113,054
Over 40 to 45 percent Mn	180,578	156,404	108,657
Over 30 to 40 percent Mn	1,263,629	1,330,169	1,666,593
Subtotal	1,881,237	2,136,337	2,552,240
Chemical:			
Over 65 percent MnO_2	13,451	14,254	10,967
Over 35 to 65 percent MnO_2	77,024	53,508	116,265
Subtotal	90,475	67,762	127,232
Total	1,971,712	2,204,099	2,679,472
Manganiferous iron ore, 15 to 30 percent Mn, 20 to 35 percent Fe	455,480	439,115	374,000
Nickel matte	e 5,500	e 10,000	11,557
Platinum group:			
Osmiridium from gold ores (sales) e troy ounces	14,000	14,000	2,800
Content of concentrates, matte, refinery products e thousand troy ounces	850	950	1,500
Silver, primary do	3,337	3,355	3,527
Tin:			
Concentrate:			
Gross weight long tons	2,897	2,979	3,247
Metal content do	1,837	1,847	1,981
Metal, primary do	686	738	603
Titanium minerals:			
Ilmenite	--	16,505	--
Rutile	--	493	--
Tungsten concentrate, 60 percent WO_3:			
Gross weight	48	61	6
Tungsten content	23	29	3
Uranium, oxide (U_3O_8)	3,522	3,610	3,737
Vanadium:			
Vanadiferous slag, gross weight, exports	--	20,926	34,383
Vanadium, content of:			
Vanadiferous slag produced e	1,450	3,000	4,930
Vanadium pentoxide	1,751	2,593	2,402
Ammonium vanadate	296	7	14
Total	3,497	5,600	7,346
Zinc:			
Concentrate:			
Gross weight	--	--	14
Metal content	--	--	e 7
Smelter	--	11,845	36,500
Zirconium concentrates	--	263	--

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969 [1]	1970 [p]
NONMETALS			
Asbestos:			
Amosite	88,225	89,949	97,380
Chrysotile	38,592	43,555	52,801
Crocidolite	109,533	124,670	137,235
Total	236,350	258,174	287,416
Barite	519	3,513	2,902
Cement ..... thousand tons	4,410	4,987	5,751
Clays:			
Bentonite	12,652	14,504	16,703
Fire	179,590	220,011	223,369
Flint	196,612	196,626	301,864
Fuller's earth	215	1,130	1,554
Kaolin	32,711	33,160	36,896
Corundum, natural	256	229	247
Diamond:			
Gem [e] ..... thousand carats	3,399	3,612	3,702
Industrial [e] ..... do	4,034	4,251	4,410
Total ..... do	7,433	7,863	8,112
Diatomite	624	514	848
Feldspar	19,888	22,036	18,896
Fertilizer materials:			
Crude, natural, phosphate rock, beneficiated ..... thousand tons	1,565	1,679	1,685
Manufactured:			
Phosphatic ..... do	911	[e] 950	NA
Potassic ..... do	900	[e] 900	NA
Fluorspar:			
Acid grade	40,524	55,728	71,199
Ceramic grade	2,896	4,503	5,257
Metallurgical grade	65,140	90,045	96,538
Total	108,560	150,276	172,994
Gem stones, semiprecious:			
Emerald crystals ..... kilograms	928	1,382	1,500
Tiger's eye [3]	148	63	1,045
Graphite	723	459	699
Gypsum, crude	316,050	359,421	410,101
Kyanite and related materials:			
Andalusite	22,444	42,449	42,522
Sillimanite	33,195	28,297	31,916
Lime [4] ..... thousand tons	1,065	938	1,079
Lithium minerals (spodumene)	36	35	9
Magnesite, crude	59,797	48,121	84,254
Mica:			
Sheet ..... kilograms	9,247	99,894	10,608
Waste	7,918	6,349	7,551
Pigments, natural, mineral:			
Ochers	3,078	2,331	2,474
Oxides	816	1,180	999
Pyrite:			
Gross weight:			
Cupriferous	116,792	248,307	260,027
Noncupriferous	587,564	589,024	607,851
Total	704,356	837,331	867,878
Sulfur content:			
Cupriferous [e]	46,700	99,400	104,000
Noncupriferous [e]	235,000	235,600	243,200
Total [e]	281,700	335,000	347,200
Quartz, quartzite, glass sand	455,931	496,148	542,598
Salt	341,642	377,937	420,060
Silcrete [5]	5,559	9,475	29,083
Stone, sand and gravel, n.e.s.:			
Dimension stone, marble	18,852	22,806	14,029
Crushed and broken:			
Limestone [4] ..... thousand tons	11,004	10,465	11,519
Shale ..... do	246	252	358
Sulfur, elemental byproduct [e]	6,000	12,000	12,000
Talc and related materials:			
Pyrophyllite (wonderstone)	5,094	4,706	4,821
Talc	9,052	8,813	7,568
Vermiculite	110,180	128,987	121,896

See footnotes at end of table.

Table 1.—Republic of South Africa: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969 [1]	1970 p
MINERAL FUELS AND RELATED MATERIALS			
Carbon black e	32,000	32,000	26,200
Coal:			
Anthracite ---- thousand tons	1,365	1,541	1,678
Bituminous ---- do	50,289	51,211	52,934
Total ---- do	51,654	52,752	54,612
Coke:			
Oven and beehive e ---- do	3,200	3,400	3,600
Gashouse, low and medium temperature ---- do	106	e 100	e 100
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	15,691	17,265	19,962
Jet fuel ---- do	533	584	792
Kerosine ---- do	947	1,114	2,266
Distillate fuel oil ---- do	12,758	13,177	14,551
Residual fuel oil ---- do	15,652	13,992	13,975
Lubricants ---- do	559	662	782
Other ---- do	1,827	2,208	3,154
Refinery fuel and losses ---- do	2,838	4,667	5,181
Total ---- do	50,805	53,669	60,663

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

[1] A number of 1969 figures differ slightly from those reported in the previous edition of the Minerals Yearbook owing to the change in units used in reporting from English (chiefly short tons) to metric. Data presented here are for the most part exactly as reported in the South African source during 1970 in metric units, rather than being converted from English units to metric units as was necessary in past editions of the Minerals Yearbook.

[2] Tantalum is the dominant component.

[3] Decorative material resulting from oxidation and silicification of crocidolite.

[4] Local sales plus exports.

[5] Rock containing up to 98 percent silica.

TRADE

According to South African Department of Mines statistics, exports of crude mineral commodities were valued at $545 million in 1970, compared with $436 million in 1969. In addition, gold sales totaled $1,162.5 million, silver $6.4 million, and diamond $105.7 million. Export sales were increased for most mineral commodities. The most notable increases, in terms of value, were in antimony, copper, iron ore, manganese, nickel, tin concentrate, vanadium pentoxide and slag, asbestos, clays, fluorspar, and coal. Although sales of platinum were not reported, earnings apparently were increased substantially for this commodity.

Exports of steel to neighboring territories and overseas markets amounted to $42 million, but imports to meet an unprecedented domestic demand required almost as much in foreign exchange. Ferroalloy exports earned $49 million, and stainless steel, $14 million. In midyear, the price of steel was increased by an average of $14 per ton, or 11 percent; an import levy of $2.80 per ton was introduced in September to cover the cost of imported steel. Except for aluminum, nonferrous metal prices declined. At yearend, the price for electrolytic copper was 36 percent below that at the first of the year.

Principal U.S. imports of mineral commodities from South Africa, in order of value, were diamond, unwrought copper, metallic ores, asbestos, and ferroalloys.

Table 2.—Republic of South Africa: Mineral products trade

(Million dollars)

Products	Exports		Imports	
	1969	1970	1969	1970
Ores and minerals	287	327	194	202
Chemical and associated industries	74	82	186	225
Products of stone, plaster, cement, asbestos, mica, ceramic, glass	10	12	38	41
Gem stones, precious metals, jewelry, coin	377	308	27	25
Base metals and products	349	367	191	281
Total	1,097	1,096	636	774

Table 3.—Republic of South Africa: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Oxide and hydroxide	39	44	United Kingdom 42.
Metal including alloys:			
Scrap	2,205	1,930	West Germany 946; Italy 205; United Kingdom 150.
Unwrought and semimanufactures	1,877	2,224	NA.
Antimony ore and concentrate	25,342	30,960	United Kingdom 15,898; United States 8,778.
Arsenic, oxides and acids	1,095	133	NA.
Chromium:			
Chromite	816,677	995,283	United States 368,784; Japan 154,179; West Germany 137,482.
Oxide and hydroxide	31	27	NA.
Copper:			
Ore and concentrate	10,418	14,446	Japan 12,748; United Kingdom 1,146.
Matte	55	33	All to Belgium.
Metal including alloys:			
Scrap	561	109	West Germany 65.
Unwrought:			
Blister and other unrefined [2]	73,697	60,457	United States 24,091; Japan 21,226.
Refined [2]	68,965	58,091	West Germany 35,948; United Kingdom 20,481.
Master alloys	214	12	NA.
Semimanufactures	8,661	3,064	United States 532; West Germany 353; United Kingdom 214.
Gold unworked or partly worked troy ounces [3]	970	1,487	NA.
Iron and steel:			
Ore and concentrate [2] thousand tons	4,476	4,739	Japan 4,583; Netherlands 82; Italy 53.
Roasted pyrite	191	1,852	NA.
Metal:			
Scrap	8,150	9,277	Japan 2,440; Netherlands 410; Israel 395.
Pig iron	829,503	611,785	Japan 534,251; Argentina 23,137.
Sponge iron, powder and shot	174	166	NA.
Spiegeleisen	925	1,788	Italy 1,626.
Ferroalloys:			
Ferromanganese	129,612	253,965	United States 156,510; United Kingdom 34,909; Canada 21,903.
Ferrochrome	75,905	107,472	United States 32,131; West Germany 21,928; Canada 17,715.
Ferrosilicon	16,883	12,913	Australia 4,676; United States 1,657; West Germany 1,408.
Other	2,196	15,105	Norway 5,080; Netherlands 4,179; Canada 2,083.
Ingots and other primary forms	15,996	71,481	Brazil 38,623; Italy 12,314; Japan 5,539.
Semimanufactures:			
Bars and rods	29,310	44,262	NA.
Angles, shapes and sections	26,669	55,002	NA.
Plate and sheet	142,141	201,124	NA.
Hoop and strip	2,807	2,887	NA.
Rails and accessories	38,316	34,583	NA.
Wire	7,420	8,040	NA.
Tubes, pipes, and fittings	25,952	20,564	NA.
Castings and forgings	729	790	NA.
Total	273,344	367,252	
Lead: [2]			
Concentrate:			
Lead	--	1,505	All to Japan.
Lead, vanadium	6,514	1,139	All to West Germany.
Oxide	82	126	NA.
Metal including alloys:			
Unwrought	48,905	54,544	Italy 14,036; United States 12,058; United Kingdom 12,032.
Semimanufactures	234	158	NA.
Magnesium including alloys:			
Scrap	88	53	NA.
Unwrought and semimanufactures	2	--	

See footnotes at end of table.

Table 3.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Manganese:			
Ore and concentrate thousand tons	1,768	1,821	Netherlands 592; Japan 517; France 280.
Oxides	31	11	NA.
Metal, electrolytic	8,044	9,329	Canada 2,144; Sweden 1,556; United Kingdom 1,492.
Mercury 76-pound flasks	7	8	NA.
Nickel:			
Ore and concentrate	4	2	NA.
Matte, speiss, and similar materials	199	1	NA.
Metal including alloys:			
Scrap	48	122	United Kingdom 47.
Unwrought	8,732	5,168	West Germany 1,593; United States 1,387.
Semimanufactures	12	66	NA.
Platinum group including alloys, all forms thousand troy ounces	800	900	NA.
Silver:			
Ore and concentrate value, thousands	$4,447	(4)	
Waste and sweepings troy ounces [5]	21,541	6,225	United Kingdom 2,987.
Metal including alloys thousand troy ounces [5]	4,109	3,818	United Kingdom 3,713; United States 105.
Tin:			
Ore and concentrate long tons	r 2,521	2,552	United Kingdom 1,302; Netherlands 1,048.
Metal including alloys:			
Scrap do	458	--	
Unwrought and semimanufactures do	162	23	NA.
Titanium, oxide	62	670	Israel 265; United Kingdom 258.
Tungsten:			
Ore and concentrate	67	47	West Germany 30; United Kingdom 10.
Metal including alloys, all forms	15	39	West Germany 4.
Vanadium, pentoxide (fused) [6]	3,701	4,762	Japan 1,202; West Germany 853; Belgium 852.
Zinc:			
Ore and concentrate [2]	36,385	65,549	United Kingdom 27,384; West Germany 15,608; Belgium 12,612.
Oxide	217	235	NA.
Metal including alloys:			
Scrap, dust and powder	83	96	NA.
Unwrought and semimanufactures	r 36	87	NA.
Other:			
Ore and concentrate of:			
Molybdenum, tantalum, titanium, vanadium, and zirconium	190	6,360	West Germany 4,887; United States 529.
Nonferrous metals n.e.s	2,850	[4] 4,517	United States 1,140; United Kingdom 925; Netherlands 707.
Ash and residue containing nonferrous metals	538	565	West Germany 322; Netherlands 111.
Waste and sweepings of precious metals troy ounces	--	1,671	United Kingdom 1,406.
Metal including alloys:			
Alkali, and alkaline earth	87	(7)	NA.
Base metals n.e.s	383	281	United Kingdom 157; United States 34.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	6	1	NA.
Grinding and polishing wheels and stones	200	344	United Kingdom 59; Australia 20.
Asbestos	258,744	278,308	United Kingdom 65,693; Japan 43,492; United States 26,334.
Barite	144	222	NA.
Cement	60,054	55,750	NA.
Chalk	7	342	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	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Clays and products:			
Crude n.e.s.:			
Andalusite, Kyanite and sillimanite	39,548	53,065	United Kingdom 21,340; Japan 19,278; West Germany 6,850.
Other	170,050	200,059	West Germany 67,204; Japan 49,784; Netherlands 30,335.
Products:			
Refractory	29,804	26,825	NA.
Nonrefractory [8]	r 3,686	1,245	NA.
Diamond:			
Gem unworked and worked thousand carats	3,439	3,690	United Kingdom 3,275.
Industrial:			
Natural do	7,466	9,327	United Kingdom 8,548; Ireland 637.
Manufactured do	2,799	4,443	Mainly to Ireland.
Diatomite	305	85	NA.
Feldspar	8,328	17,429	West Germany 4,371; United Kingdom 2,387; Italy 2,165.
Fertilizer materials:			
Crude:			
Natural nitrate	54	2	NA.
Phosphate rock	r 1,613	209	NA.
Other	438	1,684	West Germany 610; Belgium 500.
Manufactured:			
Nitrogenous	r 53,701	124,729	NA.
Phosphatic	7,015	5,826	NA.
Potassic	1,066	1	NA.
Other	r 38,221	1,018	Mainly to United Kingdom.
Ammonia	2,978	9,049	NA.
Fluorspar	87,501	113,304	Japan 64,952; United States 14,433; Italy 8,146.
Graphite, natural	44	64	NA.
Gypsum and plasters	16,608	13,908	NA.
Lime	3,380	3,940	NA.
Magnesite	2,345	1,698	United Kingdom 149.
Mica:			
Crude including splittings and waste	r 10,619	11,058	Norway 357.
Worked including agglomerated splittings value, thousands	$24	$27	United States $22.
Pigments, mineral:			
Natural, crude	2,047	1,380	United Kingdom 1,158.
Iron oxides processed	244	217	NA.
Precious and semiprecious stones, except diamond:			
Precious thousand carats	2,615	2,714	Switzerland 2,647; United States 12.
Semiprecious kilograms	334,007	273,296	West Germany 98,820; Japan 67,322.
Salt	42,508	39,300	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	174	38	NA.
Caustic potash	19	106	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	2,832	2,007	United States 1,616.
Granite	174,279	234,487	France 50,200; West Germany 38,305; Japan 36,763.
Slate	122	115	NA.
Worked including slate	149	309	NA.
Dolomite, chiefly refractory grade	11,037	11,224	NA.
Gravel and crushed rock	1,121	486	United Kingdom 302.
Limestone except dimension	7,747	9,641	NA.
Quartz and quartzite	1,352	1,935	Netherlands 792; France 110.
Sand excluding metal bearing	2,051	2,299	NA.
Sulfur:			
Elemental:			
Other than colloidal	11,010	2,884	NA.
Colloidal	121	39	NA.
Sulfur dioxide	(7)	1	NA.
Sulfuric acid	377	275	NA.
Talc and steatite	830	259	Sweden 5.
Vermiculite	96,208	104,856	United Kingdom 24,798; Italy 24,513; West Germany 13,560.

See footnotes at end of table.

Table 3.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Nonmetals n.e.s.:			
Crude	3,941	8,326	Netherlands 3,161; Japan 2,836.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	14,638	16,224	United States 10,190; West Germany 3,701.
Slag and ash, n.e.s	--	35	NA.
Building materials of asphalt, asbestos, and fiber cement and unfired nonmetals n.e.s	7,593	8,469	United Kingdom 583; United States 401; Ecuador 149.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	63	7,160	NA.
Carbon black and gas carbon	1,803	2,260	NA.
Coal and briquets:			
Anthracite	626,921	825,250	Japan 305,982; Italy 234,054; West Germany 74,484.
Other	607,714	573,254	France 11,601; Spain 8,844; Portugal 5,302.
Coke and semicoke	31,866	12,190	NA.
Gas, hydrocarbon, natural and manufactured	3,065	3,502	NA.
Petroleum refinery products:			
Gasoline, motor thousand 42-gallon barrels	r 534	185	Sea stores 6.
Kerosine and jet fuel do	r 567	543	Sea stores 451.
Distillate fuel oil do	2,048	1,551	Sea stores 1,088.
Residual fuel oil do	21,010	18,647	Sea stores 18,410.
Lubricants (including grease) do	418	321	NA.
Mineral jelly and wax do	93	103	United States 41; Netherlands 20; West Germany 11.
Other:			
Nonlubricating oils do	6	15	NA.
Pitch	--	61	NA.
Bitumen and other residues thousand 42-gallon barrels	63	60	NA.
Bituminous mixtures, n.e.s. thousand 42-gallon barrels	32	40	NA.
Tar distilled from coal, from lignite or from peat, and other mineral tar	6,423	6,557	NA.

r Revised. NA Not available.

[1] Source: Foreign Trade Statistics. V. I, 1969, 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 South-West Africa.

[3] Industrial gold only, excluding large quantities of monetary gold not reported officially in trade statistics.

[4] Ores of silver included in ores and concentrates of nonferrous metals n.e.s.

[5] Includes platinum.

[6] See lead for concentrate.

[7] Less than ½ unit.

[8] 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	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite	12,252	16,514	United States 5,670; West Germany 52.
Oxide and hydroxide	918	1,363	United Kingdom 833; United States 364.
Metal including alloys:			
Scrap	132	--	
Unwrought	24,208	41,191	Canada 36,017; United States 3,707.
Semimanufactures	8,575	6,873	United States 1,450; Canada 1,289; United Kingdom 906.
Arsenic:			
Oxides and acids	40	18	NA.
Metal [2]	NA	206	France 205.
Chromium:			
Chromite	23,109	32,377	NA.
Oxide and hydroxide	107	131	NA.
Cobalt, oxide and hydroxide	14	15	Canada 9; United Kingdom 5.
Copper:			
Ore and concentrate	59,083	9,392	NA.
Metal including alloys:			
Scrap	124	26	NA.
Unwrought	r 10,390	2,727	NA.
Semimanufactures	3,627	2,332	United Kingdom 897; Italy 375; West Germany 323.
Gold unworked or partly worked ... troy ounces	28,638	11,825	United Kingdom 6,907; West Germany 3,389.
Iron and steel:			
Ore and concentrate	119	2	NA.
Metal:			
Scrap	18,689	18,510	NA.
Pig iron, ferroalloys, and similar materials	157,398	8,967	Sweden 1,489; West Germany 1,263; United Kingdom 1,160.
Steel ingots and other primary forms	82,324	15,573	NA.
Semimanufactures:			
Bars and rods	13,996	12,123	NA.
Angles, shapes, and sections	7,617	9,482	NA.
Plate and sheet	106,835	67,251	Japan 25,982; United Kingdom 22,177.
Hoop and strip	4,128	5,411	United Kingdom 2,002; Japan 1,183.
Rails and accessories	13,818	5,066	United Kingdom 437.
Wire and wire rod	11,151	10,187	Belgium 3,629; United Kingdom 2,515; West Germany 1,360.
Tubes, pipes, and fittings	90,775	36,784	Japan 18,971; United Kingdom 4,993; West Germany 4,510.
Castings and forgings, rough	4,879	2,720	United Kingdom 1,058; Australia 354.
Total	253,199	149,024	
Lead:			
Ore and concentrate	1	4	NA.
Oxides	113	87	NA.
Metal including alloys:			
Scrap	4,838	3,873	Australia 1,007; New Zealand 442.
Unwrought	r 4,274	7,273	NA.
Semimanufactures	2,785	3,531	NA.
Magnesium including alloys, all forms	229	425	Norway 305; United States 30.
Manganese:			
Ore and concentrate	389	664	NA.
Oxides	1,536	1,994	United Kingdom 1,994.
Mercury ... 76-pound flasks	1,233	1,302	Mexico 316; Spain 295; United Kingdom 189.
Molybdenum including alloys, all forms	12	9	Austria 4; United States 3.
Nickel:			
Ore and concentrate	--	181	NA.
Metal including alloys, all forms	474	520	United Kingdom 241.
Platinum group including alloys, all forms troy ounces	6,668	5,144	United Kingdom 4,801.
Silver:			
Waste and sweepings ... do	782	1,556	NA.
Metal including alloys ... do	224,191	193,517	United Kingdom 65,602; Switzerland 49,932; West Germany 42,389.

See footnotes at end of table.

Table 4.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Tin:			
Ore and concentrate.......long tons..	35	98	United States 28.
Oxides.......do....	19	28	United Kingdom 13; West Germany 6.
Metal:			
Scrap.......do....	(3)	13	NA.
Unwrought and semimanufactures do....	394	466	United Kingdom 92.
Titanium (ilmenite):			
Ore and concentrate.......	(4)	25	NA.
Oxides.......	409	688	West Germany 486; United Kingdom 102.
Tungsten:			
Ore and concentrate.......	292	285	Australia 33; Portugal 21; Argentina 10.
Metal including alloys, all forms.......	87	41	United Kingdom 7; France 2.
Zinc:			
Ore and concentrate.......	24,018	2	NA.
Oxides.......	271	216	West Germany 104; United Kingdom 66.
Metal including alloys:			
Scrap including powder and dust.......	1,339	1,692	Australia 694; United States 162.
Unwrought.......	38,904	8,516	Australia 1,774; United Kingdom 134.
Semimanufactures.......	1,693	227	NA.
Zirconium ore and concentrate.......	(4)	547	Australia 531.
Other:			
Ore and concentrate of:			
Molybdenum, tantalum, and vanadium..	[5] 851	91	United States 43; Canada 39.
Other base metals n.e.s.......	2,196	2,077	Australia 2,017.
Ash and residue containing nonferrous metals.......	r 3,433	2,195	West Germany 1,140; Australia 343.
Oxides, hydroxides and peroxides of metals n.e.s.......	506	244	United States 142; West Germany 56.
Metals including alloys, all forms:			
Metalloids [2].......	361	--	
Silicon and tellurium.......	(2)	231	France 80; Italy 45.
Alkali, alkaline earth and rare earth....	14	250	NA.
Pyrophoric alloys.......	12	8	West Germany 4; United States 1.
Base metals including alloys, all forms n.e.s.......	386	[6] 361	United Kingdom 100; Belgium 52.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc......	4,731	2,749	NA.
Grinding and polishing wheels and stones....	264	449	United Kingdom 136; West Germany 125.
Asbestos.......	13,127	15,398	NA.
Barite.......	3,573	4,827	West Germany 1,166; Italy 1,055.
Boron materials:			
Crude natural borates.......	651	775	All from United States.
Oxide and acid.......	410	554	United States 527.
Cement.......	41,886	71,227	United Kingdom 8,199; Japan 7,207; West Germany 1,508.
Bromine.......	NA	21	NA.
Chalk.......	3,754	4,615	France 3,789; United Kingdom 530.
Clays and products:			
Crude and refractory minerals.......	12,298	10,723	United Kingdom 5,183; United States 4,157.
Products:			
Refractory.......	13,166	14,023	West Germany 4,930; United Kingdom 3,775; Japan 2,000.
Nonrefractory.......	r 4,503	9,044	NA.
Cryolite and chiolite.......	60	55	NA.
Diamond:			
Gem.......carats..	91,753	55,181	United Kingdom 47,629.
Industrial.......thousand carats..	3,618	3,081	United Kingdom 1,717; Ireland 860.
Diatomite and other infusorial earths.......	3,884	4,112	United States 3,286.
Feldspar, leucite, and nepheline syenite.......	163	118	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	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	1,453	1,583	West Germany 1,170.
Phosphatic	77,176	2	NA.
Potassic	137,462	126,212	West Germany 63,598; Canada 25,358; Spain 16,012.
Other	108	459	NA.
Manufactured:			
Nitrogenous	8,543	3,586	United Kingdom 1,264; Italy 300.
Phosphatic:			
Thomas (basic) slag	16,007	19,123	All from Belgium.
Other	1,100	214	NA.
Potassic	34,347	27,792	Spain 13,581; West Germany 7,925.
Other including mixed	[r] 32	49	NA.
Graphite, natural	492	352	West Germany 120; United States 73.
Gypsum and plaster	5,447	6,417	West Germany 4,629.
Lithium minerals not further described	NA	128	NA.
Lime	205	451	NA.
Magnesite	79,247	83,178	NA.
Mica:			
Crude including splittings and waste	147	177	United Kingdom 33.
Worked including agglomerated splittings	[7] $486,000	87	United Kingdom 57.
Pigments, mineral:			
Natural, crude	635	311	Austria 144; United Kingdom 127.
Iron oxides processed	2,668	2,559	West Germany 1,832.
Precious and semiprecious gem stones, except diamond ... value, thousands	$842	$2,234	NA.
Pyrite	8,576	28	NA.
Salt	1,982	2,653	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	10,514	10,710	Netherlands 7,413; United Kingdom 1,726.
Caustic potash	633	577	Belgium 157; West Germany 150.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	982	1,177	Italy 992.
Other	8	66	NA.
Worked	498	1,252	Portugal 558; Italy 516.
Dolomite	1,260	147	NA.
Gravel and crushed stone	70,794	64,844	NA.
Limestone	[8] 7,823	233	Italy 152.
Quartz and quartzite	14	20	NA.
Sand excluding metal bearing	243	427	United States 97.
Sulfur:			
Elemental:			
Other than colloidal	222,007	158,701	Canada 98,474; United States 40,942.
Colloidal	399	277	West Germany 229.
Sulfur dioxide	19	18	NA.
Sulfuric acid	6,440	9	NA.
Talc and steatite	2,100	2,433	Italy 1,057; Republic of Korea 373.
Other nonmetals n.e.s.:			
Crude	595	1,471	Australia 305; United States 218.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	30,156	24,898	Canada 24,130.
Slag and ash n.e.s	67	64	United States 32.
Oxides and hydroxides of magnesium, strontium and barium	141	180	United Kingdom 89; United States 29.
Iodine and fluorine	[9] 23	12	NA.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals n.e.s	[r] 2,652	1,582	Austria 482; United Kingdom 434.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	8,824	10,423	United States 4,301; Netherlands 639.
Carbon and carbon black	5,886	4,221	United States 2,003; Australia 688; Canada 502.
Coal including briquets, all grades	20,993	19,083	NA.
Coke and semicoke	6,210	7,409	NA.
Gas, hydrocarbon, natural	352	553	NA.
Hydrogen and rare gases	29	78	West Germany 27; United States 19.
Peat	52	223	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	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	54,693	56,410	NA.
Refinery products:			
Gasoline, motor do	r 5,622	4,524	Netherlands 37; United Kingdom 13.
Kerosine (including jet fuel) and white spirit do	r 3,627	3,636	Netherlands 105; United States 18.
Distillate fuel oil do	3,312	3,777	United Kingdom 313; Portugal 31.
Residual fuel oil do	6,935	6,091	United Kingdom 8.
Lubricants (including grease) do	r 1,174	924	Netherlands Antilles 227; United States 221; United Kingdom 197.
Jelly and wax do	189	186	United States 78; West Germany 49; Japan 23.
Other:			
Nonlubricating oils n.e.s do	3,109	6,605	United States 159; Netherlands 14.
Pitch 42-gallon barrels	3,834	2,547	United Kingdom 2,079.
Pitch coke do	138	193	NA.
Petroleum coke do	29,607	33,270	All from United States.
Bitumen and other residues do	23,295	31,101	United States 19,974; Netherlands 8,969.
Bituminous mixtures n.e.s do	2,436	3,054	United States 2,145.
Mineral tar and other coal-, petroleum- or gas-derived crude chemicals thousand 42-gallon barrels	377	268	United States 150; Netherlands Antilles 29; United Kingdom 10.

r Revised. NA Not available.

[1] Source: Foreign Trade Statistics. V. I, 1969, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.

[2] Metallic arsenic, phosphorus, selenium, silicon and tellurium grouped as metalloids, n.e.s. in 1968; arsenic reported separately in 1969 and the combined total of silicon and tellurium also reported separately in 1969; apparently no phosphorus or selenium was imported in 1969.

[3] Less than ½ unit.

[4] Included in other ores and concentrates of base metals, n.e.s.

[5] Includes titanium and zirconium.

[6] Includes some manufactures not separable from unwrought and semimanufactures in source.

[7] Value—quantity not reported.

[8] Includes 7,600 metric tons of agricultural limestone.

[9] Includes bromine.

Table 5.—Republic of South Africa: Major domestic mineral sales in 1970 [1]

Commodity	Thousand dollars
METALS	
Chromite	2,833
Copper	58,638
Iron ore	16,331
Manganese ore	7,024
Nickel	21,450
Tin	2,256
NONMETALS	
Andalusite and sillimanite	507
Asbestos	4,331
Clays	2,136
Feldspar	771
Fluorspar	605
Gypsum	1,491
Limestone	12,609
Lime products, burnt	11,015
Magnesite	1,081
Phosphate rock	13,786
Pyrite (for sulfur)	6,252
Salt	4,867
Silica [2]	2,690
Slate	982
Stone, dimension	16,919
MINERAL FUELS AND RELATED MATERIALS	
Coal	139,554
MISCELLANEOUS	
Other minerals	41,027
Total	369,145

[1] Does not include gold, silver, and diamond, data on which are not available.
[2] Includes silcrete, a rock containing up to 98 percent silica.
Source: Republic of South Africa, Department of Mines, Quarterly Information Circular, October–December 1970, pp. 28–29.

Table 6.—Republic of South Africa: Major mineral exports in 1970

Commodity	Thousand dollars
METALS	
Antimony concentrate	20,542
Chromite	11,945
Copper	136,153
Gold [1]	1,162,470
Iron ore	24,214
Manganese ore	30,187
Nickel	16,110
Silver [1]	6,394
Tin concentrate	4,651
Vanadium:	
Pentoxide and ammonium vanadate	13,805
Slag	13,279
NONMETALS	
Andalusite and sillimanite	2,916
Asbestos	44,064
Clays	6,647
Diamond [1]	105,734
Feldspar	586
Fluorspar	4,040
Gem stones, semiprecious	786
Lime and limestone	449
Mica	608
Salt	260
Stone, dimension	7,320
Vermiculite	2,751
Wonderstone (pyrophyllite)	503
MINERAL FUELS AND RELATED MATERIALS	
Coal	14,335
MISCELLANEOUS	
Other minerals [2]	204,741
Total	1,835,490

[1] Total value, including domestic sales, if any.
[2] Mainly platinum and uranium.
Source: Republic of South Africa, Department of Mines. Quarterly Information Circular. October-December 1970, pp. 30–31.

COMMODITY REVIEW

METALS

Aluminum.—The 50,000-ton-per-year, $67 million smelter works and more than 300 dwellings of the Alusaf (Pty.) Ltd. aluminum project at Richards Bay were completed during 1970. Local personnel were being trained in aluminum casting techniques. April 1, 1971, was announced as the official opening date. The aluminum plant is the first stage of a $560 million program designed for the industrial development of the Vryheid-Empangeni-Richards Bay region. Natal. Work on a $112-million rail link to Empangeni was underway. It appeared that primary aluminum, produced at the Richards Bay plant, will cost 14 to 15 cents per pound more than the imported metal. Alumina will be imported from northern Australia.

Early in the year, Alcan Aluminum of South Africa Ltd., the Republic's largest aluminum-processing company, decided to participate in the venture. Alcan subscribed for 1.05 million shares, at $1.40 each, in Light Metals Investment Co., which holds a one-third interest in Alusaf. The Industrial Development Corp., which is controlled by the South African Government, sponsored the project and has a 37-percent interest. Alusuisse, the Swiss aluminum company, and Rand Mines Ltd. also are participants.[6]

Usco Aluminum Corp., a subsidiary of Union Steel Corp. of South Africa Ltd., was formed to establish a continuous casting and fabricating installation at Richards Bay. The new plant will produce extruded products, high-pressure die castings, and vehicle components. Alcan reportedly was involved in a joint subsidiary with Usco for a 27,000-ton aluminum rod plant at Richards Bay and negotiated for a financial interest in Usco's 12,500-ton wire and cable plant at Vereeniging.[7]

Antimony.—Production of concentrate containing approximately 60-percent antimony, by Consolidated Murchison (Transvaal) Goldfields and Development Co. Ltd., the non-Communist world's largest producer, was reduced slightly in 1970, owing to a falloff in world market demand and the resulting cutback in prices and production late in the year. Regardless of this reduced output, Consolidated Murchison completed its expansion program to enable a milling rate of 540,000 tons of ore per year and 35,000 tons of concentrates. A new crusher plant also was commissioned. Plans were made for possible future mill expansion to an annual capacity of 700,000 tons of ore and 45,000 tons of concentrate. New mine development also was underway to expand ore output.[8]

Chromium.—The ban on Rhodesian chromite continued to assist South African producers of chromite and chrome metal. Exports of chromite totaled 979,443 tons in 1970, a 6.5-percent increase over 1969. Average 1970 prices were $5.60 per ton for fine ore and about $21 per ton for lump ore.

Rand Mines Ltd. and Johannesburg Consolidated Investment Co. Ltd. (JCI) were considering ventures involving the large-scale production and export of pelletized chrome. According to company sources, the greater efficiency of chrome pellets in making ferrochrome would enhance the value of South Africa's large reserves of low-grade chromite, which would be mined for the pelletizing process. JCI and other companies planned to develop large low-grade resources and open new chromite mines.[9]

Copper.—During 1970, output of mine, smelter, and refined copper showed marked increases over 1969. Copper domestic sales and exports also increased substantially. Palabora Mining Co. Ltd., the leading producer in the country, reported copper sales of 91,271 tons (23.6 percent over 1969), a record income of $136 million from copper, and working profits of $81.5 million, despite a drop in the mine's average head grade to 0.54-percent copper and higher labor and supply costs.

Operations of O'okiep Copper Co. Ltd., the country's only producer of blister copper, were again threatened by an acute water shortage. Because of a 3-year drought in Namaqualand, Northwest Cape Province, the dwindling water supply from the Buffels River for the Nababeep smelter

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[6] Metal Bulletin. No. 5482, Mar. 13, 1970, p. 22.
[7] Metal Bulletin. No. 5506, June 12, 1970, p. 19.
[8] Consolidated Murchison (Transvaal) Goldfields and Development Co. Ltd. 1970 Annual Report. Jan. 26, 1971, p. 3.
[9] Engineering and Mining Journal. V. 171, No. 11, November 1970, p. 358.

became a serious problem and may cause a reduction in smelter operations. Blister copper production in 1970 was about 38,000 tons, all of which was exported. In order to maintain mine production of 3 million tons of ore per year, two shafts were sunk to newly proved ore bodies. The company reported ore reserves of 31 million tons averaging 1.6-percent copper.

Messina (Transvaal) Development Co. Ltd. milled 1,051,000 tons of ore at 1.15-percent copper at Messina during the year, a marked increase over that of 1969. Recoverable copper totaled 10,830 tons. A target of 1,118,000 tons of throughput ore and 12,000 tons copper was established for the next financial year. As of September 1970, ore reserves remained unchanged at 4,976,000 tons, but grade declined slightly to 1.31-percent copper. In November, Anglo-American Corp. subscribed for 1 million shares in Messina, thereby acquiring slightly over 9 percent interest in the company and providing Messina with new capital for development projects.

Development work continued on the $78 million copper and zinc mine of Prieska Copper Mines (Pty) Ltd., a joint venture of Anglo-Transvaal Consolidated Investment Co. Ltd. (Anglovaal), Middle Witwatersrand, and United States Steel Corp., at Prieska in northwest Cape Province. United States Steel exercised an option to loan the group an additional $7.5 million and increase its equity to a 30-percent interest in the project. The deposit is a massive sulfide ore body, more than 2,000 meters in strike length, 500 meters down dip, and an average of 9 to 10 meters thick. Reserves were estimated at 32 million tons of ore containing 1.75-percent copper.[10] Other estimates indicated ore reserves as much as 47 million tons to a depth of 900 meters. An incline was started, using 20 rubber-tired scoop loaders. A circular shaft, 5.5 meters in diameter and 210 meters deep, and a concentrating plant were planned as part of a 6,000- to 7,000-ton-per-year initial operation. Presently, a copper-zinc concentrate is shipped from a small concentrator. Full-scale production was scheduled for early 1973. A second ore body, 4.5 kilometers from Vogelstruisbult, was under exploration, and a third possible ore body was discovered at Kenhardt, 110 kilometers northwest of Vogelstruisbult. A number of other major companies were prospecting in the district.

Gold.—Mine production again showed an increase and attained a new record, valued well in excess of $1 billion. A total of 74.5 million tons of ore was milled during the year. Grade remained virtually unchanged, although lower at a number of mines, particularly in the Orange Free State.

Fifteen mines, all of which are members of the Chamber of Mines, and five non-member mines received government assistance to enable them to continue operations. This assistance totaled $22 million in 1970. The subsidized mines produced gold valued at nearly $140 million during the year, roughly 12.5 percent of total gold revenues.[11]

In April, the Government announced its decision to provide an $11 million loan (of $26.6 million requested) to Randfontein Estates Ltd. for development of a low-grade gold-uranium mine in the Randfontein area, West Rand, Transvaal. This was the first such loan granted for a new, marginal operation and enhanced the possibility for further development of new mines in the future.

Although earnings from gold increased over 1969, company profits were generally lower. Increased costs of labor and supplies adversely affected all the gold mines, placing a number of the lower-grade producers in the submarginal category. According to Chamber of Mines sources, working costs in the gold mines rose nearly $0.20 per ton milled. The growing scarcity of skilled white labor hurt the entire mining industry during 1970, particularly gold mining. Because gold was virtually a fixed-price commodity, gold mining companies had difficulty in competing with other mining and industrial sectors for skilled labor.

The initial milling date at Consolidated Goldfields' East Driefontein mine was postponed until 1972, following delays in dewatering the adjacent West Driefontein mine, which was seriously flooded in 1968. High pumping costs and increased overhead resulted in upward revision of East Driefontein capital costs to an estimated $98 million. The West Driefontein mine

[10] South African Mining and Engineering Journal. V. 81, No. 4031, May 8, 1970, p. 957.
[11] von Maltitz, A. A. Presidential Address, 81st Annual Meeting, Chamber of Mines of South Africa. Johannesburg, June 22, 1971.

Table 7.—Republic of South Africa: Salient statistics of gold and uranium production by members of the Chamber of Mines, Transvaal and Orange Free State

	1969	1970
Number of operating gold mines	48	47
Ore milled thousand short tons	r 73,202	74,467
Production of gold:		
Gross weight thousand troy ounces	30,892	31,795
Per ton of ore milled troy ounce	r 0.422	0.427
Number of uranium-producing mines	8	10
Ore treated for uranium recovery thousand short tons	r 12,937	13,976
Production of uranium oxide (U_3O_8):		
Gross weight thousand pounds	7,958	8,238
Per ton of ore milled pound	r 0.62	0.59
Average realized gold price per ounce [1]	$37.17	$36.18
Premiums from private sales thousands	$80,062	$36,753
Working profit, gold and uranium do	$483,317	$427,076
Taxes and lease fees payable to Government do	$182,062	$184,292
Net dividends do	$180,334	$184,846
Average number of employees in service:		
Whites	39,660	38,845
Nonwhites	364,151	378,101
Mine development, including shaft sinking meters	934,643	930,600
Ore reserves, payable thousand short tons	r 138,699	139,125
Average grade of reserves-troy ounce per ton	r 0.526	0.555

Revised.
[1] Includes premiums from private sales.
Source: Chamber of Mines of South Africa. Published by Union Corp., Ltd. Report and Accounts 1970.

was returned to full production, although effects of the flooding accident were felt through 1969.

Anglo-American Corp.'s new Vaal Reefs South mine was under development, with completion scheduled for late 1971. The venture is a partnership of Western Reefs and Vaal Reefs North. Haulage and vent shafts were completed to 2,440-meter depths. Initial hoisting capacity is 45,000 tons per month, but production may reach as much as 180,000 tons per month at a later date.[12] The mine reportedly will become the largest gold-uranium operation in the world.

At Buffelsfontein, a $14-million, 2,440-meter, single-lift vent shaft was being sunk to deeper workings. Western Areas Gold Mining Co. completed a new shaft, adjacent to the Elsburg mine. In March, the last round was fired at the Luipaards Vlei mine, which was founded in 1888 and produced nearly $300 million in gold and uranium.

Premiums from South African gold sales in the private market were $36.8 million, compared with about $80 million in 1969. Total sales in the private market were estimated at $900 million during the year. In addition, sales at $35 per ounce to the International Monetary Fund, early in the year, totaled some $600 million.[13] In

[12] South African Mining and Engineering Journal. V. 81, No. 4046, Aug. 21, 1970, pp. 613–617.
[13] Metals Week. V. 42, No. 1, Jan. 4, 1971, p. 7.

Table 8.—Republic of South Africa: Gold output, by major producers, in 1970
(Troy ounces)

Company or mine	Production
Blyvooruitzicht	1,203,313
Bracken	437,109
Buffelsfontein	1,241,424
City Deep	190,030
Crown Mines	157,085
Doorhfontein	738,606
Durban Deep	401,560
East Daggafontein	276,828
East Geduld	147,334
East Rand	664,264
Elsburg	230,338
Freddies Consolidated	501,108
Free State Geduld	1,913,115
Free State Saaiplaas	664,614
Grootvlei	337,303
Harmony	1,076,841
Hartebeestfontein	836,836
Kinross	523,279
Kloof	1,052,677
Leslie	447,899
Libanon	678,291
Loraine	439,720
Marievale	290,675
President Brand	1,544,188
President Steyn	1,021,693
St. Helena	1,113,207
South Africa Lands	313,650
Stilfontein	696,897
Sub Nigel	131,744
Vaal Reefs	1,144,647
Venderspost	501,838
Virginia	381,077
Vlakfontein	284,473
Welkom	784,090
West Driefontein	2,782,729
Western Areas	710,477
Western Deep Levels	1,942,346
Western Holdings	1,839,564
Western Reefs	773,618
Winkelhaak	598,814
Zandpan	341,464
Miscellaneous	789,385
Total	32,146,150

Source: Chamber of Mines of South Africa. January-December 1970.

March, the free price passed the $35 level, and sales were private for the remainder of the year. Late in the year, the free price was rising and, at yearend, was approximately at the $37 level.

All gold bullion produced by the South African gold-mining companies will be processed at the Rand refinery at Germiston, where a 5-year, $5.6 million modernization program was completed. Silver and other metals are also recoverable. An electrolytic refinery produces gold of 99.99-percent purity, suitable for specialized industrial uses. Larger-capacity induction furnaces and mechanized transport and packing facilities for gold bars were installed.[14]

Iron, Steel, and Ferroalloys.—During 1970, the South African iron and steel industry experienced shortages in labor and supply of steel products. The labor problem was intensified by the high rate of economic growth and a strong demand for steel, which increased an estimated 35 percent during the year. ISCOR and other steel companies trained white women for such work as truck and crane drivers and recruited personnel in Europe. The shortages in domestic supply, which developed toward the end of the year, was aggravated by the purchase of substantial quantities for the export market to take advantage of higher foreign prices. To alleviate the shortage, ISCOR placed foreign orders for more than 400,000 tons of steel products, of which about 250,000 tons were delivered in 1970.

Iron ore.—Production of iron ore was reduced substantially in 1970, owing to labor shortages and transport difficulties. Output of magnetite concentrate chiefly by Palabora Mining Co. at Phalaborwa increased to nearly 2 million tons, but mine shipments of hematitic ores by ISCOR were about 28 percent lower than those in 1969. According to its annual report, ISCOR produced 2.3 million tons of ore at its Sishen mine and 1.7 million tons at Thabazimbi during fiscal 1970 (ending June 30, 1970). Production at both mines was under expansion as part of ISCOR's development program. ISCOR planned mechanized open pit development of the new Donkerpoort deposit, near Thabazimbi, where reserves were established at 23 million tons at 65-percent iron and 90 million tons at 30-percent iron in a banded ironstone.

Despite a year of indecision over the location of a new iron ore port—a Port Elizabeth offshore loading pier or a new Saldanha Bay harbor—and failure to conclude an export contract with Japanese steel companies, exports of iron ore increased from 2.5 million tons, valued at $21.4 million in 1969, to 3.01 million tons, valued at $24.2 million in 1970. In July, the Government announced support of the Saldanha plan, which involved an expenditure of $400 million to $600 million in a 4-year project for a 35-million-ton-per-year railroad and for harbor facilities for 250,000-deadweight-ton ore carriers. ISCOR was assessing costs and preliminary financing. A 770-kilometer pipeline for an iron ore slurry, at a rate of 10 million tons per year, was also under consideration.

Early in the year, ISCOR reportedly received a letter of intent from Japanese steel representatives for long-term supply of ore at a rate of 5 million to 10 million tons per year. However, at yearend no firm contract had been concluded. Late in the year, ISCOR submitted new proposals, reportedly undercutting competitors' prices, and offered 152 million tons of ore (70 percent lump, 30 percent fines) with scheduled deliveries by 1990 at an average price of $9.62 f.o.b. per long ton.[15]

Other companies sought iron ore sales contracts with Japanese markets. Consolidated African Mines offered 4 million tons per year during 1973–74 and 8 million tons per year by 1978, shipped from Algoa Bay at competitive prices. In addition, the South Korean Government instructed the Korean Trade Agency in Johannesburg to negotiate an iron ore contract at a rate of 2 million tons per year for a new Korean steelworks.

Iron and Steel.—The iron and steel industry operated at a rate similar to that of 1969. ISCOR continued to dominate the industry, producing 74 percent of total pig iron and steel ingot output and supplying nearly 77 percent of estimated domestic demand of 3.4 million tons for steel mill products. According to the company's annual report for the fiscal year ending

[14] South African Mining and Engineering Journal. V. 83, No. 4053, February 1971, pp. 21–27.
[15] Mining Magazine. V. 124, No. 2, February 1971, p. 93.

June 30, 1970, ISCOR produced 2.8 million tons of pig iron, 2.9 percent less than in the previous year owing to the emergency shutdown of two blast furnaces. The firm also produced 3.4 million tons of steel ingot, 1 percent more than in fiscal 1969. Net sales of all products were valued at $396.9 million.

ISCOR's expansion program was again revised on the basis of the latest technical developments, market trends, and costs. At Vanderbijlpark, expansion continued to a 3.7-million-ton-per-year ingot rate. A new slabbing and plate mill (annual capacity 1.4 million tons) rolled its first slabs in June. Two new electric arc furnaces increased annual electric steel capacity to 800,000 tons. A contract was granted for a fourth blast furnace (capacity 4,000 tons per day). A third galvanizing line was commissioned, bringing capacity to 370,000 tons per year. A semicontinuous hot-strip mill (finished width 1.83 meters), a continuous strip-annealing line, and a roll-form corrugating line were ordered. New sintering equipment, to raise sinter output by 3,000 tons per day, was planned.

At ISCOR's Pretoria works, a $36 million modernization scheme was underway, involving expansion of hot-metal output, milling, and a new wire plant. New oxygen steelmaking facilities were under construction, and vacuum degassing and continuous casting were planned.

ISCOR's third major steelworks at Newcastle was scheduled for completion in late 1973. Facilities will include two oxygen furnaces (capacity 1.3 million tons per year), a continuous casting line (0.9 million tons), and bar, billet, and wire mills.

Private companies were also engaged in expansion programs. Union Steel Corp. was expanding steelmaking and rolling capacity at its Vaal and Klip plants.[16] Highveld Steel and Vanadium Corp. awarded a contract for plant extensions to increase production of hot metal and change the rolling mill handling system at Witbank. A fifth prereduction kiln was under construction. At Middleburg, Transvaal, Southern Cross Steel Co. (Pty.) Ltd., South Africa's leading producer of stainless steel, was installing a new, 20-ton electric arc furnace, which will raise capacity to 54,000 tons per year.

Ferroalloys.—Ferrometals Ltd., a subsidiary of African Metals Corp. (AMCOR) and a major producer of several ferroalloy metals, planned to install a fourth electric furnace, for ferrosilicon, at its Witbank works. This added capacity was expected to supply domestic demand for ferrosilicon and also provide added supply for the export market.[17] Other companies in the same area, Rand Carbide Ltd. and Transalloys (Pty.) Ltd., were adding electric furnaces to expand ferroalloy output. A new company—Heavy Media Materials (Pty.) Ltd. (AMCOR 52 percent, ISCOR 22 percent, and Farbwerke Hoechst A.G. and its subsidiary Knapsack A.G. 26 percent)—will produce atomized and newly developed spheroidized ferrosilicon and traditional milled ferrosilicon products at AMCOR's Kookfontein plant.[18]

Output of ferrochrome, largely by Southern Cross Steel Co. Ltd. and Palmiet Chrome Corp. (Pty.) Ltd., both in the Rand Mines group of companies, accounted for approximately 20 percent of world production of ferrochrome in 1970. Southern Cross was expanding output to increase ferrochrome exports. Early in the year, the company's capacity was raised 60 percent with completion of a conversion project on four submerged arc furnaces.

Manganese.—Despite reduced prices and problems of rail transport, South African manganese producers registered increases in production, export, and profit for the year. Exports of metallurgical-grade manganese were valued at $28.8 million; chemical grade, $448,000; and manganiferous ores (less than 30-percent Mn), $862,000.

South African Manganese Ltd., with exports of over 1.4 million tons, was again the world's largest individual producer, although rail shipments to port were restricted at times during the year. A new deep mine, near Kuruman, Cape Province, was in the planning stage at yearend. Existing mines were undergoing expansion.

Associated Manganese Mines of South Africa Ltd. shipped 904,000 tons of ore by rail during the year. Electrolytic Metal Corp. (Pty.) Ltd., the world's second largest producer of electrolytic manganese, planned a $2.2 million expenditure to ex-

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[16] Metal Bulletin. No. 5495, May 1, 1970, p. 31.
[17] South African Mining and Engineering Journal. V. 81, No. 4023, Mar. 13, 1970, p. 527.
[18] Coal, Gold and Base Minerals. V. 18, No. 9, November 1970, pp. 25–31.

pand output from 9,500 to 12,500 tons per year at its Krugersdorp plant.[19]

Nickel.—Output of byproduct nickel increased substantially in matte produced from platinum ores. Domestic sales totaled $21.4 million, and exports were valued at $16.1 million. Rustenburg Platinum Mines Ltd. (RPM), leading producer of nickel with an output of about 8,000 tons in 1970, produced a matte containing 46-percent nickel, which was shipped to Johnson, Matthey & Co. Ltd., United Kingdom, where refined nickel was recovered and sold under contract to International Nickel Co. of Canada Ltd. Impala Platinum Mines Ltd., the other nickel producer and a member of the Union Corp. Ltd. (UCL) group, exported a nickel matte and also produced nickel powder and briquets of 99.8-percent purity at its Springs electrolytic refinery, which opened late in the year. Impala planned a production rate of 4,000 tons per year of refined nickel by 1972.

Early in the year, UCL formed a consortium with Intramet A.G., West Germany, for the sale of nickel-chrome steel castings, manufactured at UCL's Eclipse Engineering Works in Benoni, Transvaal.

Platinum.—Although platinum group metal production statistics are not reported, output was estimated at 1.5 million ounces in 1970, including 1.1 million ounces of platinum and 0.4 million ounces of palladium and other platinum group metals. This major increase in output resulted from an anticipated high world demand for platinum, particularly in the United States, in connection with antipollution control devices in automobiles and catalytic cracking of petroleum. Throughout the year, the two major producers, RPM, which accounted for an estimated 83 percent of total output, and Impala Platinum Mines, which produced most of the remainder, continued expansion programs. RPM planned production rate of 1.2 million ounces per year (platinum only) by 1973, and Impala planned a rate of 300,000 ounces per year (platinum only) by 1972. During 1970 RPM reached a production rate of 1 million ounces of platinum, and Impala reached a rate of 180,000 ounces. The only other active producer during the year, Atok Investments (Pty.) Ltd., comprising Anglovaal and Middle Witwatersrand, made its first shipment of a gravity concentrate and matte from the Middelpunt mine early in the year and produced an estimated 10,000 ounces of contained platinum during the year.

The Lonrho Ltd.-Falconbridge Nickel Mines Ltd.-South Africa Superior Oil Co. consortium formed Western Platinum Ltd. to operate its leases in the Marikana area, near Rustenburg. A 430-meter inclined shaft was completed in August, and a reduction plant was under construction. Initially, the company planned a 50,000-ounce per year operation.

Late in the year platinum surplus conditions developed, and, in November, the free market price fell to $125 per ounce. Share values in platinum companies dropped in the stock market. RPM announced a cutback in its expansion program and planned to start a stockpile. Impala announced deferment of its expansion to annual production of 300,000 ounces. Western Platinum planned to continue mine development.

Uranium.—Production increased slightly in 1970, although much was stockpiled, owing to a weak international demand. Uranium was recovered at 10 gold mines, eight of which employed the solvent extraction process of uranium recovery and two employed the ion exchange process. Several mills had converted to solvent extraction, which reduced milling costs by as much as 10 percent and produced a higher grade concentrate. In addition, a new mill under construction at the President Brand mine will also use solvent extraction.

Construction problems were encountered at the new Vaal Reefs South uranium mill, and special foundations were necessary in places. Ore capacity will be 90,000 tons per month. The new Blyvooruitzicht uranium mill, West Witwatersrand, was commissioned during the year.

A new plant for recovery of uranium oxide was nearly completed at Palabora Mining Co.'s Phalaborwa copper mine as part of a $10 million expansion program. A heavy mineral concentrate was found to contain uranothorianite. The Extractive Metallurgy Division, Atomic Energy Board, and the National Institute of Metallurgy developed a process for uranium extraction and byproduct thorium sulfate.[20] The

[19] Coal, Gold and Base Minerals. V. 18, No. 9, November 1970, pp. 25–31.
[20] South African Digest. Jan. 15, 1971, p. 5.

grade of uranium in the ore is lower than that treated at the Witwatersrand gold mines, previously the lowest grade mined anywhere in the world.

Table 9.—Republic of South Africa: Uranium production, by company, in 1970

Gold-uranium producer	Gold ore treated (thousand metric tons)	Production U_3O_8 (pounds)	Grade (pounds per ton)
Blyvooruitzicht	687	378,756	0.551
Buffelsfontein	2,791	1,686,962	.604
Harmony	1,947	629,115	.324
Hartebeestfontein	1,976	750,889	.379
Vaal Reefs	1,777	1,294,392	.730
Virginia	1,109	525,875	.474
Western Deep Levels	544	302,156	.556
Western Reefs	1,507	1,000,875	.664
West Rand Consolidated	814	1,165,904	1.433
Zandpan	824	503,341	.611
Totals and average	13,976	8,238,265	.589

Source: Chamber of Mines of South Africa. January–December, 1970.

In July the Government announced a major breakthrough in uranium enrichment with a "new and unique" process, developed by scientists of the Atomic Energy Board. Legislation invoking heavy penalties for violations of security regulations on the new process and the removal of uranium data from official statistics inhibited speculation on details of the process. A pilot enrichment plant was under construction, and a new government agency, Uranium Enrichment Corp. Ltd., was formed to handle research formerly conducted by the Atomic Energy Board.

Late in the year, four international nuclear companies—two British, one West German, and one Canadian—considered tenders for South Africa's first nuclear power reactor, to be built at Melkbosstrand, near Cape Town. Type and capacity of reactor were undetermined at yearend. According to the Electricity Supply Commission, two other reactors were planned: one on the eastern Cape Coast and the other on the Natal Coast.

Vanadium.—Increasing world demand for vanadium and a rise in ore reserves of titaniferous-vanadiferous magnetite ores at the Mapochs mine were the determining factors in Anglo-American Corp's decision to expand the Vantra (vanadium) Division of Highveld Steel and Vanadium Corp. Ltd. at Witbank, eastern Transvaal. Production will be raised by 40 percent. Export sales of vanadiferous slag more than doubled in value, reaching nearly $13.3 million in 1970. Ore reserves were estimated at more than 70 million tons at the Mapochs mine and were further augmented by development work at a new mine site in the Rustenburg area. Ore deliveries from Mapochs totaled 643,427 tons and were expected to reach the target of 900,000 tons per year in 1971. Ore deliveries to Highveld were guaranteed by South African Railways Corp. for a term of 30 years. However, shipments of products to port were not guaranteed, and the company was forced to use road transport during 1970.

A $2.8 million expansion by Ucar Minerals Ltd., a subsidiary of Union Carbide Corp., at Bon Accord, Transvaal, was well underway at yearend. Production in 1970 was about 2.2 million pounds V_2O_5 of 99-percent purity. New capacity will probably exceed 3 million pounds per year of "Carvan," a company proprietary product, largely for export.

Zinc.—Zinc Corp. of South Africa Ltd. (ZINCOR), which produced the country's first metallic zinc at the new electrolytic refinery near Springs, Transvaal, in 1969, announced plans for an increase in capacity from 100 to 150 tons per day. It was considered that imports of zinc concentrate will be necessary, unless mines in South-West Africa, supplying ZINCOR, increase their output or arrangements can be made with Anglovaal for zinc raw materials from the Prieska mine, where zinc content of ore is 3 to 4 percent.

Zirconium.—Palabora Mining planned recovery of high-quality baddelyite (zirconia, ZrO_2) from final concentrate tailings in connection with uranium-thorium recovery.

NONMETALS

Asbestos.—Demand continued high for blue asbestos (crocidolite) and the white variety of chrysotile, and export earnings increased further. New mine development was planned by several companies. Commonwealth and Overseas Asbestos Corp. planned two mines in the Kuruman area and another near Postmasburg. Existing mines were undergoing expansion.[21] Gen-

[21] Engineering and Mining Journal. V. 171, No. 11, November 1970, p. 358.

eral Mining and Finance Co. Ltd. was investigating deposits and raising mill capacity. Sales of crocidolite from General Mining's mine at Griqualand increased to 50,000 tons, despite price increases.[22] In August, the company's new Msauli chrysotile mill, eastern Transvaal, completed its first year of operation. The operation also showed a steady improvement in production, sales, and working profit. Cape Asbestos Ltd., part of the Anglo-American group, reported a sales increase of 10 percent from its amosite operation at Penge, northern Transvaal.

Cement.—A high level of activity in the construction industry resulted in a high demand for cement. Shortages developed during the year, although imports were increased. The Government, which controlled cement prices, granted permission for transport of cement by road as well as by rail. The industry experienced transport difficulties because of inadequate rail facilities.

Anglo-Alpha Cement Ltd., which supplied more than half the domestic demand during the year, continued construction of a second kiln and associated facilities at Dudfield. Pretoria Portland Cement Co. Ltd. planned extensions until 1972 in its $20 million expansion program. Cape Portland Cement Ltd. reported a sales increase of 34.5 percent for 1970. Palcaso (Pty.) Ltd., a member of the Federale group, was building a $17 million cement clinker (and sulfuric acid) plant at Phalaborwa, eastern Transvaal. Palcaso also was involved in a $1.7 million, 12,000-ton-per-year cement milling and packing plant at the same location and in association with Durban Cement Co. Ltd. The operating company, Palment (Pty.) Ltd., will receive raw material clinker from the nearby Palcaso plant, which will use byproduct gypsum to produce the clinker and sulfur-dioxide gas.[23]

Diamond.—The South African diamond industry experienced difficulties in 1970. Although production was higher than in 1969, sales from the mines dropped off 27 percent and sales by the Central Selling Organization at $529.8 million were lower by 23.5 percent than the 1969 record sales. Lagging world demand reflected the depressed economic conditions in the United States, the leading world market for diamond. According to the Chairman of De Beers Consolidated Mines Ltd., the situation was further aggravated by the fact that production other than from De Beers sources also increased considerably so that it became necessary for The Diamond Corp., a De Beers subsidiary, to purchase and stockpile substantial supplies of these diamonds to maintain price stability.[24] Diamond stocks were large at yearend.

[22] General Mining and Finance Co. Ltd. Annual Report 1970. Johannesburg, May 1971.
[23] Cement, Lime and Gravel. V. 46, No. 1, January 1971, p. 16.
[24] De Beers Consolidated Mines Ltd. Annual Report 1970. April 1971, 46 pp.

Table 10.—Republic of South Africa: Diamond production, by province

(Carats)

Province	1969			1970		
	Mine	Alluvial	Total	Mine	Alluvial	Total
Transvaal	2,703,672	29,169	2,732,841	2,677,211	22,682	2,699,893
Cape	3,844,664	1,101,065	4,945,729	4,205,465	1,023,604	5,229,069
Orange Free State	183,583	684	184,267	182,178	393	182,571
Total	6,731,919	1,130,918	7,862,837	7,064,854	1,046,679	8,111,533

Table 11.—Republic of South Africa: Diamond sales, by province

Province	1969		1970	
	Quantity (carats)	Value (thousand dollars)	Quantity (carats)	Value (thousand dollars)
Transvaal	2,725,586	20,449	2,377,916	12,689
Cape	4,774,155	119,917	4,611,558	88,389
Orange Free State	177,264	5,121	208,983	4,656
Total	7,677,005	145,487	7,198,457	105,734

Table 12.—Republic of South Africa: Diamond production of De Beers Consolidated Mines, Ltd.

(Carats)

Mines	1969	1970
Bultfontein	262,591	235,412
De Beers	236,683	266,160
Dutoitspan	189,555	189,750
Finsch	2,236,422	2,596,028
Jagersfontein	98,806	82,233
Kimberley dumps	209,763	214,600
Namaqualand areas (Annex Kleinzee, Dreyer's Plan, Langhoogte)	702,122	636,871
Premier	2,522,162	2,490,103
Wesselton	529,635	531,926
Miscellaneous	1,606	2,171
Total	6,989,345	7,245,254

Source: De Beers Consolidated Mines Ltd. Annual Report, 1970.

Mine output by De Beers increased by nearly 256,000 carats, mainly because of improved recovery methods at the Finsch mine, the leading producer. At Finsch, an exploratory shaft, 5 meters in diameter, 380 meters deep, and fully lined with steel and concrete, was being sunk to test the ground at depth below planned open pit operations.[25] A mine at Boshoff, Orange Free State, was in financial difficulty in July, owing to the price slump, and was placed under judicial management. De Beers production at Koingnaas and Dreyerspan was curtailed. De Beers announced that the Jagersfontein mine, more than 100 years old, would be closed down in May 1971, because of depleted reserves. Most of the labor force will be transferred to the newly reopened Koffiefontein mine.

Fertilizer Materials.—*Phosphate.*—Exports of crude phosphate were negligible in 1970, but the domestic fertilizer industry purchased 415,980 tons, valued at $13.8 million. Phosphate Development Corp. Ltd. (FOSKOR) sought export markets for its excess production of concentrates at Phalaborwa. FOSKOR's $3 million expansion program increased production capacity to 1.2 million tons per year and extended drying capacity. In accordance with an agreement with the Ministry of Mines, Palabora Mining will no longer dispose of phosphorus minerals, byproducts of copper ores, as waste. The mill residues, containing significant phosphorus, will be delivered to the FOSKOR plant.

Fluorspar.—Exports of 54,628 tons of acid-grade fluorspar and 55,769 tons of metallurgical-grade fluorspar earned in excess of $4 million in 1970.

In October, Zwartkloof Fluorspar Ltd., a member of Gold Fields of South Africa Ltd., began shipments from its new $5 million, 45,000-ton mine near Warmbaths, northern Transvaal, to the port at Lourenço Marques, Mozambique. The mine produced a high-quality acid-grade concentrate under a 5-year contract for exports up to a maximum of 45,350 tons per year. The central of three ore bodies was mined by open pit methods. Ore reserves were 7 million tons containing 3.7 percent CaF_2.[26]

Sulfur and Pyrite.—The Republic continued as a major producer of sulfuric acid in 1970, despite a lack of commercial deposits of native sulfur. Output in excess of 1 million tons per year was derived from domestic pyrite (55 percent), imported sulfur (35 percent), and smelter gases (10 percent).[27] Recovery of pyrite was largely a byproduct of gold and uranium production. O'okiep copper mining and Rooiberg Minerals Ltd. tin mining also contributed significantly to pyrite production. In addition, the new Prieska copper-zinc mine, where pyrite content of sulfide ores is about 50 percent, will become another important source of pyrite for sulfuric acid. ISCOR's Areachap mine, 27 kilometers northwest of Upington, Cape Province, supplied pyrite for sulfuric acid used at the new Zincor electrolytic zinc refinery at Springs, Transvaal.[28]

African Explosives & Chemical Industries Ltd. (AE & CI) was the leading consumer of the 202,132 tons of pyrite sold for sulfur content in 1970. AE & CI completed the second stage of expansion at its $8 million acid plant at Modderfontein, Transvaal. At yearend, output was reported to have reached the target of 1,000 tons of 100-percent acid per day.

Output of acid by Palabora Mining dropped nearly 14 percent, owing to further plant deterioration. Because of high operating costs and poor economic prospects at this plant, Palabora planned a new 150,000-ton-per-year plant to replace the old installation.

[25] South African Mining and Engineering Journal. V. 81, No. 4032, May 15, 1970, pp. 995–996.
[26] Coal, Gold and Base Minerals. V. 18, No. 4, June 1970, pp. 27–33.
[27] The British Sulphur Corp. Ltd. Phosphorus and Potassium. No. 46, March–April 1970, pp. 26–30.
[28] Industrial Minerals. No. 29, February 1970, p. 45.

Vermiculite.—Production of concentrate at Palabora Mining's Vermiculite Division contained 90.7 percent of the mineral. Principal demands were in fireproofing and insulating applications. American Vermiculite Co., Palabora's sales office in the United States, was transferred from New York to Atlanta, Ga., during the year.

MINERAL FUELS

Coal.—Production, local sales, and exports of anthracite and bituminous coal all registered gains in 1970. The industry made an intensive effort to develop export markets, although many difficulties were involved in attempting large-scale supply to overseas purchasers. The industry planned large investments in washing plants and other facilities for upgrading coal. Rail and port facilities were considered inadequate. A continuing shortage of rail cars seriously affected mining operations. In August, about 150,000 tons (more than 1 month's production from the Natal collieries) was piled up at the northern Natal mines because of a lack of shipping facilities. A number of mines were forced to curtail production, and coal reserves at some power stations were well below normal.

Coal associations sought large, long-term contracts for foreign delivery of coal, particularly coking coal and anthracite. The Anthracite Producers Association contracted for delivery of 500,000 tons of anthracite to French and West German iron and steel companies.[29] In March, the Natal Associated Collieries, representing all the major coal producers in Natal, sent a sales mission to Europe to attempt to secure a larger share of the export market. In August, the Transvaal Coal Owners Association negotiated a $365 million contract with the Japanese steel industry to supply 30 million tons of low-ash blend coking coal during 1972–86. Deliveries were to start at an annual rate of 450,000 tons in 1972, shipped via Lourenço Marques, Mozambique, and would accelerate to 3 million tons per year starting in 1976, when the Richards Bay port is scheduled for completion. The contract was contingent on development of adequate transport and port facilities and, at yearend, had not been finalized.

The large reserves of the No. 2 Seam, low-ash coal (inferior to straight coking coal but suitable for blending as blast-furnace feed) were evaluated in both Natal and Transvaal Provinces. ISCOR investigated the unexploited Waterberg coalfield for low-ash coal.

A report to the Coal Resources Commission on the economic exploitation of South African coals stressed the need for an increase in price if fuller extraction were required. The low pithead price inhibits the use of mechanical supports to replace the practice of leaving pillars for support.

Another report warned of a pending shortage of coking coal.[30] South African coke is made from both regular coking coals, mined in Natal, and from a mix of the straight- and weak-coking coals. Reserves of straight-coking coals were estimated at 135 million tons, and reserves of the blend coals were 65 million tons. Considering the current consumption rate of 6 million tons per year and allowing for anticipated growth, a shortage of coking coal resources may arise in about 15 years.

ISCOR intensified research efforts on formcoke, which was produced from noncoking coals by milling, mixing with other materials, and pressing into briquets. Full-scale blast-furnace tests were planned, when a new 2,600-ton-per-day briquet plant is completed at the Vanderbijlpark steelworks in 1971. South African coals were sent to the United States, the United Kingdom, and West Germany for formcoke research. Research was conducted at the Fuel Research Institute on solid, smokeless fuels for domestic and industrial use and for metallurgical formcoke. Carbonization of briquets remained a problem.[31]

General Mining and Finance Corp. Ltd. ordered a $5 million, Marion 8000 dragline from the United States in connection with plans for open pit development at its Optimum colliery in 1971. Stripping started in 1970. The giant dragline has a 84-meter boom and a 55-cubic-yard bucket.[32] Optimum's coal will be sold exclusively to the Electricity Supply Commission (ESCOM·).

In February, Anglo-American Corp.'s Kriel Coalfield, Transvaal, was selected to

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[29] Metal Bulletin. No. 5497, May 8, 1970, p. 33.
[30] Coal, Gold and Base Minerals. V. 18, No. 5, July 1970, pp. 39–46.
[31] Coal, Gold and Base Minerals. V. 18, No. 6, August 1970, pp. 67–71.
[32] South African Mining and Engineering Journal V. 81, No. 4030, May 1, 1970, pp. 881–882.

supply fuel to a new 3,000-megawatt ESCOM power station. This plant will be Africa's largest, and the coal contract also the largest in South Africa. Three separate mining systems were planned at the $24 million Kriel mine, which will supply more than 7 million tons of coal per year. Tests indicated that Kriel coal is highly consistent in quality and has a calorific value of over 9.5 British thermal units per pound. Shaft sinking was scheduled to begin late in 1973.

Petroleum and Natural Gas.—*Exploration.*—Extensive efforts, both government-sponsored and private, continued in the search for oil. Southern Oil Exploration Corp. (Pty.) Ltd. (SOEKOR), the South African Government exploration coordinating organization, predicted a substantial increase in oil exploration during the next 5 years and planned to intensify its program in both onshore and offshore drilling. At yearend, 15 offshore and four onshore concessions were under active exploration, and drilling programs totaling $24 million were planned. Offshore, four wells had been completed and others were in progress. It was expected that by mid-1971 six offshore rigs would be operating along the coast between Mossel Bay and Durban. Preparatory to drilling, seismic surveys were made, and negotiations were conducted for drilling platforms. Offshore conditions are such that semisubmersible rigs are used in most cases.

A 1969 gas discovery in Plettenberg Bay qualified South Africa Superior Oil Co. (operator for a four-company group) for a 50-percent tax rebate, income tax reduced to 20 percent of normal rates for 10 years, less stringent relinquishment requirements, and rights to a 200-square-mile lease centering on the discovery well. A drilling program was completed at three wells with no new discovery.[33] Further drilling for Superior Oil by the *Ocean Traveller,* about 5 kilometers from the 1969 discovery well, resulted in another discovery of gas in uneconomic quantities.[34] The *Ocean Traveller* also was employed in other offshore joint projects. Another offshore rig, *Transworld 61,* was working for SOEKOR and Rand Mines in the Plettenberg Bay-Mossel Bay area. Placid International Oil Co. planned three test wells, starting in midyear, in water 70 to 80 meters deep. A Total Exploration (Pty.) Ltd. consortium also started drilling during the year.

Following the first discovery of natural gas, Superior Oil conducted a survey of current and future demand for gas in the Cape Town-Port Elizabeth-Johannesburg area.[35]

In onshore activity, SOEKOR started exploration of established priority areas. Early in the year, SOEKOR announced that indications of crude oil were noted during a drill-stem test of the Colchester well, 40 kilometers north of Port-Elizabeth and about 8 kilometers inland in the Algoa Basin. This well, drilled for SOEKOR by the Department of Water Affairs, was the first oil discovery in Cretaceous formations onshore in the country.[36] A subsequent official announcement indicated that the well was not likely to become a commercial producer, owing to unfavorable formation factors, but pointed to the thicker, more favorable Cretaceous formations offshore. Drilling in the Colchester area was discontinued in September, and the rig was moved to another inland site.

SOEKOR considered the Port Elizabeth region, Zululand, Northern Karoo Basin, near Lesotho, and the Central Karoo Basin as favorable for onshore investigations. Geologic and seismic studies were conducted in several areas. Early in the year, SOEKOR issued invitations to participate in these activities. SOEKOR offered long-term exploration leases, blocks for drilling one or more wells, and minority participation.[37]

In midyear, Zululand Oil Exploration Co. (Pty.) Ltd. announced that Gulf Eastern Oil Co. Ltd. had decided to terminate participation in a lease area in northern Zululand. Other participants were Anglovaal, Rand Mines Ltd., Engelhard Hanovia, and SOEKOR.

Refineries.—Construction work on the 50,000-barrel-per-day refinery at Sasolburg, the Republic's first inland refinery, for National Petroleum Refiners of South Africa (Pty.) Ltd., progressed during the year. Formal commissioning was scheduled for May 11, 1971. Inflated costs for labor and materials were given as the reason for the

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[33] World Oil. V. 170, No. 7, June 1970, pp. 107–110.
[34] South African Digest. Jan. 15, 1971, p. 4.
[35] Gas World. May 1970; p. 574.
[36] Coal, Gold and Base Minerals. V. 18, No. 2, April 1970, pp. 57–63.
[37] World Oil. V. 170, No. 4, March 1970, p. 19.

increase from the original estimate of $77 million to $98 million. The refinery will be the largest in South Africa and one of the most sophisticated in the world. Construction was by Fluor South Africa (Pty.) Ltd. Annual capacity by refined product is as follows, in barrels: Gasoline, 8 million; diesel oil, 6 million; jet fuel, 1 million; other distillate fuel oil, 800,000; kerosine, 650,000; and paraffin, 370,000. Heavy residual oil, normally sold at coastal refineries for bunker oil, will be converted to lighter products at the Solburg refinery.

The undersea 50-inch, crude-oil pipeline, which connects the offshore single-buoy mooring station, a seven-tank farm, and the Durban refineries of Shell-BP and Mobil, was extended to a maximum length of 2.4 kilometers. The line was officially opened in September. An estimated 12 million barrels of crude was pumped to the tank farm during the last 3 months of the year.[38] Maximum offload capacity of the line is 100,000 barrels per hour.

A new $28 million lubricants refinery for South Africa Oil Refining (Pty.) Ltd. (comprising Mobil, Total, and Caltex) was under construction at Durban. It will produce 830,000 barrels of lubricants per year, starting late in 1972.

Expansion of the Caltex refinery at Milnerton, near Cape Town, was completed, and the refinery was officially opened in July.

The South African Torbanite Mining and Refining Co. Ltd., which produces gasoline, gas oil, bitumen, and tar from imported crude oils, experienced difficulties with crude oil deliveries and fell short of its contracted output. Refinery throughput totaled 698,000 barrels in 1970, about 32,000 barrels below contract rate. The company agreed to make up the deficit in 1971.[39]

[38] South African Digest. April 10, 1970, pp. 2, 3.
[39] The South African Torbanite Mining and Refining Co. Ltd. (Johannesburg). Annual Report 1970. Sept. 28, 1970, 8 pp.

The Mineral Industry of the Territory of South-West Africa

By Walter C. Woodmansee [1]

Although official statistical data on mineral production are lacking, the mineral industry of the Territory of South-West Africa apparently showed substantial growth in 1970 and continued to contribute importantly to the general economic growth of the Territory. The three major mining companies—Tsumeb Corp. Ltd., The Consolidated Diamond Mines of South-West Africa Ltd. (CDM), and The South-West Africa Co. Ltd. (SWACO)—maintained a high level of operations. Tsumeb Corp. opened its new Matchless copper-pyrite mine, and other companies reported significant copper discoveries. Rio Tinto Zinc Corp. Ltd. and South African authorities decided to proceed with open pit development of the large, low-grade uranium deposit at Rossing. A long-term contract for uranium procurement was concluded with the United Kingdom Atomic Energy Authority. In the petroleum sector, land and marine geophysical surveys were underway, following the large-scale granting of concessions in 1969.

A total of 18 mining companies and 19 mines were active in 1970. More than 100 mineral prospecting grants and 2,000 mining claims were on record. Including petroleum, 39 companies were actively prospecting for minerals in the Territory, and five companies were engaged in offshore exploration.[2]

PRODUCTION AND TRADE

The South-West Africa Administration continued its policy of not disclosing mineral production statistics for the Territory. The only available statistical data on production were derived from annual reports of the three major producing companies operating in the Territory: Tsumeb Corp. Ltd., CDM, and SWACO. The Territory traditionally produces a large variety of other minerals, particularly among the nonmetals, but output data are not available, and these commodities are not listed in table 1.

Tsumeb Corp. increased output of black arsenic, cadmium, blister copper, and refined lead, whereas mine output of silver was at a slightly reduced level. The lower recovery of diamond by CDM from beach deposits in the southern coastal area of the Territory resulted from a planned reduction in operations. SWACO output of a variety of metallic mineral concentrates at its two mining operations (Berg Aukas and Brandberg West) was in general lower, although zinc silicate output showed a substantial increase. Mine zinc production reached rated capacity at the SWACO and Imcor Zinc (Pty.) Ltd. (IMCOR) operations, where zinc concentrates are produced for shipment to a new electrolytic refinery in South Africa.

The Territory's foreign trade in mineral commodities is included in trade statistics for the Republic of South Africa and are not differentiated. Most metals and minerals produced in the Territory enter the South African or world export markets.

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[1] Physical scientist, Division of Nonferrous Metals.

[2] South African Digest. Mar. 6, 1970, p. 5.

Table 1.—South-West Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS			
Arsenic, white [2] [3]	r 2,223	r 2,217	4,062
Cadmium: [2]			
Mine output, metal content, recoverable	214	231	315
Metal, refined	168	191	232
Copper: [2]			
Mine output, metal content, recoverable	31,471	27,624	26,677
Metal, blister	32,392	27,482	28,594
Lead:			
Mine output, metal content, recoverable [4]	r 62,942	r 65,851	69,711
Metal, refined [2]	61,193	60,859	70,129
Silver mine output, metal content [2] ... thousand troy ounces	1,350	1,273	1,229
Tin mine output, metal content [5] ... long tons	r e 800	r 1,008	1,027
Tungsten mine output, metal content [6]	109	96	63
Vanadium mine output, content of concentrates [6]	r 463	r 502	402
Zinc mine output, metal content [7]	r 24,795	r 46,640	66,805
NONMETALS			
Diamond:			
Gem e ... thousand carats	1,636	1,923	2,100
Industrial e ... do	86	101	100
Total ... do	1,722	2,024	e 2,200
Lithium minerals, all types e [8]	1,216	3,967	6,909

e Estimate. p Preliminary. r Revised.

[1] In addition to the commodities listed, South-West Africa, prior to 1967, was known to produce bismuth concentrates, cesium ore, columbium-tantalum concentrates, germanium, gold, iron ore (for flux use), manganese ore, molybdenum concentrates, graphite, lime, marble, mica, salt, sillimanite, kyanite, slate, wollastonite, and a variety of precious stones, and in addition produced unreported quantities of crude construction materials (clays, stone, sand and gravel). No official statistics, however, have been published since the end of 1966; and available information is inadequate to ascertain whether production of these commodities has continued and if so, at what output levels.

[2] Tsumeb Corp. Ltd. output only; data presented are for years ending June 30 of that stated.

[3] White arsenic equivalent of black arsenic oxide produced.

[4] Output of Tsumeb Corp. Ltd. and South-West Africa Co. Ltd.; data presented are for years ending June 30 of that stated.

[5] Output of South-West Africa Co. Ltd. and the Uis tin mine of South African Iron and Steel Industrial Corp. Ltd.; data presented are for years ending June 30 of that stated.

[6] South-West Africa Co. Ltd. output only; data presented are for years ending June 30 of that stated.

[7] Reported output of Tsumeb Corp. Ltd. and South-West Africa Co. Ltd., plus an estimate for the Rosh Pinah mine of Imcor Zinc (Pty.) Ltd.

[8] Estimated on basis of recorded imports by selected countries from the statistical territory of South Africa (which includes South-West Africa) minus known production of the Republic of South Africa.

COMMODITY REVIEW

METALS

Total metal sales of Tsumeb Corp. Ltd., supplier of copper, lead, zinc, silver, cadmium, and arsenic to world markets, were $75 million[3] in fiscal year 1970 (ending June 30, 1970), a 28-percent increase over those of the previous year. At Tsumeb, modernization of surface facilities continued. Plans were made to deepen the mine and extend the ore reserves at depth. Gold Fields Cementation Mining Co., Johannesburg, Republic of South Africa, was awarded a $1.3 million contract for two shafts—one 6.7 meters and the other 4.9 meters in diameter—and 300 meters deep from the bottom of the 1,190-meter main deWet shaft. The project was scheduled for completion by March 1971.[4]

Exploration and development continued at the Tsumeb, Kombat, and Matchless operations. In general exploration, Tsumeb Corp. investigated several prospects in various parts of the Territory, often in joint ventures with other companies. An exploration project was completed in the Rehoboth area, and the concession was abandoned. A joint venture with Terra Marina Mining Co. Ltd. in the same area proved unsuccessful. A similar arrangement continued with Anglo Transvaal Consolidated Investment Co. Ltd. (Anglovaal) and SWACO. Drilling at Asis Ost in the Otavi Valley resulted in the discovery of an ore body of 594,000 tons containing 1.82 percent copper and 0.2 percent lead. Exploration was started at the Hohewarte lead-zinc prospect.

[3] Where necessary, values have been converted from South African Rands (R) to U.S. dollars at a rate of R1=US$1.40.

[4] Mining Journal. V. 274, No. 7034, June 12, 1970, p. 541.

Table 2.—South-West Africa: Salient production statistics of Tsumeb Corp. Ltd.

	Year ending June 30	
	1969	1970
Tsumeb mine and mill:		
Ore mined, gross weight short tons	606,116	571,953
Ore milled, gross weight do	569,394	550,375
Metal content of ore:		
Copper percent	4.46	4.06
Lead do	11.35	12.81
Zinc do	3.37	4.27
Silver ounces per short ton	1.70	1.95
Concentrate production:		
Lead concentrate:		
Gross weight short tons	138,109	148,642
Metal content:		
Copper percent	6.03	5.79
Lead do	44.09	43.94
Silver ounces per short ton	2.92	2.84
Copper concentrate:		
Gross weight short tons	20,218	20,225
Metal content:		
Copper percent	41.71	43.55
Lead do	10.28	10.30
Silver ounces per short ton	22.68	24.91
Zinc concentrate:		
Gross weight short tons	9,824	19,397
Metal content:		
Zinc percent	51.51	53.97
Cadmium do	1.11	1.16
Kombat mine and mill:		
Ore mined and milled:		
Gross weight short tons	411,864	416,498
Metal content:		
Copper percent	1.65	2.11
Lead do	1.79	1.66
Silver ounces per short ton	0.30	0.44
Concentrate production:		
Copper concentrate:		
Gross weight short tons	24,787	26,274
Metal content:		
Copper percent	23.44	29.64
Lead do	4.75	4.54
Silver ounces per short ton	3.11	5.23
Lead concentrate:		
Gross weight short tons	9,941	8,767
Metal content:		
Copper percent	6.17	6.60
Lead do	57.65	59.98
Silver ounces per short ton	1.35	1.57
Matchless mine and mill:		
Ore mined and milled:		
Gross weight short tons	----------	2,653
Metal content:		
Copper percent	----------	1.0
Sulfur do	----------	10.38
Smelting and refining:		
Direct smelting ore short tons	34,408	22,466
Average assay:		
Copper percent	24.66	20.50
Lead do	3.76	3.88
Silver ounces per short ton	9.69	8.17
Copper concentrates smelted short tons	44,655	46,896
Average assay:		
Copper percent	31.53	35.75
Lead do	7.23	7.04
Silver ounces per short ton	12.04	14.13
Lead concentrates smelted short tons	146,817	164,130
Average assay:		
Copper percent	6.06	5.88
Lead do	44.88	44.81
Silver ounces per short ton	2.99	3.11

Arsenic.—A total of 8,036 tons of reverberatory and converter baghouse dusts and 9,061 tons of dross skims and speiss were roasted at Tsumeb, resulting in 4,276 tons of black oxide during fiscal 1970, more than double the fiscal 1969 output. A total of 1,175 tons at 98 percent As_2O_3 and 64 tons at 95 percent As_2O_3 were packed for shipment. The refinery furnace for production of white arsenic was not operated during the year.

Cadmium.—Tsumeb Corp. processed 4,657 tons of sinter baghouse dust, a rate similar to that for the previous fiscal year.

The refined product assayed 99.98 percent pure.

Copper.—Tsumeb Corp.'s production of concentrate and blister copper was at a rate comparable to fiscal 1969. At Kombat, mine output was advanced slightly, and smelter production at Tsumeb increased 4 percent. Tsumeb Corp.'s Matchless mine and mill, which produces copper and pyrite concentrates, went into production in June. The mill was operated at about one-half its rated capacity (7,000 tons of concentrate per year) on feed from mine development and stockpile. The shaft was completed at a depth of 351 meters. Underground development totaled 691 meters. A total of 354 meters of underground drilling and 998 meters of surface drilling was completed. Ore reserves are 2.6 million short tons containing 1.88 percent copper.[5] In addition, at Matchless West, an extension of the main Matchless ore body, reserves were estimated at 600,000 short tons at 2.27 percent copper.

Anglovaal, the major South African gold-mining company, announced discovery of three copper ore bodies near Gobabis, east of Windhoek, after extensive exploratory drilling. The ore reportedly is low grade but is considered economic. Further work, including underground exploration, was under way at yeadend.[6]

Falconbridge South Africa Exploration Co. Ltd., a subsidiary of Falconbridge Nickel Mines Ltd., Canada, was developing its Oamites mine, 55 kilometers south of Windhoek. The project represents a $7 million investment and is a joint venture with the Industrial Development Corp. (IDC), an agency of the South African Government. A 7-kilometer access road was completed, and the surface plant was under construction. The scheduled annual production rate was 500,000 tons of ore and 15,000 tons of concentrate.[7]

Imcor Zinc (Pty.) Ltd., a subsidiary of the South African Iron and Steel Industrial Corp. Ltd. (ISCOR), produced a copper-lead concentrate at an annual rate of 15,000 tons at its Rosh Pinah zinc mine. This concentrate is shipped to the United Kingdom for smelting.

Silver.—Tsumeb Corp. sales of silver, largely refined on toll, were 1,368,323 ounces in fiscal 1970, an 18-percent decrease from sales during the previous fiscal year.

Tin-Tungsten.—SWACO milled 104,000 tons of ore at 0.21 percent tin and 0.14 percent WO_3 at its Brandberg West open pit during fiscal 1970. The concentrate produced assayed 35.09 percent tin and 16.43 percent WO_3. The lower production of concentrate was due to mechanical problems with open pit equipment. SWACO reported ore reserves of 5.8 million tons at 0.21 percent combined tin-tungsten.

Uranium.—Exploratory drilling continued at the Rossing deposit in the southern part of the Territory, near the Orange River delta. The operating and managing company is Rossing Uranium Ltd., in which Rio Tinto Zinc Corp. Ltd. holds the controlling interest. Other participants are the IDC, which will provide the loan portion of a $120 million investment, and General Mining and Finance Corp. Ltd. Uran-Gesellschaft A.G., a West German firm, expressed an interest in becoming a participant.

The mineralized area was reportedly extensive, measuring several kilometers in length and 1 to 2 kilometers in width, and of undetermined depth. Ore reserve and grade data were not revealed, but the deposit is large and low grade and was considered viable as an open pit operation. Production was scheduled for 1973 at a rate of 1,000 tons of U_3O_8 per year.

In January, the South African Atomic Energy Board, the United Kingdom Atomic Energy Authority, and Rio Tinto Zinc Corp. Ltd. concluded a $60 million uranium sales agreement after months of negotiations. The United Kingdom reportedly will receive 14.6 million pounds of U_3O_8 concentrate during 1976–82. The Rossing ore will be processed by the South African Nuclear Fuel Corp., the only agency authorized to export uranium from South Africa.

Vanadium, Lead, and Zinc.—At its Berg Aukas mine in fiscal 1970, SWACO hoisted 183,300 tons of ore (178,900 tons in 1969) and milled 135,900 tons containing 0.81 percent V_2O_5, 4.5 percent lead, and 24.4 percent zinc. Concentrate production, including lead vanadate (16.8 percent V_2O_5

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[5] Tsumeb Corp. Ltd. Twenty-Fourth Annual Report for Year Ended June 30, 1970, New York, New York, 14 pp.

[6] Engineering and Mining Journal. V. 171, No. 6, June 1970, p. 260.

[7] South African Digest. Feb. 20, 1970, p. 3.

and 42 percent lead), mixed and massive sulfides, zinc and lead sulfides, and zinc silicate, totaled 50,876 tons. Ore reserves, as of June 30, 1970, were 1.6 million tons at 0.7 percent V_2O_5, 5 percent lead, and 24 percent zinc.[8]

The Rosh Pinah mine of Imcor Zinc (Pty.) Ltd. was officially opened in June. The annual production rate is 50,000 tons of zinc concentrate, which is delivered to the railhead at Aus for shipment to the Zinc Corporation of South Africa Ltd. (Zincor) electrolytic refinery at Springs in the Transvaal, South Africa.[9]

Table 3.—South-West Africa: Concentrate production of The South-West Africa Co. Ltd.

(Metric tons)

Concentrate	1969 [1]	1970 [1]
Lead vanadate	5,198	4,274
Lead-zinc sulfide	18,416	16,004
Zinc silicate	25,420	30,598
Tin-tungsten	566	478

[1] Fiscal year ending June 30.

NONMETALS

Diamond.—According to the 1970 Annual Report of CDM, a member of the De Beers group, onshore, foreshore, and offshore operations were at a slightly reduced level compared with 1969. In onshore Diamond Area No. 1, output was 1,509,263 carats, an 11-percent planned reduction. However, the average size of the stones increased. The mining program was planned to effect further increases in stone size. The new No. 4 conglomerate-crushing plant, commissioned late in 1969, operated satisfactorily. Old tailings dumps were being retreated. Productivity improved 40 percent, mainly as a result of the introduction of mechanical bedrock cleaning methods.

In the foreshore area, production was improved, mainly because of an unusually rich, deeply gullied area where mining was extended into the surf zone. The 3½-year lease from Marine Diamond Corp. Ltd. (MDC) terminated at yearend 1970 and was renewed on a year-to-year basis for up to 3 years. Recovery techniques were improved; a new system of concrete prism walls permitted mining seaward to the low-tide mark.

Offshore diamond recovery from the sea floor by the dredging barge *Pomona* was suspended since reserves were nearly exhausted. Work in Hottentot Bay on the concession of Tidal Diamonds South-West Africa (Pty.) Ltd. (CDM two-thirds, Getty Oil Co. one-third) was terminated in October.[10]

[8] The South-West Africa Co. Ltd. (London). Report and Accounts. June 30, 1970, 23 pp.

[9] South African Mining and Engineering Journal. V. 81, pt. 2, No. 4036, June 19, 1970, p. 145.

[10] De Beers Consolidated Mines Ltd. Kimberley, South Africa. Annual Report 1970. May 1971, pp. 19–22.

Table 4.—South-West Africa: Salient diamond statistics

Company	Material processed (thousand metric tons)		Production (carats)		Recovery per 100 metric tons (carats)		Costs per metric ton	
	1969	1970	1969	1970	1969	1970	1969	1970
Consolidated Diamond Mines of South-West Africa Ltd	11,363	11,053	1,840,479	1,659,721	16.20	15.02	$2.36	$2.80
Tidal Diamonds, South-West Africa (Pty.) Ltd	151	195	183,813	205,718	121.78	105.48	20.42	15.99

Table 5.—South-West Africa: Operations of The Consolidated Diamond Mines of South-West Africa, Ltd.

Operation	Onshore 1969	Onshore 1970	Foreshore 1969	Foreshore 1970	Offshore 1969	Offshore 1970	Totals and averages 1969	Totals and averages 1970
Overburden stripped thousand cubic meters	17,908	16,992	2,787	1,896	XX	XX	20,695	18,888
Deposits mined and treated do	5,771	5,704	507	446	14	13	6,292	6,163
Production carats	1,696,702	1,509,263	124,649	133,872	19,128	16,571	1,840,479	1,659,706
Grade carats per cubic meter of deposit treated	0.29	0.26	0.25	0.30	1.34	1.26	0.29	0.27
Average diamond size carats	0.65	0.76	0.52	0.51	0.39	0.42	0.64	0.74
Cost per cubic meter of deposit treated dollars	3.05	3.67	4.55	4.05	41.78	55.61	3.26	3.81
Cost per carat recovered do	10.37	13.86	18.54	13.52	31.14	44.16	11.14	14.14

XX Not applicable.

Sulfuric Acid.—The plant at Tsumeb was operated intermittently during the year to supply acid for the Tsumeb and Kombat operations and for Tsumeb Corp. customers. The Matchless mine will produce 27,000 tons of pyrite annually. The 2.6 million short tons of ore reserves contain an average of 12.27 percent sulfur in pyrite.

MINERAL FUELS

Petroleum.—Both land and marine surveys were underway. Onshore exploration was in its initial stages. De Beers Oil Holding and Aquitaine SWA Ltd. planned seismic surveys in the southern part of the Territory. One area was relinquished to Southern Oil Exploration Corp. (South-West Africa) (Pty.) Ltd. (SWAKOR), a Government agency established by the South-West Africa Administration.[11] SWAKOR delineated the more favorable onshore areas and estimated that 50,000 square miles of the 200,000 square miles under its jurisdiction justified further investigation.[12]

A seismic marine reconnaissance survey was underway by BP Development Co. of South Africa Ltd. in an offshore area of 9,000 square miles, north of Walvis Bay. This project followed an earlier air magnetometric survey.[13]

[11] South African Mining and Engineering Journal. V. 81, pt. 1, No. 4029, Apr. 24, 1970, p. 849.
[12] Coal, Gold and Base Minerals. V. 18, No. 2, April 1970, p. 63.
[13] Coal, Gold and Base Minerals. V. 17, No. 11, January 1970, p. 43.

The Mineral Industry of Spain

By John D. Corrick [1]

Tightening of monetary policy by the Spanish Government in late 1969 and early 1970 succeeded in slowing an over expansion of demand, which seriously threatened both external and internal stability at the end of 1969. The Government imposed a 20-percent deposit requirement on imports that drained a large amount of liquidity from private funds, raised domestic interest rates, restricted access to special rediscount lines, and enforced a modest deferral of public investment spending. In spite of monetary restraints placed on Spanish industry, the minerals industry continued its past performance of expanding production. Increased production was evident in most major commodities and was reflected to some extent by gains in exports. Spain's Concerted Action Program, established specifically to consolidate small mining companies, had not produced the expected results by yearend. Efforts to increase mine production were impeded by continuing labor problems. Spain's Second Economic and Social Development Plan, originally scheduled to begin in 1968, was delayed more than a year. This tardiness was due to a revision of goals following the November 1967 peseta devaluation.

Improvement of Spain's balance of payments was one of the most significant results of official policy in 1970. Official reserves, which had fallen by $260 million in 1969, more than doubled in 1970, and stood at $1,730 million at the end of December. Exports increased by 26 percent while monetary restraints imposed by the Spanish Government reduced import demands, particularly in the first half of 1970, when they increased only 12 percent above those of a similar period in 1969. The gross national product (GNP) increased at a rate of 6.5 percent in 1970, down from 7.7 percent in 1969, but still above the 5.5-percent annual growth targeted by the second development plan. The value of Spanish mine production in 1970 amounted to $336 million and included $97 million in combustible minerals, $97 million in metallic minerals, $54 million in nonmetallic, and $88 million in industrial rock. Total mineral value showed a 4-percent increase over 1969, but its growth remained below that of the GNP. A 6-percent decrease in coal production was cited as a major reason for the growth of mineral production lagging behind that of the GNP. Mineral production did not keep pace with the national demand. The balance of trade in ore and metals in 1970 showed a deficit of $170 million. Among the factors causing this deficit were outdated equipment, a decreasing labor force that was becoming more restive, many marginal companies, and inadequate investments.

An agreement calling for progressive elimination of most trade obstacles between the European Economic Community (EEC) and Spain was signed in Luxembourg on June 29, 1970. Significant steps toward this objective were taken when an arrangement was made to export excess electrical energy generated at a Spanish-French nuclear powerplant at Vandellós, Spain, to France.

PRODUCTION

During 1970, important gains were made in metal and mineral output. The gains in percent were as follows: aluminum, 12; pig iron, 25; primary tin, 13; titanium dioxide, 28; tungsten, 22; metallurgical-grade fluorspar (CaF_2 content), 30; and petroleum refinery products, 13.

[1] Physical scientist, Division of Ferrous Metals.

Table 1.—Spain: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite	5,776	4,752	e 5,000
Metal, primary	89,322	r 103,250	115,146
Antimony:			
Mine output, metal content	132	122	80
Metal (regulus)	197	NA	NA
Arsenic, white	130	100	e 100
Bismuth mine output, metal content ... kilograms	r 5,735	12,147	e 12,000
Cadmium	70	80	111
Copper:			
Mine output, metal content	8,365	r 10,547	9,133
Metal:			
Blister	45,777	39,620	39,825
Refined:			
Electrolytic	78,099	76,024	82,802
Fire refined	5,486		
Iron and steel:			
Iron ore and concentrate ... thousand tons	r 5,983	r 6,409	6,954
Pig iron and blast furnace ferroalloys ... do	2,779	3,333	4,164
Electric furnace ferroalloys ... do	97	r 95	103
Crude steel ... do	r 4,924	6,005	[1] 7,388
Semimanufactures ... do	r 4,561	r 5,117	[1] 5,345
Lead:			
Mine output, metal content	74,045	r 71,749	64,936
Metal, primary	64,125	81,155	68,682
Manganese ore and concentrate	r 12,966	r 23,382	10,436
Mercury:			
Mine output, metal content ... 76-pound flasks	56,943	r 64,862	47,689
Metal ... do	r 56,391	64,456	44,760
Silver ... thousand troy ounces	r 1,704	1,823	e 1,640
Tin:			
Mine output, metal content ... long tons	140	r 261	200
Metal:			
Primary ... do	r 2,324	r 2,068	2,328
Secondary ... do	653	e 650	615
Titanium:			
Ilmenite concentrates	r 39,049	r 29,232	43,997
Dioxide	11,910	r 12,958	16,625
Tungsten mine output, metal content	124	r 202	246
Uranium mine output, U_3O_8 content	r 72	r 103	83
Zinc:			
Mine output, metal content	74,598	r 84,348	95,410
Metal, primary	75,386	80,298	89,202
NONMETALS			
Barite	60,542	63,621	e 64,000
Cement, hydraulic:			
Natural ... thousand tons	278	e 300	e 300
Other ... do	r 14,908	r 16,013	16,536
Chalk ... cubic meters	89,087	93,119	NA
Clays:			
Bentonite	27,080	34,957	e 35,000
Kaolin, marketable	226,694	274,314	e 300,000
Other ... thousand cubic meters	3,753	4,971	NA
Diatomite and tripoli e	r 18,000	18,000	18,000
Earths, industrial n.e.s	12,049	17,189	NA
Feldspar and pegmatite	47,269	43,735	e 46,000
Fertilizer materials:			
Crude potash salts, K_2O equivalent	r 616,382	r 635,648	595,498
Manufactured:			
Nitrogenous, nitrogen content ... thousand tons	454	r 463	e 480
Phosphatic, P_2O_5 content ... do	316	r 307	290
Potassic, K_2O equivalent ... do	r 543	551	e 530
Fluorspar:			
Gross weight:			
Acid grade	190,964	204,173	197,640
Metallurgical grade	118,330	101,341	141,115
Total	r 309,294	305,514	338,755
Calcium fluoride content:			
Acid grade	185,717	r 198,458	191,853
Metallurgical grade	61,131	r 52,158	67,577
Total	246,848	r 250,616	259,430
Gypsum and anhydrite, crude ... thousand tons	r 3,982	r 3,943	e 4,000
Lime (quicklime and hydrated) ... do	307	e 330	e 330
Magnesite, crude	250,590	229,080	e 230,000
Meerschaum (sepiolite), crude	33,810	17,538	NA

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
NONMETALS—Continued			
Mineral pigments, ocher	17,165	20,780	NA
Pumice	r 169,202	231,680	e 230,000
Pyrite including cupreous:			
Gross weight thousand tons	r 2,423	r 2,517	2,736
Sulfur content do	r 1,152	r 1,194	1,274
Salt:			
Rock do	911	1,076	e 1,100
Marine and other evaporated do	933	786	e 800
Sand and gravel:			
Sand:			
Silica sand thousand cubic meters	315	774	NA
Other do	1,063	955	NA
Gravel do	1,933	2,148	NA
Stone:			
Calcareous:			
Dolomite do	185	270	NA
Limestone do	19,813	25,525	NA
Marble do	144	152	NA
Marl do	2,509	2,912	NA
Basalt do	2,077	1,622	NA
Diabase do	8	3	NA
Granite do	2,209	2,048	NA
Ophite do	138	163	NA
Phonolite do	123	153	NA
Porphyry do	68	70	NA
Quartz thousand tons	289	303	NA
Quartzite thousand cubic meters	363	439	NA
Sand stone do	554	626	NA
Serpentine do	10	13	NA
Slate do	48	83	NA
Trachyte do	21	61	NA
Trass and tufa do	69	136	NA
Strontium minerals	e 4,000	r 3,600	e 4,000
Sulfur, elemental, all forms	r 9,336	5,271	e 5,000
Sulfates, natural:			
Glauberite, Na_2SO_4 content	8,978	10,500	NA
Thenardite, Na_2SO_4 content	62,779	69,483	NA
Talc and steatite	29,027	33,728	e 34,000
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural (contained)	1,772	1,854	e 2,000
Carbon black	28,100	38,000	e 40,000
Coal:			
Anthracite thousand tons	2,862	2,767	2,872
Bituminous do	9,460	r 8,860	7,815
Lignite do	r 2,810	r 2,740	2,826
Total do	15,132	r 14,367	13,513
Coke:			
Metallurgical do	3,522	r 3,686	4,012
Gashouse do	r 6	6	4
Fuel briquets, all types do	135	153	e 160
Gas, manufactured [2] million cubic feet	22,162	25,064	NA
Peat	8,746	11,200	e 11,000
Petroleum:			
Crude thousand 42-gallon barrels	925	1,386	1,457
Refinery products:			
Gasoline:			
Aviation do	98	71	27
Motor do	24,157	25,932	27,846
Jet fuel do	5,488	6,675	10,768
Kerosine do	3,054	3,079	1,837
Distillate fuel oil do	46,439	49,245	52,392
Residual fuel oil do	89,717	93,881	104,256
Lubricants do	1,526	1,391	1,869
Other do	23,958	19,394	35,030
Refinery fuel and losses do	10,053	10,882	4,439
Total do	204,490	210,550	238,464

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Excludes castings and forgings.
[2] Excludes gas produced in iron and steel plants and petroleum refineries.

TRADE

The values of mineral commodity trade and total commodity trade for each of the last 3 years follow:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1968	295	1,589
1969	289	1,900
1970	339	2,387
Imports:		
1968	1,025	3,522
1969	1,278	4,233
1970	1,524	4,747

Source: 1969-70: Estadistica del Comercio Exterior de España (Madrid), Ministerio de Hacienda.

Spain's mineral trade deficit for 1970 was $1,185 million compared with $989 million in 1969.

Exports of mineral commodities were valued at $339 million, an increase of 17 percent over that of 1969. Increased exports of crude ores, petroleum distillates, and iron and steel were partly offset by decreased exports of fertilizers, lead, zinc, and mercury. Mineral fuels, valued at $131 million, accounted for more than one-third of Spain's total mineral exports in 1970.

Imports of mineral commodities were valued at $1,524 million, an increase of 19 percent over that of 1969. Imports of most mineral commodities increased in 1970. Crude ores and concentrates, mineral fuels, and iron and steel products registered the most substantial increases. Crude oil, valued at $502 million, and iron and steel products, valued at $422 million, made up the major portion of Spain's imports.

Mineral commodity trade in 1968 and 1969 is given in tables 2 and 3.

Table 2.—Spain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum including alloys:			
Scrap	193	147	West Germany 64; France 47; United Kingdom 35.
Unwrought	6,504	1,463	United States 590; France 550; West Germany 119.
Semimanufactures	r 7,079	8,949	United States 3,696; Algeria 802; France 672.
Antimony including alloys, all forms	75	1	Netherlands 1.
Cadmium including alloys, all forms	35	34	United Kingdom 16; Netherlands 14.
Chromium oxide and hydroxide	1	2	Portugal 2.
Copper:			
Matte	111	348	United Kingdom 348.
Sulfate	1	251	Equatorial Guinea 250.
Metal including alloys:			
Scrap	166	12	West Germany 7; United Kingdom 3; Netherlands 1.
Unwrought	33,974	21,482	West Germany 7,767; Netherlands 5,513; Belgium-Luxembourg 1,633.
Semimanufactures	1,145	2,457	Romania 823; Morocco 721; Portugal 269.
Iron and steel:			
Iron ore except roasted pyrite thousand tons	1,170	1,676	West Germany 795; United Kingdom 520; France 188.
Roasted pyrite do	770	669	West Germany 564; Netherlands 53; United Kingdom 41.
Metal:			
Scrap	488	531	Portugal 383; West Germany 77; Netherlands 35.
Pig iron including cast iron	114,020	41,251	Japan 20,102; United Arab Republic 8,040; Hungary 6,310.
Ferroalloys	23,856	12,689	Poland 2,820; United Kingdom 2,190; Colombia 1,505.
Steel, primary forms	2,219	28,866	United Kingdom 25,998; Portugal 2,123; France 192.
Semimanufactures:			
Bars, rods, angles, shapes, sections	71,203	80,370	West Germany 41,141; United States 9,136; Colombia 4,335.
Universals, plates, and sheets	27,706	16,443	Argentina 6,782; West Germany 3,631; Italy 1,555.
Hoop and strip	3,512	700	Portugal 288; Brazil 267.
Rails and accessories	30	80	Argentina 26; Belgium-Luxembourg 25; Portugal 23.
Wire	1,900	2,935	Portugal 786; Romania 735; United Arab Republic 320.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Iron and steel—Continued			
Semimanufactures—Continued			
Tubes, pipes, and fittings	20,061	22,333	Morocco 3,933; France 3,688; United Kingdom 2,707.
Castings and forgings, rough	451	943	Canada 305; West Germany 14.
Lead:			
Ore and concentrate	--	10	France 10.
Oxides	21	152	Italy 119; France 26; West Germany 5.
Metal including alloys, all forms	r 87	617	Netherlands 226; West Germany 123; United Kingdom 102.
Magnesium including alloys, all forms	21	7	Netherlands 12; United States 4.
Manganese oxide	5	5	Portugal 5.
Mercury ... 76-pound flasks	42,975	41,946	West Germany 13,866; United Kingdom 7,716; Czechoslovakia 3,481.
Molybdenum including alloys, all forms ... kilograms	142	47	Netherlands 47.
Nickel:			
Metal including alloys:			
Scrap	39	55	Netherlands 37; West Germany 13; United Kingdom 4.
Unwrought	5	65	Netherlands 33; West Germany 16; United Kingdom 9.
Semimanufactures	58	35	Netherlands 7; Portugal 6; Venezuela 5.
Silicon, elemental	918	(1)	NA.
Tin:			
Metal including alloys:			
Scrap ... long tons	7	4	All to West Germany.
Unwrought ... do	283	607	West Germany 154; Hungry 108; Yugoslavia 90.
Semimanufactures ... do	1	2	Equatorial Guinea 2.
Titanium:			
Ore and concentrate (ilmenite)	6,450	3,500	France 3,500.
Oxides	3,193	666	United States 614.
Tungsten:			
Ore and concentrate	331	407	West Germany 269; United Kingdom 74; East Germany 37.
Metal including alloys, all forms	7	10	West Germany 7.
Zinc:			
Ore and concentrate	6,926	12,985	France 7,122; West Germany 4,292; Italy 1,570.
Oxide and peroxide	1,046	1,344	West Germany 310; Colombia 281; Italy 240.
Metal including alloys, all forms	r 22,666	6,975	Yugoslavia 2,251; United Arab Republic 1,026; Portugal 930.
Other:			
Ore and concentrate	(1)	33	United States 23; Algeria 7; Belgium-Luxembourg 3.
Ash and residues containing nonferrous metals.	20,027	33,929	West Germany 23,302; Finland 8,783; Belgium-Luxembourg 1,459.
Oxides, hydroxides, and peroxides of metals n.e.s	r 29	140	Equatorial Guinea 120; Cuba 19.
Metal including alloys, all forms	(1)	7	United Kingdom 6.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	7	1,738	Denmark 1,000; Equatorial Guinea 192; West Germany 184.
Grinding and polishing wheels and stones	427	1,084	West Germany 309; France 228; Poland 210.
Barite and witherite	50,150	41,624	West Germany 17,946; U.S.S.R. 12,525; United Kingdom 9,173.
Cement	65,752	89,297	Brazil 40,110; Argentina 30,040; Andorra 15,062.
Chalk	211	42	Algeria 40; France 2.
Clays and products:			
Crude n.e.s.:			
Bentonite	2,886	5,765	Sweden 3,000; Netherlands 1,637; West Germany 625.
Kaolin (china)	9,223	6,689	West Germany 5,884; Italy 800.
Other	41,364	63,875	Italy 24,789; West Germany 21,082; Andorra 5,554.
Products:			
Refractory (including nonclay bricks)	1,815	4,408	Cuba 3,204; Dominican Republic 356; Uruguay 209.
Nonrefractory	20,792	35,885	Andorra 9,743; France 8,978; United States 2,521.
Diamond, industrial ... value, thousands	--	$663	Belgium-Luxembourg $382; Netherlands $101; United Kingdom $84
Diatomite and other infusorial earths	2,106	1,402	France 410; United Kingdom 250; West Germany 291.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Feldspar	r 848	1,021	All to France.
Fertilizer materials:			
Crude:			
Nitrogenous	8	2	Andorra 2.
Potassic	644,897	514,346	Poland 171,705; Norway 85,810; United Kingdom 54,411.
Manufactured:			
Nitrogenous	r 219	911	Equatorial Guinea 742; Andorra 155.
Phosphatic	44,134	69,811	Algeria 59,476; Cyprus 2,960; Cuba 2,604.
Potassic	23,755	21,570	Algeria 8,450; Morocco 5,520; Greece 4,600.
Other including mixed	66	3,338	Italy 3,258; Andorra 65.
Ammonia	8,141	89	Norway 88.
Fluorspar	139,074	201,949	United States 154,899; West Germany 34,393; Netherlands 4,856.
Gypsum and plasters	4,249	15,446	Uruguay 11,000; Andorra 3,978; Portugal 195.
Lime	458	6,468	Equatorial Guinea 5,852; Andorra 456; Philippines 150.
Magnesite	12,646	36,364	United Kingdom 19,546; West Germany 15,530; Argentina 2,300.
Mica, all forms	42	101	West Germany 34; Cuba 23; Denmark 9.
Pigments, minerals, including processed iron oxides	r 20,753	17,633	United Kingdom 3,864; United States 2,164; Australia 1,974.
Precious and semiprecious stones, except diamond:			
Natural ... value, thousands	$4	$1	Switzerland $1.
Manufactured ... do	$109	$86	France $36; United Kingdom $18; United States $13.
Pyrite (gross weight) ... thousand tons	833	1,024	West Germany 597; France 112; Denmark 110.
Salt and brines ... do	322	273	Norway 46; Canada 41; Denmark 35.
Sodium and potassium compounds n.e.s	3,420	3,614	United Arab Republic 2,674; Syria 800; Andorra 73.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	10,947	15,143	Italy 10,876; West Germany 1,978; France 874.
Slate	7	72	Belgium-Luxembourg 40; Andorra 32.
Other	14,192	15,398	France 11,789; Italy 3,148; West Germany 359.
Worked, all types	39,648	49,475	France 37,191; West Germany 9,569.
Dolomite, chiefly refractory grade	11,054	17,086	United Kingdom 15,978; Ireland 487; Portugal 137.
Gravel and crushed rock	4,234	1,956	West Germany 871; Lebanon 500; Dominican Republic 322.
Quartz and quartzite	38,814	71,178	Norway 60,279; Sweden 3,310; France 2,750.
Sand	28,456	15,153	Andorra 14,807; Portugal 149; Libya 146.
Sulfur:			
Elemental, all forms	493	358	Morocco 349; Denmark 5; Algeria 2.
Sulfur dioxide	14	16	All to Algeria.
Sulfuric acid	14,008	10,152	France 7,923; United Kingdom 2,224.
Talc, soapstone, and pyrophyllite	28	9	Argentina 6.
Other nonmetals, n.e.s.:			
Crude	10,394	18,198	West Germany 5,326; United Kingdom 5,060; France 2,172.
Slag, dross and similar waste, not metal bearing	13,182	26,995	All to France.
Oxides and hydroxides of magnesium, strontium and barium	31	35	Republic of South Africa 20; West Germany 10; Andorra 4.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon	4,205	5,436	France 2,561; Portugal 2,361; Morocco 424.
Coal and coke including briquets	19,460	474,697	Belgium-Luxembourg 138,407; Netherlands 75,576; Romania 63,268.
Peat including briquets and litter	1	48	Italy 40; Andorra 8.
Petroleum:			
Refinery products:			
Gasoline (including natural) thousand 42-gallon barrels	10,483	8,500	United Kingdom 3,228; Sweden 1,636; United States 1,357.
Kerosine and jet fuel ... do	3,042	2,687	Denmark 654; Portugal 496; Netherlands 362.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products—Continued			
Distillate fuel oil thousand 42-gallon barrels	13,682	7,945	West Germany 2,283; Sweden 1,507; Netherlands 1,156.
Residual fuel oil do	18,328	20,433	United States 4,402; Sweden 3,310; Netherlands 2,664.
Lubricants do	8	98	United Arab Republic 70; Cuba 14; U.S.S.R. 3.
Mineral jelly and wax do	5	5	United Kingdom 5.
Other do	580	524	Portugal 152; United Arab Republic 110; Cyprus 95.
Mineral tar and other petroleum or gas derived crude chemicals	1,179	2,589	Pakistan 1,235; France 1,229; Venezuela 105.

r Revised. NA Not Available.
[1] Less than ½ unit.

Table 3.—Spain: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	72,741	93,610	Greece 41,243; Guyana 34,641; Surinam 9,340.
Oxide and hydroxide	r 181,214	215,138	Guinea 89,464; France 42,650; Guyana 39,114.
Metals including alloys:			
Scrap	8	111	Romania 33; United States 31; Canada 23.
Unwrought	16,101	26,589	Canada 15,490; Norway 2,165; Romania 2,147.
Semimanufactures	r 7,197	6,318	West Germany 1,997; Italy 769; France 673.
Antimony:			
Ore and concentrate	899	669	Morocco 334; Bolivia 189; Peru 70.
Metal including alloys, all forms	219	194	United Kingdom 117; Belgium 51; Czechoslovakia 25.
Arsenic:			
Trioxide, pentoxide, and acids	491	487	France 340; Portugal 100; West Germany 44.
Metal including alloys, all forms	11	4	All from Sweden.
Bismuth including alloys, all forms	(1)	35	United Kingdom 23.
Cadmium including alloys, all forms	4	10	United States 4; Belgium-Luxembourg 3; Netherlands 1.
Chromium:			
Chromite	29,496	45,381	Republic of South Africa 32,422; Cuba 5,082; Turkey 2,379.
Oxide and hydroxide	73	78	West Germany 53; Poland 24.
Metal including alloys, all forms	7	11	United Kingdom 8.
Cobalt oxides and hydroxides	87	74	Canada 43; Belgium 30.
Copper:			
Ore and concentrate	r 66,719	65,677	Cyprus 17,735; Ireland 17,704; Canada 11,010.
Matte	20,810	23,325	Chile 13,827; Israel 8,882.
Sulfate	19	2,650	Yugoslavia 2,587.
Metal including alloys:			
Scrap	r 25,547	19,697	Canada 7,922; United States 3,647; France 1,356.
Unwrought	41,651	48,754	Zambia 10,076; Chile 10,023; Belgium-Luxembourg 9,782.
Semimanufactures	5,985	6,632	United Kingdom 1,594; West Germany 1,476; France 839.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	594	979	Brazil 346; Morocco 328; Mauritania 203.
Roasted pyrite do	1	21	All from Mauritania.
Metal:			
Scrap do	597	1,237	United States 901; United Kingdom 218; France 31.
Pig iron, spiegeleisen and other do	17	44	Finland 29; Canada 4; Sweden 3.
Ferroalloys do	9	16	Greece 3; Republic of South Africa 3; West Germany 2.
Steel, primary forms do	729	929	West Germany 238; United States 185; Japan 171.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	112	158	West Germany 62; France 23; United Kingdom 18.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Semimanufactures—Continued			
Universals, plates and sheets thousand tons	223	619	West Germany 155; United Kingdom 119; Japan 76.
Hoop and strip do	22	33	West Germany 9; Belgium-Luxembourg 7; France 7.
Rails and accessories do	5	12	France 9; West Germany 2.
Wire do	7	9	West Germany 3; France 2.
Tubes, pipes, fittings do	38	42	West Germany 18; France 7; Sweden 4.
Lead:			
Ore and concentrate	11	1	Ireland 1.
Oxides	66	22	United Kingdom 12; West Germany 10.
Metal including alloys:			
Scrap	14	52	United States 37; Andorra 11.
Unwrought	41	63	United Kingdom 40; United States 22.
Semimanufactures	r 461	87	West Germany 36; Belgium-Luxembourg 17; France 15.
Magnesium including alloys, all forms	353	721	United States 267; Norway 195; Canada 161.
Manganese:			
Ore and concentrates	184,186	142,078	Ghana 32,926; India 31,439; Australia 29,375.
Oxides	482	451	United States 91; Netherlands 63.
Metal including alloys	107	223	France 114; Republic of South Africa 63; United States 25.
Mercury 76-pound flasks	6	5	Austria 2; West Germany 1.
Molybdenum including alloys, all forms	7	11	Netherlands 4; Austria 3; United Kingdom 2.
Nickel:			
Matte, speiss and similar materials	538	489	Canada 204; Cuba 136; France 65.
Metal including alloys:			
Scrap	50	58	France 39; Canada 7; United States 7.
Unwrought	1,545	2,073	United Kingdom 550; Cuba 421; Canada 349.
Semimanufactures	r 1,485	1,728	France 737; United Kingdom 270; Italy 255.
Platinum group:			
Waste and sweeping	303	361	United States 359.
Metal including alloys, all forms troy ounces	19,792	69,665	France 36,644; West Germany 19,387; United States 10,607.
Rare earth:			
Oxides	51	66	France 40; United Kingdom 15; United States 7.
Metal including alloys	10	6	France 4; United Kingdom 2.
Selenium, elemental	7	9	Canada 3; West Germany 3.
Silicon, elemental	222	2,765	Norway 799; Switzerland 745.
Silver:			
Unwrought and semimanufactures thousand troy ounces	3,278	3,633	West Germany 482; Switzerland 289; United Kingdom 289.
Rolled silver do	229	96	France 32; West Germany 32.
Tellurium, elemental	1	3	Peru 3.
Tin:			
Ore and concentrate long tons	2,502	4,949	Australia 1,406; Congo (Kinshasa) 1,135; Bolivia 718.
Oxides do	r 186	164	United Kingdom 139; Belgium-Luxembourg 23.
Metal including alloys, all forms do	r 76	108	United Kingdom 71; West Germany 23; France 8.
Titanium:			
Ore and concentrate	r 3,830	2,213	Australia 1,996; United States 117; Republic of South Africa 60.
Oxides	5,477	8,196	West Germany 3,177; United Kingdom 2,652; Finland 941.
Tungsten:			
Ore and concentrate	28		
Metal including alloys, all forms	6	9	West Germany 3; Netherlands 2.
Zinc:			
Ore and concentrate	54,622	12,672	France 4,292; Canada 4,043; Iran 2,985.
Oxide and peroxide	239	234	West Germany 204; Italy 18; France 7.
Metal including alloys:			
Scrap	101	96	United States 49; Sweden 20.
Blue powder	105	102	United States 43; United Kingdom 32; Norway 15.
Unwrought	1	919	France 569; Belgium-Luxembourg 350.
Semimanufactures	39	20	Belgium-Luxembourg 11.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Zirconium including alloys, all forms kilograms	24	215	Switzerland 100; West Germany 49; France 36.
Other:			
Ore and concentrates	r 24,699	21,536	Norway 17,172; Australia 3,778.
Ashes and residues containing nonferrous metals	18,960	11,448	United States 2,419; United Kingdom 2,250; Canada 1,959.
Oxides, hydroxides and peroxides of metals n.e.s	r 1,039	965	France 281; West Germany 265; United States 111.
Metal including alloys, all forms:			
Alkali, alkaline earth, and rare earth	r 281	168	West Germany 166.
Pyrophoric alloys	5	4	West Germany 2; Andorra 1; Austria 1.
Other base metals including alloys, all forms.	r 165	229	Belgium-Luxembourg 131; West Germany 46; United Kingdom 25.
NONMETALS			
Abrasive, n.e.s.:			
Pumice, emery, natural corundum, etc	681	1,073	Greece 700; United States 142; Italy 119.
Dust and powder of precious and semiprecious stones value, thousands	$73	$89	Netherlands $49; United Kingdom $21; Switzerland $13.
Grinding and polishing wheels and stones	645	811	West Germany 221; Italy 162; France 110.
Asbestos	62,812	85,446	Canada 42,709; Republic of South Africa 39,446; Italy 2,886.
Barite and witherite	680	947	West Germany 520; France 421.
Boron materials:			
Crude natural borates	20,511	26,365	United States 18,965; Turkey 7,000.
Oxide and acid	892	1,448	France 832; United States 576.
Cement thousand tons	304	406	France 127; Norway 102; Romania 95.
Chalk	6,986	7,818	France 4,745; Belgium-Luxembourg 1,060; West Germany 988.
Clays and products:			
Crude n.e.s.:			
Bentonite	15,136	19,094	Morocco 8,475; United Kingdom 5,542; Italy 3,147.
Kaolin (china)	5,889	11,263	United Kingdom 8,922; United States 1,453; Portugal 800.
Other	77,383	87,627	United Kingdom 70,317; France 8,327; Morocco 2,677.
Products:			
Refractory (including nonclay bricks)	11,656	24,895	Austria 6,409; West Germany 5,222; United States 4,034.
Nonrefractory	14,080	11,849	Italy 6,162; Portugal 2,439; West Germany 1,970.
Cryolite and chiolite	1,059	1,962	Denmark 1,962.
Diamond:			
Gem not set or strung value, thousands	$2,293	$3,053	Belgium-Luxembourg $2,487; India $229; United Kingdom $128.
Industrial do	$631	$663	Belgium-Luxembourg $382; Netherlands $101; United Kingdom $84.
Diatomite and other infusorial earths	8,193	5,910	Algeria 3,846; United States 863; France 609.
Feldspar	1,648	2,356	France 975; Portugal 565; Republic of South Africa 446.
Fertilizer materials:			
Crude:			
Nitrogenous	165,844	158,555	Chile 75,051; Norway 63,404; France 11,158.
Phosphatic	8,550	17,905	France 10,403; Israel 7,292; Senegal 209.
Potassic	(1)	9	France 7.
Nitrogenous	224,285	196,431	West Germany 94,007; France 23,271; Romania 19,668.
Phosphatic:			
Thomas (basic slag)	26,480	29,959	Belgium 27,788; France 2,165.
Other	8,331	47,605	United States 21,261; Mexico 14,928; Belgium-Luxembourg 10,945.
Potassic	1,135	494	All from West Germany.
Other including mixed	206,950	276,741	West Germany 86,919; United States 73,037; Italy 38,754.
Fluorspar	20	4	France 3; Argentina 1.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Graphite, natural	850	885	West Germany 274; Malagasy Republic 243; France 197.
Gypsum and plasters	1,010	1,109	Morocco 708; West Germany 273; United Kingdom 110.
Iodine	21	36	Chile 27; Japan 8.
Lime	3,547	4,492	United Kingdom 3,234; Portugal 1,052; Morocco 199.
Magnesite	19,030	23,503	Greece 8,288; Italy 3,612; Austria 3,001.
Mica, all forms	758	1,218	Norway 293; India 276; Argentina 200.
Pigments, mineral including processed iron oxides	2,022	2,531	West Germany 1,990; United Kindom 247; France 137.
Precious and semiprecious stones, except diamond:			
Natural value, thousands	$406	$623	West Germany $198; India $158; United Kingdom $59.
Manufactured do	$337	$413	Switzerland $189, France $94; Belgium-Luxembourg $71.
Pyrite (gross weight)	15	101	Italy 62; United States 19; West Germany 14.
Salt and brines	1,297	1,817	Netherlands 1,113; United Kingdom 612; West Germany 18.
Sodium and potassium compounds, n.e.s	4,123	14,502	France 5,083; Poland 3,977; Italy 3,732.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	20,408	27,679	Italy 16,975; Portugal 9,151; Greece 627.
Slate	532	447	Andorra 376; France 66; West Germany 5.
Other	7,446	8,532	Norway 3,312; Sweden 1,406; Republic of South Africa 1,179.
Worked:			
Slate	598	598	Italy 511; France 78; United Kingdom 8.
Paving and flagstone	152	132	Norway 84; West Germany 24; Belgium-Luxembourg 19.
Other	1,407	2,123	Portugal 1,128; Italy 627; Norway 294.
Dolomite, chiefly refractory grade	1,821	2,315	Norway 1,832; France 246; Belgium-Luxembourg 208.
Gravel and crushed rock	12,676	17,378	Morocco 12,979; Italy 2,380; France 1,449.
Quartz and quartzite	680	704	Sweden 320; Belgium-Luxembourg 199; West Germany 60.
Sand excluding metal bearing	59,499	66,888	Belgium-Luxembourg 34,649; Morocco 22,437; Netherlands 6,901.
Sulfur:			
Elemental, all forms	60,699	75,682	France 62,171; Poland 10,394; United States 2,932.
Sulfur dioxide	275	153	Netherlands 153.
Sulfuric acid	26,725	22,034	Italy 19,595; Portugal 2,231.
Talc, steatite, soapstone, and pyrophyllite	2,729	3,727	France 1,227; Norway 1,066; Italy 832.
Other nonmetals, n.e.s.:			
Crude	64,587	71,990	United States 19,133; Italy 7,964; Turkey 7,000.
Slag, dross and similar waste, not metal bearing	260	680	France 639; West Germany 39.
Oxide and hydroxides of magnesium, strontium, and barium	696	618	France 264; United States 177.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	841	826	United States 616; United Kingdom 170; Mexico 20.
Carbon black and gas carbon	17,591	17,209	France 7,768; Netherlands 4,021; United Kingdom 2,942.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	2,146	2,246	United States 1,574; Poland 344; West Germany 298.
Lignite and lignite briquets do	29	18	France 18.
Coke and semicoke do	101	111	Italy 21; West Germany 19; Greece 17.
Gas, natural value, thousands	$16,511	$18,418	France $10,015; United States $2,375; Algeria $1,465.
Hydrogen, helium and rare gases	r 430	400	France 346.
Peat including peat briquets	2,666	2,863	Ireland 1,113; West Germany 628; United Kingdom 485.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	206,200	202,960	Saudi Arabia 61,678; Libya 56,543; Iraq 21,218.
Refinery products:			
Gasoline do	883	406	Surinam 203; Netherlands 100; United Kingdom 87.
Kerosine and jet fuel do	1,496	571	Italy 275; Netherlands 91; United Kingdom 64.
Distillate fuel oil do	636	163	Italy 86; Netherlands 77.
Residual fuel oil do	348	484	Italy 275; Surinam 125; Ivory Coast 54.
Lubricants do	217	320	Netherlands 71; United Kingdom 60; United States 57.
Other do	1,547	1,352	United States 884; West Germany 261; Netherlands Antilles 104.
Mineral tar and other coal, petroleum, or gas derived crude chemicals thousand tons	29	106	United States 68; Netherlands 10; France 7.

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—As a result of measures taken in 1969, the Spanish aluminum industry in 1970 was comprised of two main groups of primary producers and semifabricators. They were the Empresa Nacional del Aluminio, S.A. (ENDASA), associated with Aluminium Co. of Canada Ltd. (ALCAN); and Aluminio de Galicia, S.A. (ALUMIGASA), associated with the French Groupe Péchiney. A technical cooperation agreement between ENDASA and Péchiney ended in 1970 with ENDASA selling its 10 percent interest in ALUMIGASA to Péchiney.

Primary aluminum production increased 12 percent in 1970, a markedly reduced rate if compared with the previous 3 years' average increase of 18 percent. The reduced growth rate was attributed to measures taken by the Government to restrain price and wage increases, particularly in the aluminum industry. Slower growth resulted in noticeable increases in stocks held by smelters and integrated fabricating plants.

Primary aluminum imports decreased 51 percent in 1970 compared with the 1969 figure, while exports increased 139 percent to 3,500 tons. Prior to 1970, primary aluminum consumption by Spain had increased significantly, averaging 12 percent for each year between 1967–69. Governmental restraint placed on the market in 1970 caused the rate of aluminum consumption to remain essentially unchanged from 1969. Primary aluminum consumption by Spain was reported as 125,000 tons in 1970. Aluminum consumption increased for use in general engineering and packaging applications; decreased for use in electrical engineering, building and construction, and domestic and office equipment; and was unchanged for use in transportation and miscellaneous uses.

ENDASA completed the second phase of its second electrolytic series and forecasted a 6,000-ton production increase to 66,500 tons in 1970. ALUMIGASA continued expansion of its La Coruña factory. Birlec Española S.A. (BIRESA) of Bilbao built three large furnaces to heat aluminum plate for ALUMIGASA's Amorebieta rolling mill at Vizcaya.

Copper.—Spain's copper industry produced 82,802 tons of refined copper in 1970, an increase of 9 percent over that produced in 1969. Demand for copper was reported as 95,000 tons in 1970. Copper exports totaled 22,003 tons in 1970, a 10.4 percent decrease from 1969. Imports of concentrate and matte remained relatively unchanged from 1969. In 1970 the consumption pattern for copper in percent was as follows: electrical industry, 53; heavy and precision engineering, 7; transportation, 3; construction, 2; the chemical industry, 1; mechanical engineering, 4; export, 10; and other, 20.

In December, Rio Tinto-Patiño, S.A. (RTP) began producing copper concentrates from its Cerro Colorado ore deposit located near Rio Tinto. RTP erected two concentrators at Rio Tinto with daily ore capacities of approximately 10,000 tons of copper and 6,000 tons of precious metals. Production at Cerro Colorado may eventually reach 20,000 tons of copper metal per year, and 3,000 kilograms of gold and 30,000 kilograms of silver are expected to be obtained from the oxidized surface ores. Cerro Colorado reserves were estimated at 44 million tons of copper ore averaging, after dilution, 0.78 percent copper; and 15.4 million tons of gossan ore grading 2.2 grams of gold and 40.4 grams of silver per ton. Additional copper and sulfur reserves were reported adjacent to the Cerro Colorado deposit. A new custom copper smelter, electrolytic refinery, and sulfuric acid plant began operations at Huelva in mid-1970. Initially problems were encountered because the smelter treated concentrates from numerous sources. Operations should improve once the Huelva smelter begins treating concentrates from Cerro Colorado. The Huelva smelter operated two 30- by 4-foot Momoda furnaces having a combined annual capacity of 200,000 tons. The refinery's initial annual capacity will be 55,000-to-60,000 tons of anodes.

A group of foreign companies and Spanish companies comprised of Unión Española de Explosivos, Rio Tinto, and RTP continued exploration work near Santiago de Compostela (northwest Spain) where sufficient copper ore was discovered and partly developed to assure annual production of 10,000 tons of copper metal. Part of the ore will be concentrated and shipped to RTP's smelter at Huelva. Development of these northwest Spanish ores together with the Cerro Colorado ore will make the RTP group the major Spanish copper producer, accounting for over 50 percent of the total.

Compañia Española de Minas de Rio Tinto, S.A. (RTE) worked two deposits in 1970—San Antonio and San Dionisio. Development work continued at San Antonio with underground production targeted for 1972, at an annual rate of 300,000 to 500,000 tons of ore. San Dionisio consisted of an open pit (Corta Atalaya) mined since 1906, and an underground mine (Alfredo) operated since 1880. Ore grade of Corta Atalaya was reported as 0.8 percent copper and 48 percent sulfur. Daily output was 3,000 tons of pyrite ore and 15,000 cubic meters of overburden. Daily mine production at Alfredo was reported as 1,500 tons of pyrite and 600 tons of mineralized porphyry. Tonnages of porphyry ore were expected to increase in the future.

Spain's Banco Central and Germany's Metallgesellschaft A.G. planned reopening the Andaluza de Piritas, S.A. mine at Aznacollar near Seville. Prospecting and development work conducted by German and Spanish experts led to the discovery of a 50-million-ton ore reserve with high lead-zinc-copper content. Production may reach 1.5 million tons of ore per year. Operation of a small pilot plant indicated a yearly production of about 25,000 tons of copper ore, in addition to significant lead, zinc, and pyrite output.

Iron Ore.—To meet Spain's expanding need for ores and metals, the nation embarked on a Programa Nacional de Investigacion Minera to explore, evaluate, and develop mineral resources for future production. An important segment of this program was directed at iron ores to supply Spain's rapidly growing steel industry. Iron ore output in 1970 increased about 545,000 tons over that of 1969 to 6,954,000 tons, with an iron content of 3,453,000 tons. Substantial increases in production are expected in the next few years as major mining companies accept the Ministry of Industry's credit privileged program of pooling resources and increasing the quantity and quality of ore mined. Iron ore reserves at the beginning of 1970 were reported as 1,450 million tons, including 400 million tons partly developed. Four companies, Compañia Minera de Sierra Menera, Agrupacion Minera, S.A., Ferarco, S.A., and Minera del Andevalo, S.A., planned to invest approximately $51 million in development work and modern equipment. However, these efforts and those by other companies were not expected to increase ore production enough to meet demand. Spain's steel industry will require 6,300,000 tons of iron by 1972, while producing only 5,700,000 tons if present expansion and modernization plans are implemented.

Spain's second development plan (1968–72) called for immediate modernization of obsolete equipment in the northern mines in Bilbao and Santander, purchases of mining and ore concentration equipment in the southwestern region (Huelva, Seville, and Badajoz), concentration and pelletizing plants in the northwestern region (Galicia and León), and transport and ore shipping facilities in the southeastern (Murcia and Almería) and eastern regions. The plan called for the following investments by regions:

Northern	$37,700,000
Northwestern	17,700,000
Southwestern	37,000,000
Southern	13,000,000
Eastern	7,150,000
Total	$112,550,000

Of this total, approximately 35 percent was to go for construction and engineering, 40 percent for Spanish-made equipment, and 25 percent for foreign equipment.

Spain's domestic demand for iron ore continued to grow in 1970 and resulted in the nation becoming a net importer of iron ore for the first time in several years. Imports for 1970 increased nearly 2.5 times over those of 1969, to a record 2,430,000 tons, while 1970 exports increased 21 percent over those of 1969, to 2,040,000 tons. Imports came mainly from Brazil, Mauritania, and Canada, while exports were destined principally for West Germany, the United Kingdom, and France. In 1970 the Government imposed a $3.57 duty on exports of red iron oxide containing 70 to 75 percent iron and a $14 duty on oxide containing more than 75 percent iron.

Until 1974, when expansion of pyrite mining will result in the beneficiation of 3 million tons of pellets (63–65 percent iron), Spain may have to import 1 million tons of high-grade iron ore (lump and pellets). Investments in new equipment and mine development by the two major pyrite producers, Tharsis Sulphur and Copper Co. Ltd. and RTE, increased Spain's output of pyrite in 1970 by 219,000 tons to 2,736,000 tons, an increase of 9 percent over the 1969 output. Additional investments planned by the pyrite industry totaled about $142.8 million and included as follows: primary roasting plants, $16.1 million; beneficiating and finishing plants, $22.1 million; hydrometallurgy, $0.3 million; and production of salable iron pellets, $61.4 million.

Iron and Steel.—The state of Spain's iron and steel industry in 1970 was best described as one of steady expansion, in spite of declines in domestic demand for steel during the final months of the year. Raw steel output increased to 7,388,250 tons, a 23-percent increase over that produced in 1969. Production of semimanufactures increased 4.5 percent over 1969 production, to 5,345,120 tons. Spain's Linz-Donawitz (LD) capacity was reported as 5,003,000 tons in 1970. Completion of Unión Siderúrgicas Españolas S.A. (UNINSA) LD facilities at Veriña in 1971 will add 2,424,000 tons to this capacity. Domestic consumption in 1970 remained essentially unchanged from that of 1969 and was reported as 8.5 million tons.

Iron and steel production continued to be dominated by three firms: the state-owned Empresa Nacional Siderúrgica, S.A. (ENSIDESA) and the private firms of Altos Hornos de Vizcaya, S.A. (AHV) and UNINSA. However, ENSIDESA and UNINSA declared their intention to merge. The new company will be known as UNIESA, with an expected capacity for raw steel of 7 million tons per year. Both companies are subsidiaries of the state's Instituto Nacional de Industria (INI), although 33 percent of UNINSA was held by private investors in 1970. INI was expected to control 70 percent of Spain's steel production by 1971. Production by the three companies through three-quarters of 1970 was as follows, in thousand metric tons:

	AHV	ENSIDESA	UNINSA
Pig iron	1,061	1,202	395
Crude steel	1,104	1,440	430
Rolled products	1,295	670	494

Source: Mining and Metallurgy (Spain). Plastics and Electricity. No. 354, October 1970, p. 49.

In the first three-quarters of 1970 the foregoing companies either approached or surpassed their entire annual production for 1969. For the period January through August, production data indicated increases over 1969 production as follows: pig iron, 30.6 percent; crude steel, 29.2 percent; and rolled products, 15.7 percent.

Exports of iron and steel totaled about 330,000 tons; imports totaled 3.1 million tons in 1970. Major items imported were scrap, 1.36 million tons; strip, 441,192 tons; semimanufactures, 367,030 tons; sheet and plates, 791,702 tons; and special steel products, 93,594 tons. The large imports of iron and steel were attributed to insufficient domestic production. This deficiency led the Spanish Ministry of Commerce to extend quotas for duty-free imports of certain iron and steel products until December 31, 1970.

Plans for a fourth major steel complex at Sagunto continued to progress. A commission appointed by INI completed a detailed study of the project, including a construction timetable and financing requirements, and submitted its report to the Minister of Industry. The plant is not expected to be completed before 1975.

In 1970 ENSIDESA completed the first expansion stage of its ore preparation facilities, together with additional continuous casting equipment serving No. 2 LD shop at Avilés. ENSIDESA announced plans to complete the last expansion phase of the ore preparation plant at Avilés by yearend 1971. The expansion includes a 1.5-million-ton-per-year semicontinuous hot strip mill, a 0.5-million-ton-per-year pickling line, and a 210,000-ton-per-year shearing line. At the Laminación-Este works lines for galvanizing (65,000 tons per year) and tinplating (145,000 tons per year) were to be installed. The Spanish company Siderúrgica Asturiana was to be dissolved following absorption of its work force by ENSIDESA.

AHV continued an expansion program which included the installation of a new blooming-slabbing mill with a capacity of 1.5 million tons per year at its Sestao works, enlargement of the hot-roll wide-strip mill at Ansio raising capacity to 1.35 million tons per year, and expansion of cold-roll facilities at Echarri-Aranaz. A stainless steelmaking venture planned for 1975, by AHV, apparently will be built in the vicinity of the joint Japanese-Spanish cold-roll stainless steel mill at Algeciras. The joint Japanese-Spanish project will be Spain's first stainless steel plant. It will be operated by Cia. Española para la Fabricacción de Acero Inoxidable (ACERINOX) with initial output of 2,500 tons per month of cold-rolled stainless steel by 1972. ACERINOX will import hot coil from Japan duty free until 1980. AHV's new project was to have an initial capacity of 30,000 tons per year, eventually reaching 120,000 tons per year. The project will house a pressure-pouring plant and hot mill to produce coil for possible use by the ACERINOX facilities after 1980.

UNINSA's new mill at Veriña, near Gijón, was scheduled to light its first blast furnace in the spring of 1970. However, the operation was delayed by a crane collapsing. Other facilities under construction by UNINSA included three LD converters with capacities of 125 tons each, a No. 2 blast furnace, a 1.75-million-ton-per-year blooming-slabbing mill, and a 600,000-ton-per-year blooming mill. GEC Electrical Products Ltd. was to supply the computer-control facilities for UNINSA's steelworks, near Gijón.

Lead, Zinc, and Associated Metals.—Spanish lead reserves were assessed at 750,000 tons contained metal. Mine output of lead ore showed a 9-percent decrease from 1969 production. Output of Spanish lead by smelters decreased in 1970 to 68,682 tons, a 15-percent drop from that of 1969. Domestic demand for lead was reported at 85,000 tons. Compañia Minero y Metalúrgica Los Guindos, S.A. reported that the closure of its lead smelter at Málaga was beneficial to the company. The company increased exploration activities at concessions held in the La Carolina-Jaén, Azuaga-Badajoz, Alhaurin el Grande, and Enix regions. Banco Atlantico of Madrid brought a 25-percent interest in Los Guindos held by Stolberger Zink. Sociedad Minera y Metalúrgica de Peñarroya-España S.A. inaugurated a new lead-zinc smelter at Cartagena in 1970, with a smelting capacity of 100,000 tons per year of lead concentrate. Annual output capacities were reported as 65,000 tons of lead bullion and 75,000 tons of refined lead. Another new smelter was being installed at San Juan de Nieva, near Oviedo. American Smelting and Refining Co. (ASARCO) obtained concessions from the Spanish Ministry of Industry to explore and develop mineral deposits in Zone No. 2 of the old mining region in Murcia Province. All operations were to be carried out in cooperation with the Instituto Geológico y Minero de España (IGME). The Government was promoting the merger of lead smelting companies, and called for the entire Spanish lead production to be centralized in two major and two or three smaller smelters.

The Spanish Government established a similar merger policy for zinc producers. Current expansion of production capacity from 65,000 tons to over 100,000 tons per year was complicated by the fact that producers were required to increase output of zinc ores and concentrates during a period when the Government was attempting to consolidate the industry. Major production centers were located at Manto de Los Azules and Reocín mines in northern Spain; the latter was recovering from flooding. Spanish reserves of zinc were assessed at 1,500,000 tons contained metal. Production in 1970 was 89,202 tons of zinc, an increase of 11 percent over that of 1969. Zinc electrosmelting capacity increased from 70,000 tons in 1968 to 84,200 tons in 1970. Part of the increased production came from the new Cartagena plant of Española del Zinc S.A., which began operations in early 1969. The plant's annual capacity was 30,000 tons, with plans to increase this to 40,000 tons.

Reopening of the Andaluza de Piritas mine at Aznacollar reportedly will add 45,000 tons of lead ore and 125,000 tons of zinc ore to Spain's total yearly production. A new lead-zinc vein with good metal content was discovered at the Los Guindos mine in southeast Spain. German engineers were working with Spanish interests in a modernization program at Los Guindos. German capital also was being used.

Mercury.—Spain remained near the top of the world's important mercury producers in 1970. The principal producing center was at Almadén, south of Madrid, with less important areas in the Asturias region of northern Spain. Spain produced 44,760 76-pound flasks of mercury in 1970, a decrease of 19,696 flasks from 1969 production. Major reasons for reduced production were lower world prices and lower mercury content in the ore. Exports increased to 43,280 flasks in 1970, compared with 41,946 flasks in 1969. This is considerably below the 1967 high of 50,532 flasks. Exports were destined mainly to West Germany, Japan, and France.

Spain and Italy attempted to prevent a major price drop in mercury by withholding a portion of their 1970 production. Average price per flask f.o.b. New York was $535 in 1968, dropping to $505 in 1969, and was reported at $345 in August 1970. Spain also felt the effect of mercury coming from Lake Pinchi, Canada, particularly in the U.S. market.

The Minas de Almadán y Arrayanes mine had proven reserves of approximately 6 million flasks, which is about half the known world reserves. Reserves at the main producing level (19th) were reported at 100,000 flasks, sufficient for 15 years' production. Diamond drilling revealed three veins, San Pedro, San Nicolas, and San Francisco, extending 300 meters below the 19th level. Ore grade was reported at 3 to 5 percent mercury. One of Almadén's four Herreschoff eight-hearth furnaces was down for alterations during 1970. New condenser lines and automatic furnace-temperature controls were being installed. The company employed a new separation process to reduce a residue problem. The process, registered under the name of "Almadén-Cenim," was developed in cooperation with Centro de Investigaciones Metalúrgica (CENIM) of Madrid. In 1970 Almadén supplemented furnace feed with material from waste dumps grading 3 percent mercury. Present ore reserves coupled with extensive waste dumps available for reworking, make a goal of 110,000 flasks for 1980 a distinct possibility. However, actual production will depend more on the mercury market than on mining or processing capacity.

Uranium.—Spain was reported to rank second among Western European and sixth among the free nations of the world in uranium ore deposits. Known Spanish reserves of uranium ore totaled approximately 10,000 tons as U_3O_8 extractable at $10 per pound of U_3O_8. Additional estimates of deposits and resources of uranium as U_3O_8 were 31,000 tons extractable at $10 to $15 per pound and 240,000 tons extractable at $15 to $30 per pound. Uranium ore output in the first half of 1970 was 29,282 tons. The principal uranium producing province was Badajoz, accounting for more than half of the 1970 production. The Government announced plans to build a 1,000-ton-per-day uranium concentration plant near a high-grade deposit in Salamanca Province and a 200-ton-per-day concentration plant at Andujar in southern Spain.

NONMETALS

Diamond.—Europe's only known diamond occurrence was being evaluated by INI, Cie. Royale Asturienne des Mines, Placer Management Ltd., and Noranda Exploration Ltd. of Canada following termination of the exploration program during the year. This discovery site was located at Carratraca, northwest of Málaga. The major geological feature at Carratraca was an altered and metamorphosed ultrabasic batholith. Kimberlite bodies had developed locally in the main batholith.

Fertilizer Materials.—*Phosphate.*—Spain had no phosphate production in 1970; however, Empresa Nacional Minera del Sahara (ENMINSA) through its operating subsidiary, Fosfatos de Bu Craa, S.A., was developing a 1,700-million-ton phosphate deposit in the Spanish Sahara. Production was scheduled to start in June 1971 at a rate of 3 million tons per year and increasing to 5 million tons by 1975. By yearend 1970, the Spanish Government had almost completed work on port facilities along the Spanish Sahara coast including a breakwater and ore-loading pier. The latter was to have a loading capacity of 2,000 tons per hour. Part of the phosphate production will be consumed in privately owned phosphoric acid and fertilizer plants at Huelva, Spain, in close cooperation with Rio Tinto's sulfuric acid production.

Potash.—Spanish potash mining made great progress in recent years, increasing from 292,500 tons of K_2O in 1964, to 530,000 tons in 1970. Much of the increase was attributed to the state-controlled Potasas de Navarra, S.A. However, significant contributions are expected from privately owned companies in northeast Spain once Vinicolar Co.'s new potash-phosphate fertilizer plant begins operating. Participating in Vinicolar's undertaking were Imperial Chemical Industries Ltd., Solvay, and Péchiney. An anticipated $24 million was to be invested during 1970–71 in the Spanish potash industry and should increase production to about 925,000 tons K_2O by 1971.

Fluorspar.—Production of metallurgical-grade fluorspar in 1970 was 67,600 tons CaF_2 content, an increase of about 29 percent over that of 1969. Acid-grade fluorspar production decreased to 191,900 tons CaF_2 content in 1970, a 3-percent decrease from that of 1969. Significant discoveries of fluorspar deposits in Spain during 1970 indicated that Spain has about 35 percent of the fluorspar reserves in Western Europe.

Magnesite.—The Spanish magnesite industry has expanded rapidly. Prior to 1967, the domestic industry produced only enough magnesite to supply Spain's requirements. By 1970, the industry was not only supplying the domestic industry, but also exporting an estimated 35,000 tons. Spain's largest producer, Magnesitas Navarras, S.A., led the expansion by installing new facilities at its Zubiri plant in Navarra Province. The plant had two rotary kilns in operation in 1970 with a total annual capacity of 110,000 tons of deadburned magnesite. Magnesitas Navarras, a subsidiary of Didier Werke A.G., a West German refractories concern, expected to export 80 percent of its production to West Germany and the United Kingdom. The other major magnesite producer was Magnesitas de Rubian C.A., located in northwest Spain. The company converted from shaft to rotary kilns 2 years ago. A second kiln was nearing completion in 1970. Its reputation was built on the marketing of a good agricultural grade of magnesite referred to as AGMA. A typical analysis follows:

Compound–FG85, FP85	Percent
MgO	86.90
SiO_2	5.90
Fe_2O_3	3.25
Al_2O_3	2.15
CaO	1.05
loss on ignition	.75
Total	100.00

Source: Industrial Minerals. No. 39, December 1970, p. 23.

MINERAL FUELS

Coal and Lignite.—The Government extended $67 million in credit to the coal industry during 1966–71 in an attempt to achieve production of 17 million annual tons. However, the Spanish coal industry produced only about 13.5 million tons in 1970, a decrease of about 6 percent from 1969. Consumption was expected to increase to 18 million tons by 1972. This increased demand for coal coupled with antiquated production techniques was expected to place heavy burdens on Spanish coal producers. Spanish imports of coal increased rapidly in 1970, surpassing imports for 1969 by about 53 percent. Imports from the United States, Spain's principal supplier of coking coal, reached 2.8 million tons in 1970, or 80 percent of Spain's coal imports. This increase reflected a growing gap between Spanish production of coking coal and the rising demand of the domestic steel industry. Spain exported more than 400,000 tons of coal between January and September 1970. Ranked first in exports was pit coal, 242,732 tons; followed by anthracite, 157,600 tons; and lignite, 545 tons.

Reorganization of the Spanish coal-mining industry and layoffs of surplus labor, which resulted in strikes during 1969, cost the state-controlled Hulleras del Norte, S.A. (HUNOSA) over $14 million. Many small mining companies were either closing down or joining HUNOSA. The colliery of Minas de Solvay informed workers that it would close its mine over the next 3 to 4 years; this mine is one of the last four privately owned coal mines in Asturias (northern Spain). HUNOSA controlled about 75 percent of the coal output in the Asturian coal basin. In 1970 INI took full control of the HUNOSA coal-mining company. The state-controlled INI received government approval to pay HUNOSA's debts and establish before December 30, 1970, a new company with a minimum capital of over $55 million and with INI as the only share holder in HUNOSA. The new company was to get subsidies for coal as follows: from July 1, 1970, to July 1, 1973, $1.64 per ton; July 1, 1973 to July 1, 1974, $1.14 per ton; and from July 1, 1974 to July 1, 1975, $0.57 per ton. The Government planned to adopt measures that would (1) liberalize the price of noncoking coal; (2) bring the price of locally produced coking coal into line with the price of similar coal imported from the United States; (3) grant more credit to modernize pits; (4) reconsider dismissed labor; and (5) grant funds for vocational training and relocation of surplus personnel.

Nuclear Energy.—Spain's first nuclear powerplant, Unión Eléctrica Madrileña's (UEM) "Juan Cabrera" at Zorita de los Canes, which became operational in 1968 attained a production level of 1,600,000 kilowatt-hours on October 31, 1970. The second nuclear powerplant, operated by Nuclenor at Santa Maria de la Garona and located equidistant from Bilbao, Santander, and Burgos, successfully completed its first series of tests in 1970. March 1971 was set for startup of the power station. The plant, jointly owned by Iberduero and Electra del Viesgo, was reported to cost over $1 million. Five additional nuclear powerplants were being built or considered. A joint Spanish-French plant under construction at Vandellós is scheduled for operation in November 1972, with annual output of 3.2 billion kilowatts. Excess electrical energy will be exported to France. The Spanish Government granted provisional approval in March 1969 to the Iberduero, S.A., project for a 500-megawatt nuclear powerplant at Lemoniz, on the bay of Basordas near Bilbao. The Government required that at least 47 percent of the engineering, construction, and equipment would be under Spanish control, and that the plant use Spanish uranium concentrate. Three Spanish companies, Hidroeléctrica Española, S.A., UEM, and Compañía Servillana de Electricidad, applied in August 1969 for governmental approval of a 1,000-megawatt, twin-unit, nuclear powerplant at Almaraz, near Rio Tajo. The company was studying alternate reactor types and fuel systems and expected to complete the plant by 1975. Hidroeléctrica Española made no progress on its 300- to 500-megawatt plant at Irta, Castellón Province, officially authorized in November 1966. The Government extended the company's time limit to December 1, 1970. Fuerzas Eléctricas de Cataluña, S.A. (FECSA) was studying the feasibility of a 600-megawatt nuclear plant at Asco near Barcelona. FECSA planned to submit a preliminary project-study to the Government during the first half of 1971. FECSA was planning a light-water enriched-uranium-type reactor. A timetable for Spanish projects and their nuclear generating capacities follows:

	Megawatts
1975	2,500
1978	5,000
1981	8,500

Petroleum.—Two oil strikes were reported by a consortium of companies headed by Shell, the French Caparex, and the Spanish groups of INI and Compañia Arrendataria Del Monopolio de Petróleos, S.A. (Campsa). The strikes were located 80 kilometers southwest of Tarragona off Spain's Mediterranean coast near the mouth of the Ebro River. The first well, Amposta Marino C1, was reported August 1970, and tested at 2,500 barrels per day heavy crude. The second well, Amposta Marino C2, was discovered late in the year. The consortium was drilling a third appraisal well, Castellón E1. The new oilfield was believed to hold over 10 million tons. Spain's only operating oilfield in 1970, at Lora, Burgos, produced 200,000 tons.

Spain continued to be a net importer of crude petroleum in 1970. Spain's imports increased in 1970 to 30.9 million tons, up 11 percent from 1969, as a result of increased refinery capacity. Libya and Algeria provided 31 percent of the imports in

1970, Iraq and Saudi Arabia 24 percent, the Persian Gulf area 31 percent, the Caribbean 9 percent, Nigeria and Angola 3 percent, and the U.S.S.R. 1 percent. Among liquid fuel exports between January and September 1970, fuel oil ranked first with 2,093,205 tons; followed by gas oil, with 1,251,760 tons. Sales of petroleum products by the State Petroleum Monopoly in the first half of 1970 were 9,067,332 tons, an increase of 15 percent over sales in the same period in 1969.

The Mineral Industry of Sweden

By F. L. Klinger [1]

A decline in production and exports of iron ore was the most noticeable development in the Swedish mineral industry in 1970. Output capacity continued to increase, however, not only for iron ore but also for nonferrous ores and pyrite. Underground ore haulage by 45-ton trucks began at Malmberget; reopening of the Yxsjöberg tungsten mine was expected by 1972; two pyrite mines and the North Garpenberg lead-zinc-silver mine were being prepared for production in 1972-73; and output of copper-ore at Aitik will be more than doubled by 1974. Gains in production and exports of stone were also evident in 1970.

In the metallurgical industry, output and exports of iron and steel products continued to rise, with a substantial increase in value. Domestic consumption of steel was predicted to rise at an average annual rate of 3 percent, to the year 2000. Annual smelter capacity for copper at Rönnskär increased to 60,000 tons and the Boliden Co. planned further expansion to 100,000 tons. Consumption of copper, lead, and zinc was less than in 1969 but consumption of nickel rose sharply. In the chemicals industry, output capacity for sulfuric and phosphoric acids was being increased.

In the energy sector, petroleum refinery capacity continued to rise and the output of products was equivalent to nearly 50 percent of consumption compared with less than 25 percent in 1965. Exploration for oil and gas was continued in southern Sweden, including Continental Shelf areas, and the first offshore hole was expected to be drilled in 1971. In nuclear energy, the Marviken project was abandoned but the first commercial reactor at Oskarshamn was expected to begin generating power in 1971. No decision was reached concerning commercial development of Sweden's uranium resources in the Billingen shale.

PRODUCTION

Indices of the volume of production for different sectors of the Swedish mineral industry in 1969 and 1970 are shown in the following tabulation:

Industry sector	(1959 = 100) 1969	1970
Iron ore mining	190	181
All mining and quarrying p	178	171
Primary metals	212	219
Nonmetallic mineral manufacturing	191	187
Products of coal and petroleum e	350	420
All industry	r 193	208

e Estimate. p Preliminary. r Revised.

Source: Central Bureau of Statistics (SCB), Stockholm. Statistiska Meddelanden I. No. 30, p. 1 (7), July 26, 1971.

The lower index for all mining and quarrying in 1970 resulted mainly from a drop in production of iron ore. The influence of iron ore mining (about 65 percent of the total material annually extracted from Swedish mines and quarries) on the overall index of production masked substantial increases in output of pyrite concentrates and stone as well as slight increases in output of concentrates of copper, lead, and zinc. The increased index for primary metals resulted from gains in output of pig iron and steel. There was also a substantial rise in output of chemicals and petroleum products.

[1] Physical scientist, Division of Ferrous Metals.

Table 1.—Sweden: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 [p]
METALS			
Aluminum:			
Primary	[r] 55,958	[r] 66,766	66,200
Secondary	16,800	19,000	20,000
Arsenic, white	21,100	16,500	16,400
Bismuth mine output, metal content	44	33	[e] 33
Copper:			
Mine output, metal content	[r] 18,213	[r] 25,150	23,100
Matte	[r] 175	[r] 1,793	NA
Cement	400	--	--
Metal refined:			
Primary	[r] 34,584	39,138	51,202
Secondary	[r] 12,097	12,621	
Gold:			
Mine output, metal content troy ounces	49,737	[r] 45,011	44,207
Metal including alloys do	[r] 106,965	[r] 119,215	135,033
Iron and steel:			
Iron ore and concentrate, gross weight:			
Direct shipping ore thousand tons	26,632	26,883	24,092
Concentrates do	[r] 5,787	6,302	7,426
Total do	[r] 32,419	33,185	31,518
Roasted pyrite, gross weight do	[r] 19	--	--
Pig iron and blast furnace ferroalloys [2] do	2,648	2,675	2,793
Electric furnace ferroalloys do	[r] 231	247	233
Crude steel do	5,095	[r] 5,322	5,496
Steel semimanufactures:			
Bars, rods, and sections do	[r] 1,499	[r] 1,503	1,586
Plate and sheet do	[r] 1,571	1,734	1,762
Strip do	[r] 169	[r] 197	167
Rails and accessories do	38	51	50
Pipe and tube stock do	242	264	272
Other including forgings and castings do	[r] 172	163	177
Total do	[r] 3,691	[r] 3,912	4,014
Lead:			
Mine output, metal content	[r] 72,032	[r] 78,244	[e] 80,000
Metal refined:			
Primary	41,900	42,100	40,600
Secondary	19,000	10,600	[e] 15,000
Manganese ore, 13 to 15 percent manganese, gross weight	[r] 11,722	8,756	--
Selenium, elemental refined	76	[e] 90	[e] 90
Silicon, elemental	8,200	9,700	12,100
Silver:			
Mine output, metal content thousand troy ounces	3,524	3,683	[e] 3,700
Metal including alloys do	[r] 4,689	[r] 6,857	6,109
Uranium oxide (U_3O_8)[e]	70	70	70
Zinc:			
Mine output, metal content	[r] 81,321	[r] 90,444	93,800
Clinker (70 to 75 percent zinc)	29,500	29,500	30,800
NONMETALS			
Cement, hydraulic thousand tons	3,912	3,958	3,994
Chalk	[r] 16,784	[r] 18,489	22,000
Clays:			
Fire	[r] 69,411	[r] 44,492	NA
Kaolin:			
Crude	[r] 27,639	[r] 23,864	[e] 29,000
Washed	[r] 95	[r] 4,833	NA
Other (klinkerlera)	[r] 42,935	[r] 49,739	NA
Diatomite:			
Crude	3,450	6,050	[e] 6,000
Calcined	[r] 537	[r] 608	[e] 600
Feldspar	[r] 27,296	[r] 33,224	31,900
Fertilizer materials manufactured, gross weight:			
Nitrogenous thousand tons	298	NA	NA
Phosphatic:			
Thomas slag do	74	NA	NA
Other do	414	NA	NA
Other including mixed do	792	NA	NA
Lime (quicklime and hydrated) do	[r] 900	[r] 877	766
Pigments, natural mineral	[r] 1,246	[r] 1,235	NA
Pyrite and pyrrhotite (including cupreous):			
Gross weight thousand tons	474	495	575
Sulfur content do	[r] 240	[r] 250	[e] 290

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
NONMETALS—Continued			
Stone and gravel n. e. s.			
Dimension:			
Unworked:			
Limestone and marble thousand tons	100	88	NA
Granite and gneiss do	208	245	NA
Quartz (crude blocks) do	54	59	NA
Quartzite (crude blocks) do	19	21	NA
Other including slate do	166	161	NA
Worked, all types do	r 198	r 186	NA
Crushed gravel and other:			
Dolomite:			
Crude do	r 373	r 389	NA
Burnt do	r 57	55	NA
Limestone and other calcareous:			
For cement, lime, and flux do	r 9,790	r 9,827	NA
Other do	r 403	458	NA
Granite and gneiss do	r 7,511	6,410	NA
Quartz (except crude blocks) do	34	20	NA
Quartzite (except crude blocks) do	1,258	1,255	NA
Other do	r 882	r 697	NA
Sulfur:			
Elemental	6,354	6,504	e 6,000
Sulfuric acid (100 percent) and oleum	632,015	648,000	e 650,000
Talc and steatite	r 24,343	r 28,825	32,300
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades thousand tons	20	22	e 10
Coke:			
Coke oven do	523	533	530
Gashouse do	493	402	e 400
Peat:			
For agricultural use do	100	e 100	e 100
For fuel use e do	25	25	25
Oil shale:			
For fuel use do	278	197	NA
For other use do	448	246	NA
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	10,022	10,659	11,050
Jet fuel do	1,248	1,296	936
Kerosine do	248	341	349
Distillate fuel oil do	14,845	20,329	24,417
Residual fuel oil do	29,337	32,741	35,751
Lubricants do	560	483	455
Other do	7,021	7,840	8,784
Refinery fuel and losses do	7,180	7,208	5,347
Total do	70,461	80,897	87,089

e Estimate. p Preliminary. r Revised. NA Not available.
[1] In addition to the commodities listed, cobalt, molybdenum ore and metallic titanium are also produced, but output is not reported and information is inadequate to make reliable estimates of output levels.
[2] Includes sponge iron as follows, in thousand tons: 1968—152; 1969—178; 1970—185.

TRADE

Compared with 1969, the total value of Swedish exports of mineral commodities in 1970 increased 11 percent; imports increased about 23 percent. The trade deficit attributable to mineral commodities increased more than 50 percent, to approximately $680 million.

Iron and steel products accounted for the largest increase in value of both exports and imports, but the principal commodities contributing to the deficit were nonferrous metals and crude and refined liquid fuels. Exports of iron ore and iron and steel products continued to account for about 70 percent of the value of mineral commodity exports, although the net surplus generated in these sectors was less than in 1969.

Quantitatively, principal gains in exports were registered in stone, petroleum products, and sulfuric acid. Exports of iron ore were 3.7 million tons less than in 1969. The largest increases in imports in 1970 occurred in crude oil and petroleum products, iron and steel products, coal and coke, salt, and gypsum.

West Germany and the United Kingdom continued to be Sweden's principal trading partners in 1970. The European Free Trade Association (EFTA) and Europeon Economic Community (EEC) each supplied about 30 percent of the value of Sweden's mineral commodity imports. Purchases of mineral commodities by EFTA countries amounted to approximately 41 percent of the value of Swedish exports, while the EEC share was about 38 percent.

Swedish trade in mineral commodities in 1968 and 1969 is detailed in the following tables.

Table 2.—Sweden: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum metal including alloys:			
Scrap	963	552	West Germany 491.
Unwrought	16,103	15,981	Norway 9,506; United Kingdom 3,180; West Germany 2,474.
Semimanufactures	18,452	26,371	Finland 7,987; United Kingdom 6,703; Denmark 4,363.
Arsenic, oxide and acids	14,436	NA	NA.
Copper:			
Ore and concentrate	930	1,081	All to East Germany.
Matte	1,751	1,800	All to Belgium-Luxembourg.
Metal including alloys:			
Scrap	933	1,081	West Germany 347; Italy 157.
Unwrought	31,385	39,175	United Kingdom 15,159; West Germany 7,171; France 6,888.
Semimanufactures	37,097	35,078	Denmark 12,822; Norway 11,063; United States 4,018.
Iron and steel:			
Iron ore and concentrate except roasted pyrite thousand tons	r 28,761	31,713	NA.
Roasted pyrite do	277	256	West Germany 154; United Kingdom 97.
Metals:			
Scrap do	19	16	West Germany 9; Norway 3; Netherlands 1.
Pig iron including speigeleisen [1] do	100	224	Japan 74; United Kingdom 42; West Germany 30.
Ferroalloys do	50	75	United Kingdom 28; West Germany 17; United States 14.
Steel, primary forms do	61	100	Denmark 38; United Kingdom 30; West Germany 11.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	415	420	United Kingdom 84; West Germany 60; United States 44.
Universals, plates, and sheets do	575	576	Denmark 121; West Germany 92; Norway 88.
Hoop and strip do	55	58	Denmark 8; United States 7; West Germany 6.
Rails and accessories do	5	11	Norway 5; United States 2; West Germany 2.
Wire do	54	60	United States 10; West Germany 7; United Kingdom 5.
Tubes, pipes, and fittings do	231	207	U.S.S.R. 42; United Kingdom 25; West Germany 23.
Castings and forgings, rough do	2	3	Mostly to Belgium-Luxembourg.
Total semimanufactures do	1,337	1,335	
Lead:			
Ore and concentrate	48,508	46,870	West Germany 40,447; Belgium-Luxembourg 6,423.
Oxides	2,598	1,143	NA.
Metals including alloys, all forms	r 13,588	12,817	Denmark 4,490; United Arab Republic 4,049; Finland 2,997.
Magnesium metal including alloys:			
Scrap	168	237	West Germany 160.
Unwrought and semimanufactures	7	22	NA.
Manganese ore and concentrate	3,089	2,401	NA.
Nickel metal including alloys:			
Scrap	650	504	West Germany 214; Belgium-Luxembourg 163.
Unwrought	485	339	Netherlands 207; West Germany 46; United Kingdom 33.
Semimanufactures	1,308	1,645	Bulgaria 206; United States 177; United Kingdom 129.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Platinum group and silver:			
Waste and sweepings value, thousands	r $3,926	$2,967	West Germany $1,954; United Kingdom $837; United States $98.
Metals including alloys unworked or partly worked:			
Platinum group do	$248	$287	Finland $124; Denmark $116.
Silver do	$9,235	$10,953	West Germany $6,476; United Kingdom $2,975, Denmark $422.
Silicon elemental	r 8,536	6,734	NA.
Tin metal including alloys:			
Scrap long tons	24	14	NA.
Unwrought and semimanufactures do	199	64	West Germany 28; Denmark 15.
Tungsten:			
Ore and concentrate	447	81	All to India.
Metal	112	152	NA.
Zinc:			
Ore and concentrate	141,703	159,914	Belgium-Luxembourg 54,021; Norway 45,769; West Germany 42,458.
Oxide and peroxide	353	350	NA.
Metal including alloys:			
Scrap	1,364	1,426	Norway 764; West Germany 196.
Unwrought and semimanufactures	r 651	600	Finland 275.
Other:			
Ore and concentrate	140	1,711	West Germany 1,639.
Ash and residues containing nonferrous metals	r 79,272	54,385	Norway 39,383; Belgium-Luxembourg 5,496; United Kingdom 4,439.
Oxides, hydroxides and peroxides of metals n.e.s	62	94	NA.
Base metals including alloys, all forms	r 155	357	NA.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc. value, thousands	$3	$6	NA.
Dust and powder of precious and semi-precious stones do	$12	$16	NA.
Grinding and polishing wheels and stones	r 2,474	2,484	West Germany 481; Denmark 463; France 347.
Cement	4,547	59,094	NA.
Chalk	2,774	2,570	NA.
Clays and products (including all refractory brick):			
Crude	2,679	1,233	NA.
Products:			
Refractory (including nonclay bricks)	r 30,038	41,475	Norway 16,027; Finland 11,722; Denmark 10,066.
Nonrefractory	r 31,754	33,791	Norway 9,914; Denmark 9,195; Finland 5,290.
Diamond:			
Gem not set or strung value, thousands	$357	$344	Finland $144; Denmark $103.
Industrial do	$39	$54	NA.
Feldspar and fluorspar	14,875	14,632	Italy 2,906.
Fertilizer materials manufactured:			
Nitrogenous	r 92,675	54,416	India 30,715; East Germany 10,147; United Kingdom 10,075.
Phosphatic, Thomas slag	32,680	26,567	NA.
Other including mixed	r 13,681	23,934	NA.
Graphite, natural	48	--	
Lime	648	636	
Magnesite	93	4	NA.
Pyrite, gross weight	41,622	41,611	All to United Kingdom.
Salt and brines	273	188	NA.
Stone, sand and gravel:			
Dimension stone crude and partly worked:			
Granite, gneiss, sandstone, etc	145,123	526,265	Netherlands 386,678; West Germany 82,938; Denmark 18,273.
Marble and other calcareous	5,927	5,571	Denmark 3,701.
Slate	2,609	4,506	NA.
Dolomite chiefly refractory grade	9,421	3,372	Denmark 2,012.
Gravel and crushed stone	800,981	808,674	West Germany 456,511; Denmark 312,321; Norway 30,970.
Limestone	472,480	543,539	Finland 292,061; West Germany 195,963; Denmark 53,467.
Quartz and quartzite	104,146	149,603	Denmark 98,213; Norway 20,565; West Germany 17,150.
Sand excluding metal bearing	38,053	47,531	Norway 27,029.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Sulfur:			
Elemental, all forms	18	4	NA.
Sulfuric acid including oleum	65,338	109,488	NA.
Talc and steatite	4,714	3,876	Denmark 2,958.
Other nonmetals n.e.s.:			
Crude	14,917	29,630	United Kingdom 16,896; Denmark 4,079.
Slag dross and similar waste not metal bearing	r 63,687	61,642	Norway 41,312; Denmark 18,667.
Oxides and hydroxides of magnesium, strontium and barium	50	86	NA.
Bromine, iodine and fluorine	14,472	24,528	West Germany 13,446; United Kingdom 3,134; Finland 1,763.
Building materials of asphalt, asbestos, and fiber cement and unfired nonmetals n.e.s	26,896	29,110	NA.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke including briquets	9,406	143,356	West Germany 87,219; Finland 27,962; Denmark 14,818.
Hydrogen, helium and rare gases	208	147	NA.
Peat including briquets and litter	16,620	17,811	Denmark 8,088; Norway 3,284; Italy 1,251.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	4,514	5,189	United Kingdom 2,475; Denmark 1,508; Norway 1,190.
Kerosine and jet fuel do	885	780	Denmark 312; United Kingdom 248; Norway 220.
Distillate fuel oil do	2,994	2,019	Norway 1,056; Denmark 960.
Residual fuel oil do	3,928	4,031	Norway 1,994; Denmark 1,815; West Germany 129.
Lubricants do	409	397	Norway 126; Finland 125; Denmark 71.
Other including liquefied petroleum gas do	377	480	Denmark 311; Norway 82; Finland 57.
Total do	13,107	12,896	
Mineral tar and other coal petroleum or gas derived crude chemicals	26,598	27,510	Netherlands 14,586; West Germany 5,698; East Germany 4,885.

r Revised. NA Not available.

1 Includes cast iron and shot, grit, sponge, etc. of iron and steel.

Table 3.—Sweden: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrates	41,045	67,672	Greece 39,727; Guyana 5,846; United States 3,200.
Oxide and hydroxide [1]	143,757	148,105	Jamaica 86,859; Guyana 32,053; West Germany 14,218.
Metal including alloys:			
Scrap	r 2,159	2,231	Norway 1,163; Finland 882.
Unwrought	24,835	34,668	Norway 21,361; Ghana 5,100; United States 1,800.
Semimanufactures	r 26,106	32,210	Norway 7,471; Austria 5,063; West Germany 2,862.
Chromium:			
Chromite	149,437	183,976	U.S.S.R. 127,524; Turkey 31,502; Republic of South Africa 12,305.
Oxide and hydroxide	r 1,884	2,038	West Germany 1,052; U.S.S.R. 295; Italy 270.
Cobalt oxide and hydroxide	6	6	NA.
Copper:			
Ore and concentrate	46,263	51,904	Canada 27,085; Peru 9,506; Chile 7,778.
Matte	18,885	25,039	France 17,384; Belgium-Luxembourg 7,655.
Metal including alloys:			
Scrap	9,572	12,841	United States 6,723; France 2,071; Denmark 1,319.
Unwrought	80,683	74,342	Chile 31,579; Zambia 19,321; Belgium-Luxembourg 11,062.
Semimanufactures	r 18,755	20,331	Finland 6,846; United Kingdom 3,457; West Germany 3,157.
Iron and steel:			
Ore and concentrate except roasted pyrite	81,553	46,976	Liberia 45,610.
Roasted pyrite	5,135	1	NA.
Metal:			
Scrap	r 194,276	426,256	U.S.S.R. 206,479; United States 119,325; East Germany 35,295.
Pig iron including cast iron [2]	278,032	272,269	Finland 157,280; U.S.S.R. 53,778; East Germany 29,171.
Ferroalloys	r 85,707	99,408	Norway 41,703; Republic of South Africa 14,110; India 10,966.
Steel, primary forms	14,420	65,672	United States 24,095; Finland 22,561; United Kingdom 10,285.
Semimanufactures:			
Bars, rods, angles, shapes, and sections	r 327,119	427,986	West Germany 104,276; Belgium-Luxembourg 99,544; France 75,672.
Universals, plates, and sheets	694,712	881,961	West Germany 167,527; Belgium-Luxembourg 142,065; United Kingdom 127,735.
Hoop and strip	r 60,676	80,029	Belgium-Luxembourg 31,077; West Germany 16,140; Czechoslovakia 12,969.
Rails and accessories	6,540	6,124	West Germany 2,911; Denmark 1,355; Belgium-Luxembourg 816.
Wire	r 17,334	24,101	United Kingdom 10,978; Belgium-Luxembourg 3,964; West Germany 3,520.
Tubes, pipes, and fittings	191,099	223,022	West Germany 80,832; United Kingdom 35,995; Austria 15,922.
Castings and forgings, rough	r 6,244	5,905	Poland 3,847; Norway 624; Belgium-Luxembourg 524.
Total semimanufactures	r 1,303,724	1,649,128	

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Lead:			
Oxides	1,591	1,173	United Kingdom 515; East Germany 305.
Metal including alloys:			
Unwrought	5,458	7,174	Peru 4,239; Republic of South Africa 1,112; United Kingdom 792.
Semimanufactures	r 1,898	1,325	Belgium-Luxembourg 713; West Germany 423.
Magnesium metal including alloys:			
Unwrought including scrap	657	688	Norway 523; United Kingdom 71.
Semimanufactures	123	88	NA.
Manganese:			
Ore and concentrate	87,414	68,174	Republic of South Africa 51,576; U.S.S.R. 15,331; West Germany 769.
Oxides	1,104	1,105	Japan 726.
Mercury ... 76-pound flasks	3,974	1,595	Spain 1,189; Italy 174; Yugoslavia 116.
Molybdenum:			
Ore and concentrate	4,396	6,613	NA.
Metal including alloys, all forms	29	36	United States 15; West Germany 6; Austria 4.
Nickel:			
Matte	1,031	1,260	Switzerland 537; Canada 412; U.S.S.R. 270.
Metal including alloys:			
Scrap	r 2,160	3,390	United States 2,310; Canada 304; Netherlands 271.
Unwrought	r 14,002	13,070	Norway 6,295; United States 3,657; Canada 429.
Semimanufactures	986	1,821	United Kingdom 676; Netherlands 639; West Germany 194.
Platinum group and silver:			
Ore and concentrates ... value, thousands	r $1,867	$774	Canada $471; Peru $294.
Waste and sweepings ... do	r $3,559	$2,036	United States $1,029; United Kingdom $861; Denmark $116.
Metals including alloys unwrought or partly worked:			
Platinum group ... do	r $1,785	$1,875	United Kingdom $1,119; West Germany $548; Switzerland $144.
Silver ... do	r $5,502	$6,689	United Kingdom $3,673; West Germany $2,493; Switzerland $312.
Tin metal including alloys:			
Unwrought including scrap ... long tons	762	577	United Kingdom 456; Netherlands 38; mainland China 25.
Semimanufactures ... do	147	148	United Kingdom 97; West Germany 16.
Titanium:			
Ore and concentrate	2,661	3,463	NA.
Oxides	5,640	6,967	Finland 1,233; Japan 1,184; United Kingdom 1,015.
Tungsten:			
Ore and concentrate	1,930	2,440	Canada 1,095; mainland China 745; Republic of Korea 427.
Metals including alloys, all forms	39	71	West Germany 46; France 10; United Kingdom 6.
Zinc:			
Oxide	2,119	2,436	Netherlands 926; Belgium-Luxembourg 581; West Germany 384.
Metals including alloys:			
Blue powder (dust)	251	246	Norway 181.
Unwrought	r 38,424	43,104	Norway 21,923; Poland 7,812; Canada 4,771.
Semimanufactures	r 1,536	1,371	West Germany 831; Poland 190; Belgium-Luxembourg 188.
Other:			
Ore and concentrate	2	60	NA.
Ash and residues containing nonferrous metal	48,856	51,856	West Germany 16,781; Norway 16,580; Poland 6,347.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Other—Continued			
Oxides, hydroxides and peroxides of metal n.e.s.	1,653	1,970	Finland 702; West Germany 341; United Kingdom 252.
Metals including alloys all forms	r 3,467	5,400	Republic of South Africa 1,452; France 933; West Germany 767.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	597	506	NA.
Dust and powder of precious and semi-precious stones value, thousands	$585	$527	United Kingdom $257; United States $134; Netherlands $76.
Grinding and polishing wheels and stones	3,195	3,542	United Kingdom 1,489; Austria 680; West Germany 561.
Asbestos	18,731	16,102	Canada 7,390; U.S.S.R. 4,300; Cyprus 1,835.
Barite and witherite	1,285	1,617	West Germany 1,542.
Boron materials:			
Crude natural borates	6,362	7,974	United States 6,212; Turkey 1,507.
Oxide and acid	793	790	NA.
Cement	23,605	24,190	Denmark 19,732; West Germany 1,777; United Kingdom 1,307.
Chalk	r 12,462	9,131	Denmark 6,603.
Clays and products (including all refractory brick):			
Crude n.e.s. (bentonite, kaolin, refractory)	270,510	272,102	United Kingdom 236,870; West Germany 10,932; United States 9,441.
Products, refractory (including nonclay brick)	r 95,243	120,384	Austria 31,855; United Kingdom 30,230; West Germany 24,112.
Cryolite and chiolite	1,275	431	Denmark 424.
Diamond:			
Gem not set or strung value, thousands	$1,928	$1,887	Belgium-Luxembourg $1,331; Netherlands $284; Israel $186.
Industrial do	$681	$1,032	United Kingdom $442; Netherlands $366.
Diatomite and other infusorial earths	8,720	9,812	Denmark 4,747; United States 2,813.
Fertilizer materials:			
Crude:			
Nitrogenous	25,834	25,677	All from Chile.
Phosphatic	527,974	521,334	Morocco 418,219; U.S.S.R. 91,155; Senegal 11,960.
Manufactured:			
Nitrogenous	494,077	503,391	Norway 446,247; Netherlands 51,302; West Germany 4,487.
Phosphatic	r 18,656	42,523	Tunisia 41,273.
Potassic	221,389	238,831	East Germany 61,629; Canada 58,813; West Germany 57,978.
Other	42,970	41,050	Norway 34,215; West Germany 5,790; Denmark 614.
Ammonia	67,182	76,257	Norway 76,251.
Fluorspar including feldspar	19,209	22,966	Republic of South Africa 5,880; France 4,799; mainland China 4,387.
Graphite, natural	1,107	1,229	West Germany 601.
Gypsum and plasters	387,077	396,026	France 190,924; Poland 183,311; West Germany 19,732.
Lime	14,446	12,510	Denmark 7,812; West Germany 3,098.
Magnesite	6,000	6,836	Austria 1,806; Czechoslovakia 1,595; United Kingdom 1,298.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Mica, all forms	1,184	1,045	NA.
Pigments, mineral:			
Natural, crude	291	146	NA.
Iron oxides, processed	6,356	7,151	West Germany 5,912; United Kingdom 447.
Precious and semiprecious stones except diamond value, thousands	$1,017	$1,981	Ireland $1,957.
Pyrite	63,914	112,877	Norway 74,069; U.S.S.R. 38,390.
Salt	r 936,154	993,414	Netherlands 426,844; West Germany 262,481; United Kingdom 169,257.
Sodium and potassium compounds n.e.s.:			
Caustic soda	57,719	77,458	Belgium-Luxembourg 45,253; United States 7,123; Finland 7,093.
Caustic potash	1,357	1,118	West Germany 867; United Kingdom 202.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous stone	2,970	2,704	Italy 1,337; Belgium-Luxembourg 665.
Slate	5,378	6,142	West Germany 3,644; Norway 2,365.
Other including granite, gneiss, etc	2,876	3,980	Norway 3,517.
Worked, all types	19,694	20,909	Portugal 16,626; Italy 1,704; Norway 611.
Dolomite, chiefly refractory grade	26,168	24,213	Norway 23,568.
Gravel and crushed rock	48,953	52,663	Denmark 27,112; Finland 12,183; Norway 8,391.
Limestone (except dimension)	85,039	121,093	United Kingdom 69,656; Denmark 40,426; Norway 10,768.
Quartz and quartzite	4,692	8,046	Spain 7,670.
Sand excluding metal bearing	207,924	312,445	Denmark 195,397; Belgium-Luxembourg 103,686; Norway 8,740.
Sulfur:			
Elemental, all forms	148,928	118,340	Poland 46,101, France 37,465; Finland 22,015.
Dioxide, sulfuric acid, and oleum	36,618	25,304	Norway 11,913; Finland 10,985; West Germany 2,219.
Talc, steatite, soapstone, and pyrophyllite	18,922	18,721	Norway 8,264; Belgium-Luxembourg 4,162; Austria 2,830.
Other nonmetals, n.e.s.:			
Crude	r 25,940	33,759	West Germany 12,976; Norway 12,892; United Kingdom 4,007.
Slag dross, and similar waste, not metal bearing	r 16,734	15,233	NA.
Oxides and hydroxides of magnesium, strontium, and barium	8,690	9,700	Norway 6,116; United Kingdom 1,641; France 489.
Bromine, iodine, and fluorine [3]	1,312	953	NA.
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals n.e.s.	16,213	14,439	Belgium-Luxembourg 4,631; West Germany 4,523; Denmark 2,588.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	r 911	607	United States 414.
Carbon black	23,573	17,562	Netherlands; 8,287; United Kingdom 4,480; West Germany 1,965.
Coal and briquets:			
Anthracite and bituminous coal thousand tons	r 1,734	1,570	United States 568, U.S.S.R. 488; Poland 227.
Lignite and lignite briquets	8,567	13,796	East Germany 10,185; Czechoslovakia 2,803.
Coke and semicoke thousand tons	1,074	1,101	West Germany 475; United Kingdom 181; Czechoslovakia 53.
Hydrogen, helium and rare gases	147	244	Norway 72.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	66,840	77,420	Oman and Abu Dhabi 22,537; Venezuela 14,774; Iran 12,595.
Refinery products:			
Gasoline (including natural) do	21,743	22,057	Italy 5,142; Trinidad 2,618; Netherlands 2,363.
Kerosine and jet fuel do	3,272	2,992	United Kingdom 1,666; Bahran 306; Denmark 238.
Distillate fuel oil do	51,504	50,333	United Kingdom 13,570; Trinidad 5,737; U.S.S.R. 5,461.
Residual fuel oil do	46,880	57,343	Norway 5,361; Netherlands 3,536; Denmark 3,210.
Lubricants do	1,022	1,092	United Kingdom 357; Netherlands 294; United States 221.
Other including liquefied gases do	1,029	1,239	United States 504; Netherlands Antilles 252; West Germany 224.
Total refinery products do	125,450	135,056	
Mineral tar and other coal, petroleum, or gas derived chemicals	r 39,357	23,129	Belgium-Luxembourg 6,854; Netherlands 6,231; West Germany 3,941.

r Revised. NA Not available.
1 Excluding artificial corundum.
2 Includes spiegeleisen and sponge, powder, and shot of iron and steel.
3 Mostly chlorine.

COMMODITY REVIEW

METALS

Aluminum.—Production and consumption of aluminum in 1970 was relatively unchanged from 1969 levels although productive capacity continued to increase. Owing to a decline in demand during the last half of 1970, output of primary metal was down 1 percent and production of semimanufactures was down about 8 percent compared with 1969. Imports of bauxite and alumina increased more than 20 percent, and imports of unwrought metal and alloys increased to 40,000 tons, but trade in semimanufactures was little changed from 1969. Consumption of primary aluminum was reported to be 77,500 tons in 1970 (76,400 tons in 1969).[2]

Gränges AB, which acquired AB Svenska Metallverken (SM) and its subsidiary companies in 1969, was the principal Swedish producer of aluminum in 1970. The company's Essem division was raising the output capacity of the Sundsvall smelter by 30 percent, to 85,000 tons of aluminum annually. Sixty-two new electrolysis units were installed. At the Finspång works, which produced 59,400 tons of light-metal semimanufactures in 1970, a second casting machine for wide strip was installed and a third casting machine was ordered for delivery in 1971. Productive capacity for aluminum extrusions was more than doubled, to 16,000 tons annually. At Skultuna, a new rolling mill for extra-wide foil started production in 1970.

Copper.—Production of copper concentrate increased about 2 percent in 1970, to 114,000 tons. The Boliden Co. continued to account for more than 90 percent of total output, with the remainder produced by Stora Kopparberg Bergslags AB (SKB) from mines at Falu and Tomtebo.

In March 1970 Boliden decided to proceed with expansion of mining operations at Aitik in Norrbotten County. Production of copper ore from this property will increase to 5 million tons annually in 1974 (2.2 million tons of crude ore were produced in 1970). The increased volume of ore mined is expected to drop the average content of copper to approximately 0.4 per-

[2] World Bureau of Metal Statistics (London). World Metal Statistics. V. 24, No. 7, July 1971, p. 9.

cent, compared with 0.5 percent at the present time.

Boliden's contract with the Government to operate the mines at Adak was renewed in 1970, for a period of 10 years. About 250,000 tons of copper ore are produced annually at Adak.

SKB was increasing production capacity of its mine at Falu. The modernization program, which includes a new headframe, was scheduled for completion in early 1971.

Output of copper at the Rönnskär smelter of the Boliden Co. included 51,200 tons of electrolytic copper, and 500 tons of blister copper for sale. Approximately 40 percent of this quantity was produced from ores mined by Boliden. The expansion of production capacity for blister copper was not completed until late in 1970.

Imports of copper ores and matte rose to 79,000 tons in 1970. Exports and imports of unwrought copper and alloys declined 17 percent and 5 percent, respectively, compared with 1969; exports of semimanufactures declined slightly but imports increased by 40 percent. Production of copper and brass products by Gränges Essem division of Gränges AB, which accounts for the bulk of Swedish output, was 93,000 tons in 1970 (97,000 tons in 1969). Swedish consumption of refined copper declined to 82,500 tons, 6.4 percent less than in 1969.[3]

Iron and Steel.—*Ferroalloys.*—Airco Alloys AB planned to add a third electric furnace to its ferroalloy plant at Vargon. The new furnace, rated at 75,000 kilovolt-amperes (Kva), is expected to double the plant's annual output of ferromanganese and ferrosilicon to a total of 125,000 tons. The two existing furnaces are rated at 35,000 Kva and 15,000 Kva. Cost of the expansion program was reported to be $8.7 million, including $4 million for pollution control equipment.

Total output of ferroalloys in Sweden in 1970 was slightly less than in 1969 but production of alloy steel rose 5 percent to 1,281,000 tons. The principal increases occurred in stainless and tool steels. Imports of several alloying materials increased substantially compared with 1969: manganese ore was up 70 percent; tungsten ore, 46 percent; molybdenum ore, 12 percent; and chromite, 8 percent. Net imports of nickel and alloys were up 50 percent and apparent consumption of nickel increased to 23,000 tons. There was also an increase of 25 percent in production and exports of elemental silicon.

Iron Ore.—Production and exports of iron ore in 1970 declined by 5 percent and 12 percent, respectively, compared with 1969. The declines were caused mainly by a strike at the mines of Luossavaara-Kiirunavaara AB (LKAB) early in 1970 and by reduced demand for ore in West European markets during the latter part of the year. The strike at LKAB, which began December 9, 1969 and lasted until February 4, 1970, caused Swedish production and exports of iron ore in the first quarter to fall 40 to 50 percent below figures for the comparable period of 1969. During the following 9 months the rate of production was greater than in 1969 but export demand declined in the last quarter and the loss could not be made up.

The decline in production appeared to affect only direct-shipping lump ore, output of which (17.47 million tons) was 15 percent less than in the previous year. Production of direct-shipping fines rose by 5 percent and output of concentrates increased by 18 percent. Production of iron ore pellets increased by 20 percent, to 4.9 million tons, while output of sinter and other agglomerates (3.4 million tons) was unchanged. Pellets and sinter made up 14 percent of iron ore exports in 1970, compared with 11 percent in 1969.

Swedish deliveries of iron ore in 1970 totaled 32.5 million tons, of which 28 million tons were exported and 4.5 million tons were shipped to domestic consumers. Mine stocks at yearend totaled 4.6 million tons.

Higher prices were realized for Swedish iron ore products in 1970. The statistical mean price (f.o.b.) was equivalent to approximately $8.35 per metric ton, compared with $7.35 in 1969. In contracts for 1970 deliveries, LKAB and Gränges AB reported average price increases of 10 percent and 14 percent, respectively, compared with the previous year. A further price increase of about 9 percent was reported by Gränges AB in contracts for deliveries in 1971.

Production, deliveries, and exports of iron ore by the principal Swedish producers in 1970 were as follows (quantities in thousand metric tons):

[3] Page 38 of work cited in footnote 2.

Company	Production	Deliveries	
		Domestic	Exports
LKAB	23,780	600	24,100
Gränges AB	e 3,600	1,612	1,980
Stora Kopparberg	894	967	--
Fagersta Bruks AB	e 880	NA	NA

e Estimate. NA Not available.

LKAB production (including output of pellets in parentheses) was 16.2 million tons at Kiruna (1.6), 5.02 million tons at Malmberget (0.79), and 2.56 million tons at Svappavaara (1.4). The Svappavaara pelletizing plant had its first full year of production in 1970 and accounted for most of the increase in Sweden's output of pellets. About 75 percent of LKAB exports of iron ore were shipped through the port of Narvik and 25 percent through the port of Luleå. Principal destinations of ore exports in 1970 (with quantities in million tons) were West Germany (9.6), Belgium (7.1), and the United Kingdom (2.7). Improved ore handling facilities at Narvik were indicated by an increase of 6 percent in the average cargo loaded (to 34,000 tons) and by a decrease of 36 percent in average turnaround time per ship, compared with 1969.

LKAB also continued to improve production facilities at its underground mines at Kiruna and Malmberget. Hoisting capacity at both localities was being increased. At Kiruna, the first of five crushing stations planned for the new main haulage level, and the first of five new hoists being installed in the 10-skip hoisting shaft, were expected to be completed by mid-1971. At Malmberget, the conversion to sublevel caving was nearly completed, and haulage on the 600-meter level was begun with 45-ton trucks. One of the four shaft furnaces for pellets at Malmberget was being replaced; the new unit will have a production capacity of 500,000 tons per year and will increase total output capacity for pellets to 1.5 million tons per year in 1972.

Output of ore products by Gränges AB in 1970 included 3 million tons at Grängesberg and an estimated 600,000 tons at Stråssa. Total deliveries of ore by the company were about 12 percent less than in 1969, and exports were about 21 percent less. Production of iron ore pellets included 490,000 tons at Stråssa and 102,000 tons of cement-bonded ("Grangcold") pellets at the new plant in Grängesberg. The latter plant began production in the fall of 1970 and was expected to reach full capacity of 1.5 million tons per year by the end of 1971. In 1970 Gränges AB negotiated its first long-term contract for delivery of "Grangcold" pellets; the contract calls for delivery of 1.3 million tons over a 5-year period to the Polish state firm of Stalexport.

An alternative "cold-binding" technique for producing iron ore pellets, developed at the Royal Institute of Technology in Stockholm, was reported to be undergoing pilot-plant testing in 1970. In this process, iron ore concentrates and a binder such as cement, slaked lime or slag are pelletized, then hardened under high pressure in steam autoclaves at a temperature of 200°C for 8 hours.

Output of iron ore by SKB in 1970 came from five mines in central Sweden. Deliveries by mine (in thousand metric tons) were as follows: Risberg (304), Blötberget (246), Håksberg (234), Vintjärn (91), and Ramhall (92). Deliveries included 488,000 tons to Gränges AB and 305,000 tons to the SKB steelworks at Domnarvet. The company continued to increase productive capacity at its mines and ore dressing plants, under an expansion plan which is expected to raise total output capacity for iron ore to 1.4 million tons annually by 1975. A 19 foot by 28 foot autogenous grinding mill was reportedly being installed in 1970, and a new ore body was found at a depth of 500 meters near the Vintjärn mine.

Fagersta Bruks AB produced iron ore from three mines in 1970. The largest mine, operated by AB Dannemora Gruvor (68-percent owned by Fagersta) produced 690,000 tons of iron ore products from 1.3 million tons of crude ore. This was a 33-percent increase in output of iron ore products compared with 1969, and a further increase of 15 percent was expected in 1971. Fagersta leased the Bäckegruvan mine in Västmanlands County from Uddeholms AB, for a period of 10 years beginning January 1, 1970. The Bäckegruvan mine produced 130,000 tons of low-phosphorus (.003 percent P) concentrates in 1968. The third mine operated by Fagersta was the Smältarmossgruvan property in Kopparberg County. In other activities, deep explorations were continued in five sections of the Dannemora ore-field, and the Dannemora-Hargshamn railway line was converted to standard-gauge and reopened by midyear.

Boliden Aktiebolag completed its investigation of the Stav and Kantorp iron mines in 1970, at a total cost of $1.3 million. Iron ore reserves were estimated at 11 million tons, with an average iron content of 36 percent. Although the ore is low in sulfur and phosphorus, considerable investment would be necessary to prepare the mines for production and the company deferred plans for further development. The mines are located in Södermanland County and were purchased from Boxholms AB in 1967.

Gränges AB ordered three 265,000-ton-deadweight ore/oil carriers in 1970. Two were ordered in February and are scheduled for delivery in 1973-74. The third, ordered jointly by Gränges and another Swedish company, is scheduled for delivery in June, 1974. All three vessels will be built at the Uljanik shipyards at Pula, Yugoslavia. The Gränges shipping division's fleet in 1970 included two 76,000-ton ore carriers and five ore/oil carriers of 21,000 to 106,000 deadweight tons.

Pig Iron.—Output of pig iron and sponge iron in 1970 was equivalent to 92 percent and 82 percent, respectively, of Swedish production capacity. Blast-furnace production of pig iron increased about 4 percent compared with 1969, and the quantity of hot metal used directly for steelmaking rose 9 percent to 2,161,000 tons. Imports of pig iron increased 35 percent to 355,000 tons while exports were less than 2,000 tons compared with 71,000 tons in 1969.

The Guldsmedshyttan iron works of Gränges AB was sold at yearend to Sandviken Jernverks AB. The plant was sold because Gränges' requirements for ingot moulds at the Oxelösund steel-works have been sharply reduced by developments in continuous casting. The Guldsmedshyttan plant, which produced 49,000 tons of pig iron in 1970, will continue to receive most of its blast furnace feed in the form of iron ore pellets from Stråssa, under a 10-year contract between Gränges and the new owners.

Gränges production at Oxelösund in 1970 included 893,000 tons of pig iron and 35,000 tons of sponge iron.

Norrbottens Järnverk AB (NJA) ordered a new blast furnace in 1970 from the West German firm of Demag. The furnace is scheduled to be installed at Luleå by mid-1973 and is expected to raise the company's output capacity for pig iron to 1.6 million tons annually. Present capacity is about 500,000 tons. NJA expects to double its steelmaking capacity by 1975.

Steel.—Steel production, consumption, and trade continued to grow in 1970. Output of crude steel was equivalent to about 92 percent of production capacity, compared with 89 percent in 1969. Apparent domestic consumption of crude steel rose 5 percent to 5,745,000 tons.[4] The quantity of imports of finished steel exceeded exports by 25 percent, but the relatively high value of Swedish exports again generated a trade surplus of about $200 million. Investment in the iron and steel industry increased 20 percent in 1970, to $120 million. A government forecast for the next 5 years predicted a 1.5 percent reduction in the number of man-hours worked, an average annual production growth rate of 6 percent, annual investment requirements of $130 to $140 million, and an annual export growth rate of 8.5 percent, subject mainly to limiting factors of labor availability and investment capital.

A study by the Swedish Ironmasters' Association (Jernkontoret) in 1970 estimated that growth in Swedish consumption of steel will average about 3 percent annually from 1970 to the year 2000. The study also estimated that the proportion of special steel in Sweden's total steel output would increase from 28 percent in 1969 to 40 percent in 2000.

Electric furnaces continued to account for the largest share of crude steel production in 1970 but the share produced by oxygen processes was increasing. By process, the shares of total output in 1970 (1969 shares in parentheses) were: electric, 41.5 percent (41.1); oxygen, 34.8 (32.8); open-hearth 23.2 (25.4); and basic Bessemer (Thomas) 0.5 (0.7). Continuous castings accounted for 14 percent of the crude steel produced (12 percent in 1969).

Consumption of scrap for steelmaking in 1970 was estimated at about 3.1 million tons, equivalent to approximately 56 percent of crude steel production. In 1969, the latest year for which data were available, scrap consumed by steelmaking processes was equivalent to 89 percent of the output of electric steel, 67 percent of open-hearth

[4] Organization for Economic Cooperation and Development (OECD), Paris. Draft Report on the Iron and Steel Industry in 1970 and Trends in 1971. Document DIE/1/IS/71.105, Statistical Annex, Aug. 3, 1971.

steel, 30 percent of Thomas steel, and 5 percent of oxygen steel. Imports of scrap in 1970 totaled 481,000 tons, including 53,000 tons of stainless steel scrap of which 65 percent was imported from the United States.

Gränges AB produced 842,000 tons of crude steel at Oxelösund in 1970. Output of continuously–cast slabs increased 31 percent to 352,000 tons, while output of heavy plate totaled 534,000 tons. The company planned to increase production capacity for heavy plate to 625,000 tons annually by mid–1971. In the fall of 1970, a $4.3 million roller-spray quench plant for construction steel plate was installed at Oxelösund. The plant was reported to be the only one of its kind outside the United States and Japan, and its production capacity was estimated at 30,000 tons of quenched and tempered plate per year. The Gränges Hedlund division continued to export about 40,000 tons annually of large–diameter gasline pipe to the Soviet Union.

SKB produced 947,000 tons of rolled steel in 1970, slightly less than in 1969. The company was investing $73 million in order to increase production capacity for finished steel products by 30 percent to 1.3 million tons annually by 1975. In 1970 a $16 million tandem cold-rolling mill was installed in the SKB steelworks at Domnarvet. The mill has a production capacity of 700,000 tons per year. The existing reversible mill is to be rebuilt for continuous rolling of stainless steel strip. A substantial share of the company's output of stainless steel has been shifted from Söderfors to Domnarvet, to take advantage of continuous casting facilities. SKB produced 23,700 tons of stainless steel in 1970. At Söderfors, a vacuum degassing plant using the ASEA-SKF [5] process was installed. SKB was also expanding productive capacity for specialty steels at Söderfors and Vikmanshyttan.

NJA planned to invest about $83 million by 1975, to double the output of steel at Luleå to 1.2 million tons annually by 1974. Orders were placed with a West German firm for an oxygen plant (capacity 14,000 cubic meters per hour), and with an Austrian firm for a Linz-Donawitz converter (capacity 900,000 tons per year). Rolling-mill and foundry capacity will also be expanded.

In other developments, Uddeholms AB announced plans to invest a total of about $50 million during the next 3 years at its plants at Degerfors (stainless steel sheet), Hagfors (bars and wire), Munkfors (cold-rolled strip), and Storfors (pipe). NJA and SKB were considering construction of a large coking plant at Gävle. Fagersta Bruks AB started up a new hot strip mill at Fagersta in 1970, and planned to install a new vacuum degassing furnace in 1971 as well as continuous slab-casting facilities for stainless steel in 1972. The company also planned to increase production capacity for high-speed steel by installation of two more electro-slag refining (ESR) furnaces.

Lead and Zinc.—Production of lead concentrates (108,200 tons) and zinc concentrates (167,500 tons) were slightly higher than in 1969. About 60 percent of the lead concentrates were produced from the Laisvall and four other mines in northern Sweden, while about 60 percent of the zinc concentrates was produced from 10 mines in central Sweden. The total output of concentrates was produced by 21 mines, of which 17 were operated by Boliden and 1 each by Bolaget Vieille Montagne, AB Statsgruvor, SKB, and the Axel Johnson Group. Boliden's share of the total output of concentrates included about 65 percent of the zinc and 85 percent of the lead. In addition Boliden produced 30,800 tons of zinc clinker (70 to 75 percent Zn) from copper and lead slags at Rönnskär.

Boliden continued to develop the North Garpenberg mine in central Sweden for production in 1972–73. The ore contains appreciable quantities of silver, in addition to lead and zinc. While the metal contents were not reported, the sulfide ores of this region generally contain 6 to 13 percent combined lead and zinc, and 0.4 to 0.8 percent copper; gold is usually associated with chalcopyrite, and silver with galena and zinc blende.[6]

Exports in 1970 included 47,000 tons of lead concentrates, 180,000 tons of zinc concentrates, and 32,000 tons of zinc-bearing residues. The principal countries of destination continued to be Norway, West Germany, and Belgium.

Sweden's consumption of refined lead dropped to 48,800 tons in 1970 (54,900 tons

[5] Developed by Allmänna Svenska Elektriska Aktiebolaget (ASEA) and AB Svenska Kullagerfabriken (SKF).

[6] Mellansvenskgruvindustri (The Mining Industry of Central Sweden). Statens offentliga utredningar No. 51 (1970). Industridepartementet, Stockholm, p. 39.

in 1969) while consumption of slab zinc was 36,000 tons (38,100 tons in 1969).[7]

Tungsten.—AB Statsgruvor continued preparations to reopen the Yxsjöberg copper-tungsten-fluorspar mine in central Sweden. Running-in of the new concentrator was expected to begin in the fall of 1971, using tailings from former operations. Regular production will probably begin in 1972. An estimated $3.5 million is being spent on the Yxsjöberg development.

The Yxsjöberg deposit is about 800 meters long. It consists of three separate ore bodies lying between depths of 250 and 450 meters. The main working level of the mine will be at 300 meters, with ore hoisted from the 450-meters level. All crushing will be done underground. The mine will produce about 150,000 tons of ore annually, yielding about 500 tons of scheelite concentrates with an average content of 72 percent WO_3. The ore is reported to contain 5 to 10 percent fluorspar, but the distribution of this mineral is irregular. Copper content was not reported. Ore reserves are reportedly sufficient for 15 to 20 years' production.

Scheelite will be concentrated by shaking-tables, followed by roasting and high-intensity magnetic separation. Two concentrates will be produced; the first directly after rod-milling of the crude ore and the second after ball-milling and removal of copper sulfide and fluorspar by flotation. The sulfide concentrate will contain about 25 percent copper, while the fluorspar concentrate is expected to contain 95–96 percent CaF_2.

Uranium and Nuclear Energy.—Investigations were continued at Ranstad by AB Atomenergi, to investigate the economics of producing uranium on a commercial scale from deposits in the Billingen shale. The company was expected to submit its report and recommendations to the Government in 1971. Meanwhile, the mine and mill continued to operate at about 40 percent of rated capacity. Swedish demand for uranium was expected to be 1,800 tons annually by 1980, increasing to 3,000 tons annually by 1985.

The Swedish Geological Survey reported finding large uranium-rich boulders in the Arjaplog region of Norrbotten County.

Functional defects found in the Marviken reactor system, and a review of the basic design, led AB Atomenergi to abandon the heavy-water project in April 1970. After considering the feasibility of substituting a light-water reactor in the system, the nuclear power project was dropped altogether. A proposal to convert the plant into an oil-fired station was being considered.

Some delay was experienced in completion of the Oskarshamn nuclear powerplant. Production of power on a commercial scale was expected to start in 1971, with full output (about 400 megawatts of electricity) being reached in 1972. A second unit (Oskarshamn II, with a capacity of 580 megawatts) was under construction and scheduled for service by 1975.

NONMETALS

Cement and Other Construction Materials.—Activity in building construction appeared to be little changed from 1969. Production and imports of cement rose slightly, while exports were sharply reduced. Output of building bricks continued to decline. Building costs were 5 to 10 percent higher than in 1969.

Quarry production of broken and crushed granite increased by 1 million tons, and of sandstone and quartzite by 300,000 tons. Output of limestone for cement manufacture was down about 3 percent. Exports of stone increased by more than 350,000 tons, or about 20 percent compared with 1969.

Output of construction materials by Höganäs AB in 1970 included 220,000 tons of fire clay, 60,000 tons of chamotte, and 30,000 tons each of olivine and soapstone. The output of fire clay was nearly 50 percent more than in 1969.

LKAB continued to mine quartzite at Nukutusvaara, north of Kiruna. The quartzite is used by the company in the manufacture of iron ore pellets.

AB Forshammars Bergverk, which is owned two-thirds by LKAB, mined quartz, quartzite, and feldspar from a number of deposits in central Sweden. Quartzite was mined and processed in Dalsland, principally at Vingenäs and Byn (output capacity about 74,000 tons per year); and also at Ämnebyn (output about 20,000 tons per year); the product was shipped mainly to AB Ferrolegeringar at Trollhättan and to Avesta Jarnverks AB at Rådanefors, and some was exported to West Germany. The Ämnebyn quartzite is used in manufactur-

[7] Pages 51 and 65 of work cited in footnote 2.

ing lining material for electric iron and steel furnaces. About 20,000 to 25,000 tons of feldspar is mined annually at Limberget, Forshammar (Västmanland), from a deposit having proven reserves of about 1.5 million tons. In addition, 400 tons of potash feldspar and 4,000 tons of quartz is mined per year at Drömgruvan in the vicinity of Norrköping. The company's total production capacity for feldspar was about 32,000 tons per year, while the capacity for quartz was considerably higher than the current rate of production. About 60 percent of the feldspar is sold on the domestic market and the rest is exported.[8]

The Reymersholm Works of the Boliden Co. produced an estimated 150,000 tons of byproduct gypsum from the manufacture of phosphoric acid in 1970. The company hopes to produce gypsum pure enough to be used by the cement industry and for other construction materials, but at present the byproduct is wasted. Expansion of phosphoric acid production by the company is expected to increase output of gypsum to 500,000 tons per year by 1973. Swedish imports of gypsum totaled 487,000 tons in 1970.

Pyrite and Sulfur.—Approximately half of the increase in Sweden's output of pyrite in 1970 came from the Näsliden and other mines of the Boliden Co. Production of pyrite concentrates by Boliden rose to about 480,000 tons, about 8 percent more than in 1969. The company's production goal was 600,000 tons annually. Two new pyrite mines—the Kedträsk and Udden properties in Västerbotten County—were scheduled to go into regular production in 1972–73.

Trade in pyrite was not appreciably changed, with imports of 118,000 tons and exports of 52,000 tons in 1970. Imports of elemental sulfur rose to 134,000 tons. Imports of sulfuric acid in 1970 (77,000 tons) were four times the quantity imported in 1969, and exports (188,000 tons) increased by more than 70 percent. Output of sulfuric acid from Boliden plants at Rönnskär and Hälsingborg increased 14 percent to 632,000 tons.

Boliden's capacity for production of sulfuric acid was expected to rise to nearly 1 million tons annually by the end of 1971, when a new 250,000-ton-per-year plant is to be completed at Hälsingborg. Plants for production of liquid sulfur dioxide were completed at Ronnskär (30,000 tons per year) and at Hälsingborg (55,000 tons per year) in 1970.

Other Nonmetals.—Norrlandsfonden, a government agency which promotes development of mineral resources in northern Sweden, was conducting economic studies and technical research on several deposits of nonmetals in Norrbotten County. These included a large body of rock containing 50 to 70 percent of anthophyllite asbestos, located about 80 kilometers north of Kiruna; a 20 million-to-50-million-ton body of graphitic schist (location not specified), containing about 30 percent of fine-grained graphite; 1 to 3 million tons of low-iron soapstone near the community of Tärendö; fluorspar, as disseminated deposits in sandstone grading 15 to 30 percent CaF_2 (location unknown); and several bodies of marble in the vinicity of Jokkmokk, Luleå, and Tärendö. The soapstone may be used as a source of ceramic- or paper-grade talc. Sweden's imports in 1970 included 300,000 tons of kaolin and other clays, 19,000 tons of asbestos, 16,000 tons of fluorspar, and 22,000 tons of talc.

MINERAL FUELS

Coal and Coke.—The small output of coal in Sweden continued to be produced by Höganäs AB, as a byproduct of clay mining.

Imports of coal rose to 1.66 million tons, about 6 percent more than in 1969, while imports of coke rose nearly 10 percent to 1.2 million tons. Coking and gas coal made up 67 percent of total coal imports (including breeze), followed by anthracite (7 percent) and steam and other coal (26 percent). Gränges AB produced 501,000 tons of coke at Oxelösund.

Electric Energy.—Preliminary figures indicated that production of electric power increased to 60.8 billion kilowatt-hours in 1970, of which 68 percent was produced by hydroelectric plants and 32 percent by thermoelectric plants. Nuclear power provided only 0.3 percent of the total thermal output in 1970, but this was expected to begin rising in 1971 with completion of the first commercial nuclear powerplant at Oskarshamn.

Petroleum.—Oljeprospektering AB con-

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[8] LKAB Tidningen. V. 14, No. 2, 1971, pp. 19–24.

tinued seismic surveys in the southern province of Skåne in 1970, and also conducted aeromagnetic surveys of the Swedish Continental Shelf along the west coast and eastward to Gotland in the Baltic Sea. The company was preparing to drill its first offshore hole, near Trelleborg, to a depth of 3,000 meters.

A bill concerning onshore exploration and exploitation of oil, gas, and salt was introduced into Parliament. The law is intended to be effective from 1973, and will supersede the Coal Field Act of 1886.[9]

Imports of crude petroleum rose to 11.8 million tons in 1970, an increase of nearly 12 percent from 1969 and 30 percent compared with 1968. Refinery throughput increased by 10 percent, but net imports of petroleum products also increased by 12 percent to 19.1 million tons as consumption continued to increase. Inland consumption of petroleum products in 1969 and 1970 is shown in the following tabulation, in thousand metric tons:

Product	Inland consumption	
	1969	1970
Gasoline	2,633	2,825
Kerosine	216	226
Gas/diesel oil	8,250	9,103
Residual fuel oil	11,959	13,764
Other	1,633	1,592
Total	24,691	27,510

Source: Organization for Economic Cooperation and Development (OECD), Paris. Provisional Oil Statistics by Quarters, Fourth quarter, 1970. 1971, 21 pp.

[9] Bulletin of the American Association of Petroleum Geologists. V. 55, No. 9, September, 1971.

The Mineral Industry of Taiwan

By K. P. Wang [1]

Lacking extensive resources, Taiwan's mineral industry in 1970 became increasingly engaged in processing such foreign raw materials as crude petroleum, steel scrap, bauxite, and phosphate rock to meet national needs. The cement industry continued to be the principal industrial sector using domestic raw materials. Together with the chemical fertilizer industry, these processing industries had a combined added value many times the value of the extractive sector, where coal, despite declining output, was still by far the most important commodity.

The second year of the fifth 4-year plan (1969-72) ended fairly successfully in 1970 with a gross national product (GNP) preliminarily estimated at $4,550 million [2] in 1964 prices and $5,440 at current prices. This represented a 10.2-percent increase over GNP in 1969 and well above the overall 7-percent annual growth rate projected for the plan. The mining sector accounted for 1.5 percent of the GNP and the mineral processing and related products sector, including the cost of raw materials, 17.5 percent. Breakdown by value of output for the specific sectors was as follows, in million U.S. dollars:

Economic sector	1969	1970
Overall mining	$80.3	$81.5
Coal	50.1	49.4
Metals	7.4	7.2
Oil and natural gas	16.9	17.0
Salt evaporation	2.7	4.2
Nonmetals and quarrying	3.2	3.7
Manufacturing of mineral and related products	833.0	955.0
Chemical products	333.0	361.0
Oil and coal products	192.0	231.0
Nonmetallic mineral products	148.0	149.0
Base metals	129.0	183.0
Metal products	31.0	31.0

A firm decision was made during the year to go ahead with an integrated 2-million-ton conventional steel plant that utilizes moslty imported raw materials. The projected cost would be approximately $415 million. However, efforts to interest a foreign company in a joint venture were not successful. Work progressed on the further integration of the nonferrous metal industries. In late 1969 the Asian Development Bank had granted a $2.7 million loan to the Taiwan Aluminum Corp. (TALCO) and a $1.1 million loan to the Taiwan Metal Mining Corp. for expanding rolling and fabrication facilities. In 1970 Taiwan Metal completed a furnace to make copper matte.

Preliminary work was started on a large petroleum refinery at Shenao near Keelung in the north to complement refineries in Kaohsiung down south. Plans were made to build Taiwan's second naphtha-cracking plant. The coal industry had another difficult year, and the Government initiated an ambitious program to revitalize it. Expansion and modernization of many cement facilities in Taiwan continued. Construction began on another large fertilizer plant —this one to produce urea and ammonium sulfate at Nankong near Taipei. Intention to construct a $15-million phosphate plant was announced. To aid farmers, fertilizer prices were significantly lowered.

On September 13, the Executive Yuan announced a 10-year energy plan aimed at raising generating capacity threefold to 6.1 million kilowatts [3] by 1980. This total comprised 2.8 million kilowatts for thermal power, 2.1 million for atomic power, and 1.2 million for hydropower. In October 1969 the Taiwan Power Co. (TPC), which produces the bulk of Taiwan's power, had awarded a joint contract to General Electric Co. and Westinghouse Electric Corp.

[1] Supervisory 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.

[3] Installed capacity. Peak capacity estimated at 6.6 million kilowatts.

to build a 604,000-kilowatt, light-water reactor plant at Chinshan in northern Taiwan by 1975. The $142.7 million project—$96.1 million in foreign currency and $46.6 million in local currency—will be financed in part by a $79.7 million loan from the U.S. Export-Import Bank. In 1970, a major share of Taiwan's power consumption, which totaled approximately 9 billion kilowatt-hours (kwh), was utilized by the minerals and related industries as follows: 474 million in mining, 1,312 million in chemicals, 659 million in fertilizers, 497 million in alkalis, 121 million in ceramics, 595 million in cement, 156 million in metal products, 894 million in iron and steel, and 537 million in aluminum.

A new statute for the Encouragement of Investment was approved to cover the decade ending 1980.[4] In late 1970 a selective policy on foreign investments was also announced, with priority approval given to foreign applications involving one of the following conditions: Finished products entirely for export which, in the process of manufacture, have used at least some domestic materials or semifinished products of Taiwan origin; a manufacturing process that involves advanced technology for products in demand both on the domestic and foreign markets; joint ventures (foreign and Chinese) for the exploration and development of natural and underground resources; basic industries that require large capital outlay and sophisticated production know-how; or ventures that will help improve domestic technical standards and stimulate industrial development.

Late in the year, serious consideration was given to the merger of research and service activities of the Mining Service and Research Organization (MRSO) in Taipei, the United Industrial Research Institute in Hsinchu, and the Metals Industries Research Institute in Kaohsiung into a new nonprofit science and technology institute, following the pattern of the one established in South Korea. The Battelle Memorial Institute and Arthur D. Little, Inc., were contracted to evaluate the project.

PRODUCTION

Gross production from mining and extraction showed little change. However, coal output declined further because of safety problems, low prices, and competition from fuel oil. Natural gas output remained steady. A significant increase was registered in 1969 when the pipeline to Taipei was completed. Salt output, though not too important in terms of value, increased more than 40 percent in tonnage to meet the growing need for sodium compounds in the paper, textile, aluminum, and petrochemical industries. Production of construction raw materials increased slightly, in line with the rise in cement output.

Manufacture of mineral and related products showed a sharp upturn. In iron and steel products, important increases were noted in both tonnages and diversity of products. The 22-percent increase in aluminum was due to completion of new reduction potlines. Oil refining activities were accelerated, notably in making fuel oil; overall output rose more than 10 percent. Better transport and distribution through the use of new large tankers helped to improve the petroleum situation. Fertilizer output showed an overall slight decline in tonnage, because of the difficulty in marketing under high price conditions. Various new facilities were being built, however, and fertilizer output should rise again in the near future.

[4] U.S. Embassy, Taipei, Taiwan. State Department Airgram A-55 (Economic Trends in the Republic of China), Mar. 9, 1971, pp. 11-12.

Table 1.—Taiwan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
METALS			
Aluminum:			
Alumina, gross weight	37,374	44,217	41,817
Metal, primary	20,020	22,108	26,991
Copper:			
Mine output, metal content [e]	2,300	2,300	2,500
Metal refined, secondary	2,542	[r] 3,244	3,752
Gold metal, primary ... troy ounces	20,994	21,486	22,550
Iron and steel:			
Iron ore and concentrate	[e] 5,847	7,847	5,870
Pig iron ... thousand tons	76	78	56
Ferroalloys (ferrosilicon)	2,189	1,718	5,039
Steel ingots and casting ... thousand tons	242	271	294
Silver metal, primary ... thousand troy ounces	90	81	95
NONMETALS			
Asbestos	1,200	3,081	2,842
Cement ... thousand tons	3,993	4,088	4,305
Clays:			
Ceramic and pottery ... do	NA	7	NA
Paper filler ... do	NA	5	NA
Used in cement ... do	NA	755	NA
Brick and tile ... do	NA	1,104	NA
Fertilizer materials, manufactured:			
Urea (46 percent N) ... do	204	257	180
Ammonia anhydrous ... do	172	147	156
Ammonium sulfate (21 percent N) ... do	382	418	398
Nitrochalk (20 percent N) ... do	75	54	46
Compound fertilizer (20 percent N, 5 percent P_2O_5, 10 percent K_2O) ... do	65	121	118
Calcium superphosphate (18 percent P_2O_5) ... do	204	197	190
Gypsum	5,636	5,123	11,325
Lime ... thousand tons	119	110	128
Marble ... do	1,421	1,292	1,286
Pyrite and pyrrhotite (including cupreous): [1]			
Gross weight ... do	39	38	40
Sulfur content [e] ... do	14	14	15
Quartz, quartzite, and glass sand ... do	NA	129	NA
Salt, marine ... do	311	383	535
Stone:			
Dolomite ... do	79	59	63
Limestone ... do	6,612	7,406	NA
Sulfur, elemental, native other than Frasch [2]	4,432	4,830	6,060
Talc and related materials, soapstone	29,054	24,373	38,717
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous ... thousand tons	5,014	4,645	4,473
Coke ... do	256	253	279
Natural gas [3] ... million cubic feet	24,877	31,553	32,400
Petroleum:			
Crude ... thousand 42-gallon barrels	421	581	638
Refinery products:			
Gasoline, aviation and motor ... do	[r] 3,035	3,811	4,519
Kerosine ... do	171	125	158
Jet fuel ... do	2,912	[r] 3,735	NA
Diesel oil ... do	[r] 3,338	[r] 5,376	7,243
Fuel oil ... do	[r] 11,222	[r] 14,874	16,812
Liquefied petroleum gas ... do	[r] 666	[r] 993	1,370
Asphalt ... do	[r] 719	[r] 746	945
Lubricant oils ... do	161	196	321
Other, including unspecified [4] ... do	776	901	1,025

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] From Chinkuashih only.
[2] Additional sulfur produced from oil refineries.
[3] Includes unknown amount processed into natural gas liquids by field plants.
[4] Includes only solvents and base oils, according to Chinese definitions.

Source: Industry of Free China (Taipei, Taiwan). February 1971, pp. 82–99.

TRADE

Taiwan's total foreign trade rose by 32.5 percent in 1970, with exports totaling $1.55 billion and imports, $1.52 billion. Exports and imports made 40-percent and 26-percent gains, respectively. In 1970 mineral and metal products represented approximately 8 percent of all exports and 17 percent of all imports. This reflects Taiwan's economic position as importer of raw materials and exporter of finished products.

Table 2 shows the breakdown of mineral items traded, in terms of value.

Iron and steel products has been the foremost item of mineral imports, primarily ungalvanized sheet and plate, and secondarily, galvanized sheet, tin plate, wire and rod, and pipes and fittings, Petroleum imports comprised mainly of crude oil and, to a far lesser extent, fuel oil and lubricating oil ranked second. Nonferrous metals has been sizable as an overall category. Imports of these metals are somewhat evenly split among copper, lead, zinc, and aluminum. Steel scrap, sulfur, and fertilizers have been in the $5 to $10 million range each year. Annual phosphate imports amounted to $3 to $3.4 million and bauxite, $1 to $1.5 million.

During 1970 and 1969, sharp increases were noteed in the export of steel products, nonferrous metal products, and cement, whereas petroleum and glass products remained somewhat steady. Although Taiwan does not report realistic values for exports of primary copper materials, Japan, virtually the exclusive recipient country, reported imports of $3.5 to $4.7 million

Table 2.—Taiwan: Value of principal mineral exports and imports

(Million dollars)

Commodity	1968	1969	1970 p
EXPORTS			
Iron and steel products	$13.0	$24.2	$57.1
Nonferrous metals	6.3	8.8	12.2
Copper, primary materials [1]	4.2	3.5	4.7
Cement	16.3	10.7	15.2
Glass products	8.7	9.0	10.3
Refined petroleum products e	6.0	8.0	10.0
IMPORTS			
Iron and steel products	71.6	100.6	117.5
Scrap metals	9.0	10.2	e 9.5
Nonferrous metals	20.1	22.0	33.9
Natural phosphates	3.0	3.4	3.0
Sulfur	8.6	8.6	e 8.0
Other minerals including bauxite	10.0	9.2	12.9
Manufactured fertilizers, mainly potassic	9.3	7.8	5.5
Crude oil	45.0	45.0	47.0
Fuel oil	9.0	9.0	e 9.0
Lubricant oils	3.0	3.9	e 3.8

e Estimate. For 1970, estimates were mainly made on the basis of 10-month figures. p Preliminary.
[1] Japan's imports of copper ore and concentrate, cement copper, and copper matte.

Source: Industry of Free China (Taipei, Taiwan). February 1971, 185 pp.

Table 3.—Taiwan: Exports of principal mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	6,052	7,875
Copper:		
Ore and concentrate	16,452	11,033
Metal including alloys, all forms	1,541	1,762
Iron and steel semimanufactures:		
Bars, rods, angles, shapes, sections thousand tons	47	80
Universal plates and sheets do	18	40
Others do	30	48
NONMETALS		
Cement thousand tons	882	553
Fertilizer materials manufactured:		
Nitrogenous	49,377	90,008
Potassic	6,800	1,996
Others including alloys, all forms	200	9,509
Soda caustic	3,509	3,325
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline (including natural) thousand 42-gallon barrels	15	264
Distillate fuel oil do	119	984
Lubricants do	320	294
Other do	255	304

Source: Chinese Maritime Customs, Statistical Department, Inspectorate General of Customs (Taipei, Taiwan). The Trade of China 1968 (pub. 1969), 916 pp.; 1969 (pub. 1970), 960 pp .

Table 4.—Taiwan: Imports of principal mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate thousand tons	55	106
Metal including alloys:		
Scrap	4,299	1,577
Unwrought and semimanufactures	6,580	3,668
Copper metal including alloys, all forms	r 5,662	5,575
Iron and steel:		
Ore and concentrate thousand tons	49	58
Metal:		
Scrap do	223	242
Pig iron, ferroalloys, and other similar materials do	28	40
Steel primary forms:		
Ingots and other primary forms do	21	39
Semimanufactures do	425	506
Lead metal including alloys, all forms	4,139	2,943
Manganese oxide	1,632	1,565
Mercury 76-pound flasks	1,408	1,104
Nickel metal including alloys, all forms	385	215
Tin metal including alloys, all forms long tons	303	459
Titanium oxide	4,136	4,641
Zinc metal including alloys, all forms	10,797	10,685
NONMETALS		
Abrasives (natural), pumice, emery, corundum, etc	1,989	2,271
Asbestos	r 3,352	5,949
Fertilizer materials:		
Crude, phosphatic e thousand tons	150	145
Manufactured, potassic do	111	135
Graphite, natural	4,651	4,432
Gypsum thousand tons	85	94
Mica, crude including splittings and waste	50	39
Sulfur, elemental, all forms thousand tons	66	186
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke including briquets thousand tons	r 21	201
Carbon black and gas carbon do	4	5
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	r 20,852	22,301
Refinery products:		
Distillate fuel oil do	r 4,479	5,607
Lubricants do	r 216	250
Mineral jelly and wax do	28	33
Other do	90	120
Mineral tar and other coal, petroleum, or gas derived crude chemicals	3,645	4,360

e Estimate. r Revised.
[1] Including U.S. Agency for International Development (A.I.D.) imports.

Source: Chinese Maritime Customs, Statistical Department, Inspectorate General of Customs (Taipei, Taiwan). The Trade of China 1968 (pub. 1969), 916 pp.; 1969 (pub. 1970), 960 pp.

annually during 1968–70. This figure obviously includes precious metals. Taiwan's copper trade has been largely limited to shipment of primary copper materials to Japan for custom smelting; the copper and byproducts are then returned to Taiwan.

COMMODITY REVIEW

METALS

Aluminum.—During 1970 the Government-owned TALCO, sole producer of primary aluminum in the country, made significant headway towards expanding facilities to 76,000 metric tons of alumina annually (from 42,000 tons) and 38,000 tons of aluminum annually (from 20,000 tons). Construction was slightly behind schedule, but with the completion of the last 16 of 66 pots by March 1971, this phase of growth will have been brought to a successful conclusion. The next phase of expansion is aimed at 70,000 tons of aluminum by 1976, and the ultimate objective in the late 1970's is about 100,000 tons. The French company Péchiney has been assisting TALCO since 1963 in construction of the alumina and reduction facilities. One project in progress is a 90,000-kilowatt diesel generating plant being installed by TALCO itself. The plant is scheduled for completion by 1973.

TALCO also produced most of Taiwan's mill and extruded aluminum products, as well as considerable quantities of structural end products. Its combined 1970 output of plates, sheets, and strips alone totaled 14,672 tons, slightly more than half of the ingot output. The only other significant companies in the products field were the China Wire & Cable Company and the Walsin Electric Wire & Cable Co. Both companies have Properzi mills and extrusion presses. In 1970 TALCO had a hot-rolling capacity of 50,000 tons per year, a cold-rolling capacity of 23,000 tons, a foil capacity of 2,500 tons, an extrusion capacity of 3,000 tons, plus fabricating facilities for producing structural aluminum products and castings. Expansion underway will nearly double these capacities. New projects include an aluminum can plant, an alloy wire shop, a shipping container and truck body shop, an aluminum refrigerator-evaporator shop, a super-purity aluminum plant, and modernization and expansion of existing rolling and extrusion facilities. Financial and technical assistance for building these projects will come from French, German, Japanese, U.S. and other international sources (Asian Development Bank).

Consumption of aluminum products in Taiwan has risen 10 to 20 percent since 1965, with the greatest growth in recent years. Ingot exports have declined sharply, whereas imports averaged more than 5,000 tons in 1968–70. A few thousand tons of scrap have also been imported annually. Supplementary raw materials have been needed to make products for export. In 1969 Taiwan exported over 6,000 tons of aluminum semimanufactures, including 4,000 tons of sheet and plate and 1,500 tons of wire. Exports of semimanufactures were even higher in 1970. Sheets and plates alone exceeded 5,000 tons. Overall rising domestic demand for Taiwan's aluminum products has justified construction of the additional smelting and fabrication facilities.

Malaysian bauxite from two adjoining mines in Johore was the principal raw material for TALCO's 1970 operations; Brunei was the next important source. All told, Taiwan imported 105,900 tons of bauxite in 1969, and an even larger tonnage the following year. During 1970 TALCO consumed 537 million kwh of electricity, or just under 20,000 kwh per metric ton of ingot, and approximately 12,000 tons of caustic soda.

Copper.—The Chinkuashih mines of the Government-owned Taiwan Metal Mining Corp. continued to account for over 90 percent of the mine copper produced. All Chinkuashih output, which included copper concentrate (15- to 20-percent-grade) and cement copper (25- to 30-percent-grade), was shipped to Japan for smelting. In fact, Japan imported 17,432 metric tons of copper concentrate and 3,483 tons of cement copper from Taiwan in 1970. The precious metals and the copper were returned. Chinkuashih ores, though not high in gold and silver, provide more than 30,000 tons of pyrite annually. A new plant for making copper matte was built in 1970 to produce a 44-percent-grade product, which in the beginning will be shipped to Japan for further smelting.

Taiwan Metal's existing refinery also accounted for most of Taiwan's electrolytic copper produced (reportedly 3,752 tons in 1970), all of which was derived from copper and brass scrap. Although various small wire plants processing both domestic and imported raw materials were in existence, none belonged to Taiwan Metal. In an effort to become integrated like TALCO, Taiwan Metal has made arrangements to errect a modest fabrication plant to produce annually 200 tons of copper strip, 400 tons of brass strip, and 1,200 tons of copper wire. Foreign financial and technical assistance have already been obtained, including a loan from the Asian Development Bank.

Copper exploration continued in the Chimei area near Hualien in eastern Taiwan, with indefinite results. Geophysical and geochemical investigation had suggested the presence of sizable tonnages of porphyry copper. Followup drilling by MRSO, with expenditure of part of the $1.5 million committed by Taiwan Metal Mining Corp., China Petroleum Corp., and TPC, was unable to prove up reserves as desired. The Government had hoped to find out more about Chimei and other nearby prospects before making arrangements with one of the interested foreign companies. In early 1971, the Canadian firm Noranda Mines, Ltd., was finally contracted to explore the Chimei area, with the option of the "first refusal" for exploitation. The Australian manager of Noranda had made a 10-point report[5] suggesting more de-

[5] Lien-ho-pao (Taipei). Nov. 11, 1969, p. 8.

tailed aerial and ground surveys, a need for better core recoveries, attention to by-product minerals and genesis of ore bodies, and possible existence of at least 10 million tons of ore analyzing 0.3 to 0.9 percent copper.

Iron and Steel.—Taiwan's plan for building an integrated steel mill at a cost of $415 million did not get started as had been hoped. Funds for local expenses had already been budgeted into the 1971 appropriations. A team from the United States Steel Corp.[6] went to Taiwan to discuss possible participation in this project, without any apparent results. Other American companies and any other suitable foreign firm would be welcome to take part in the project. The Japanese and the West Germans have shown interest in this type of steel project, which involves the large, conventional blast furnace. However, there was a mild recession in Japanese steel circles early in 1971. The Australians were interested in a much smaller type of steel project that would involve electric smelting of metalized agglomerates, which they intend to produce. Thus, at yearend there was considerable uncertainty.

The proposed conventional integrated steel plant, preferably to be run by private enterprise, according to Chinese officials, was planned to be established in three stages.[7] The first stage, which would cost $69 million, would involve the construction of rolling and fabrication facilities. The second stage, which would cost $232 million, would deal with the building of coking, smelting, and supporting facilities for producing 1 million metric tons of ingot steel annually. About $121 million would be spent in the third stage, with a view to doubling plant capacity to 2 million tons. This plant is to be located in Kaohsiung. The long-term thinking would be to expand this integrated plant to possibly 5 to 6 million tons eventually, with a timetable geared to the growth in demand. Virtually all iron ore and part of the coking coal would have to be imported.

About 200 private, small, iron and steel manufacturers, with a combined $30 million investment and annual output of 1.2 million tons of products, were in existence at yearend 1970. Domestic and foreign scrap and imported semimanufactures represented the principal iron raw materials, there being not even a single medium-sized blast furnace working within Taiwan. The rapid rise in demand for steel products has so far justified the building of these small manufacturing plants.

NONMETALS

Cement.—The Taiwan cement industry had another good year. Production was up 5 percent to 4.3 million tons. Exports during the first 10 months of 1970 were 609,000 tons, more than all of 1969 but less than the 1968 level. Since South Vietnam was the principal foreign market, there was concern over the long-term prospects for exports. However, domestic demand continued its upward trend.

Expansion and modernization of cement facilities continued. Taiwan Cement Corp. (TCC), converted to private management since 1954, increased its capacity to about 2.3 million tons per year, or roughly 40 percent of the national total. During 1969–70, TCC accomplished the following: Replaced three of the five kilns at its principal plant (Kaohsiung) with a new 1,500-metric-ton-per-day (mtpd) suspension preheater kiln; built another kiln of this type (1,100 mtpd) at its Suao plant and thereby doubled production capacity; and expanded its Chutung plant. The Chien Tai Cement Co. had, in recent years, installed a 1,400-mtpd Japanese kiln at its plant in Kaohsiung. Asia Cement Corp. added a fourth kiln at its only plant in Hsinchu during 1970 and thereby doubled production capacity to about 1.7 million tons per year. Universal Cement Corp. has two kilns at its Kaohsiung plant with a combined capacity of 1,550 mtpd, and Chia Hsin Cement Corp. has a 500,000-ton-per-year plant at Kangshan. Finally, the Tung Nan Cement Co. installed a 600-mtpd Chinese-manufactured kiln at its plant in Kaohsiung. This plant is twice as large as Tung Nan's two other kilns put together.

Fertilizers.—In early 1970 Taiwan had a total annual fertilizer capacity of about 1.2 million metric tons divided among six companies and 13 plants. The Government's Taiwan Fertilizer Co. (TFC) owned eight of the plants and accounted for 62 percent of production capability. Annual output capacity, by kind of fertilizer (with TFC's portion in parentheses) is as follows:

[6] American Metal Market (New York). Dec. 4, 1970, p. 2.

[7] Modern Asia (Hong Kong). November-December, 1970, p. 33.

	Thousand metric tons	
Ammonium sulfate	480	(240)
Urea	290	(170)
Calcium superphosphate	210	(180)
Nitrochalk	70	(70)
Ammonium phosphate	25	(25)
Mixed fertilizers	110	(50)

A second phosphoric acid plant was commissioned by TPC at Kaohsiung in the spring of 1970 which, at 30,000-ton-per-year capacity, brings Taiwan's total capacity to 40,000 tons. A 600-ton-per-day ammonia plant was being built at Nankong jointly by the TFC, the Kaohsiung Ammonium Sulphate Corp. (KASC), and the China Petroleum Corp. At yearend, the Allied Chemical Corp, and the Mobile Oil Corp. were trying to sell their 35-percent interests in an ammonia-urea complex for a total of $12 million. The complex was built to use local oil and gas. China Petroleum owns the remaining 30 percent; TFC may decide to buy the rest.

Taiwan has adequate local pyrite and a little sulfur, but must depend on imports for the bulk of the phosphates and potassic minerals. The United States, which has been the principal source of phosphate rock, shipped 70,031 and 118,945 metric tons of phosphate rock during 1969 and 1970, respectively, at about $20.50 c.i.f. Taiwan. Imports of chemical fertilizers vary greatly from year to year, but the total tonnage of imports are much smaller than domestic production. Exports, predominantly to South Vietnam, have been in the range of 50,000 to 100,000 tons annually.

Marble.—In 1962, the Retired Servicemen's Engineering Agency (RSEA) built a marble plant near the coastal city of Hualien. The plant was based upon extensive reserves of many varieties of high-quality marble in eastern Taiwan. By 1970, RSEA's facilities had expanded to seven marble quarries, a limestone quarry, a sawmill, a marble chip factory, a slab shop, and a marble craft shop.[8] With just over 500 workers, RSEA produced half of Taiwan's marble in 1970, and grossed more than $1 million and exported $500,000 worth. RSEA anticipates sales and exports to increase several fold. An agreement was signed with Cathage Marble Co. to handle sales in the United States. According to marble experts, prospects for greatly expanding sales of Taiwan marble in Australia were excellent.

Salt and Soda.—Taiwan's salt and soda industries have undergone great change in recent years. A program of expanding marine salt production has been underway. Output registered a 40-percent increase in 1970, to more than 535,000 metric tons. A salt surplus situation lasted until about 1966, followed by a balanced supply in 1967–69, and a shortage beginning in 1970. The bulk of the salt is consumed by the soda industry, which has shown considerable growth.

Taiwan's caustic soda is produced entirely by electrolysis processes, simultaneously with chlorine. About 20 alkali-chlorine plants were in existence in 1970.[9] Their combined annual capacities were approximately 150,000 metric tons of caustic soda (and 50,000 tons of soda ash) and 130,000 tons of chlorine. The Taiwan Alkali Corp. (TAC), a provincial government enterprise with three plants, was expanding its Kaohsiung plant to 135 tons per day of caustic soda and 120 tons of chlorine. Formosa Plastics Corp. has a caustic soda plant with an output capacity of 110 tons per day. The paper, textile, aluminum, and soap industries have been the main consumers of soda in the past. Soon the expanding petrochemical industry will need increasing quantities of alkali-chlorine products.

MINERAL FUELS

Coal.—Coal production continued its downward trend; the 1970 output fulfilled only 90 percent of the 5-million-ton target. A high accident rate, inadequate safety standards, low prices, and declining demand all contributed to the industry's problems.[10] The fatality rate was about 30 miners killed per million tons of coal produced. Mine owners were reluctant to invest in expensive safety measures, because of generally poor business conditions. Reportedly, 42 out of roughly 300 mines (all small) were ordered closed in 1970. Only three were still in government hands, under the Taiwan Metal Mining Corp. The Coal Adjustment Commission formed over a decade ago to assist the coal industry was dissolved, and the work was turned

[8] Modern Asia, Hong Kong. March 1971, pp. 12–14.

[9] Industry of Free China (Taipei). Alkali-chlorine Industry in Taiwan. April 1970, pp. 32–38.

[10] U.S. Embassy, Taipei, Taiwan. State Department Airgram A–59 (Coal and Coke Production), Mar. 16, 1971, pp. 1–3.

over to the Provincial Construction Bureau. Coal production difficulties during 1969–70 necessitated emergency imports of Australian coal to meet the needs of coal-burning powerplants.

Significant steps were taken in late 1970 to revitalize the industry. The mine inspection system was strengthened, and $750,000 worth of loans provided for future measures to improve safety. The Ministry of Economic Affairs announced a 4-year program to overhaul mining operations at a cost of $7.25 million. Mine owners are to raise $2.5 million; $1.5 million will be government grants; and an additional $3.25 million will be government loans. The aim is to mechanize 25 of the larger mines to raise their combined output from 1.9 million to 3.4 million metric tons annually. Effective January 1, 1971, the coal price to government enterprises was to have been raised 5.5 percent.

The long-term outlook for coal still remained uncertain. Natural gas was fast replacing coal as a household fuel, and many factories shifted to petroleum and gas. An even more serious factor was the increasing difficulty in mining the thin and steeply dipping coal, reserves of which are relatively small. Prospects were that yearly output may level off to between 3 and 3.5 million tons. The coal in place is good-quality bituminous, suitable particularly for special purposes. As an energy raw material, however, the competition from other fuels is great. A suggestion was made for the Government to collect a tax on petroleum imports in order to subsidize coal. The rise in petroleum prices also gives some additional hope to coal producers.

Natural Gas.—Development of natural gas continued in 1970, with the efficient utilization of limited resources. Exploration near the present fields, which are centered around Miaoli, extended to offshore areas close to land, and results have been encouraging. A natural gas processing plant, capable of treating 100 million cubic feet daily and recovering up to 300,000 barrels of gasoline annually plus liquefied petroleum gas, was completed at the Tiehchenshan field. Previously, a similar but much smaller unit was installed at the nearby Chinshu field. Two nearby nitrogenous fertilizer plants had been the principal consumers of Taiwan's natural gas in the northwest. In 1970 the Chank Chun Petrochemical Co. Ltd. completed a 150-ton-per-day methanol plant in the Toufen industrial park. This company has become another consumer. Plans have been made to greatly expand the northern petrochemical complex, primarily through the China Petrochemicals Development Corp. (CPDC). A pipeline system involving about 220 miles of 16-inch lines by 1972 was being implemented to further the use of natural gas. The Tiehchenshan and Hsinchu fields had already been connected to Taipei; the plan is to build a similar line to Kaohsiung in the south.

Petroleum.—Although output of indigenous crude oil increased by nearly 10 percent, production was merely a fraction (just over 2 percent) of crude and refined petroleum demand, which amounted to perhaps 30-million barrels, worth roughly $60 million. Continued efforts were made by the Government to lower the cost of purchasing crude, which came mainly from the Middle East, primarily from Iraq. The program to acquire big tankers was a step in this direction. However, at yearend the Organization of Petroleum Exporting Countries (OPEC) was discussing the matter of raising prices, which, no doubt, will have a bearing on Taiwan's future energy policy. Oil consumption has been increasing at a rate of nearly 10 percent annually, and future projections indicate a 15-percent annual rise.

The Government-owned China Petroleum Corp. has been the principal entity in virtually all of Taiwan's petroleum and natural gas activities. In 1969 it grossed about $180 million and made a profit of approximately $60 million. Construction of China Petroleum Corp.'s No. 6 crude distillation plant (refinery), rated at 100,000 barrels per day and scheduled for completion at yearend 1971, was well underway at Kaohsiung, where most of its refining facilities are located. Four 100,000-deadweight-ton (d.w.t.) tankers had been ordered; the last two were scheduled for delivery by yearend 1970. Offshore unloading facilities for these tankers were completed. At Shenao near Keelung in the north, a new 110,000-barrel-per-day refinery is planned, along with offshore discharging facilities to handle 150,000-d.w.t. tankers. Construction of a 15,000-barrel-per-day catalytic cracking plant with desulfurizing units, scheduled for completion in late 1971, was underway at Kaohsiung. China Petroleum currently operates more than 160 gas stations, and was building more.

In addition to oil and gas, China Petroleum Corp. has also been in the fertilizer and petrochemical businesses. CPDC is the wholly owned subsidiary directly involved in petrochemicals. In addition to the petrochemical complex in the north, CPDC was developing a southern complex in the Kaohsiung area. In late 1970 CPDC ordered a 26,400-ton-per-year dimethyl terephthalic acid plant (DMT) from Mitsui Shipbuilding of Japan. The plant will be built with a $10.2 million loan from Asian Development Bank and is scheduled for completion in June 1972.[11]

On offshore matters, Senkaku Islands (or Tiao-yu-t'ai as the Chinese call these islands) made news as a controversial area with regard to jurisdiction. The area, located about 100 miles north of Taiwan, shows good promise in petroleum potential, based on the results of two separate general surveys. Taiwan and Japan had previously made claims on Senkaku Islands. On December 3, the Chinese Communists also put in a bid for these islands as an extension of the Continental Shelf from mainland China.[12] Meanwhile, the Chinese Government on Taiwan had already given out a few concessions to international oil companies who were willing to take a general look despite recognizing the implications. In early 1971 U.S. companies were cautioned against further involvement.

[11] Look Japan (Tokyo). Dec. 10, 1970, p. 9.
[12] Washington Post (Washington, D.C.). Dec. 5, 1970, p. 1.

The Mineral Industry of Thailand

By K. P. Wang [1]

Thailand's mineral industry recorded a moderate growth in output value in 1970, chiefly as a result of a sharp increase in antimony production under very high price conditions and a significant gain in fluorspar production. Actually tin, Thailand's premium mineral, barely held its own, whereas iron ore output virtually ceased. The higher value of mineral output was an element in the overall continued upturn in the national economy reflected in the figures for the gross national product (GNP) which amounted to $6.78 billion [2] (current prices) for 1970, compared with $6.29 billion for 1969.

Thailand's third 5-year development plan, scheduled to start in October 1971, was in the stage of allocating resources of money, manpower, and equipment among the various economic sectors. The plan was submitted to a World Bank gathering in Paris during September for an informal review. Twelve Bank members representing the important free world industrialized countries gave their collective advice to Thai delegates.[3] It was felt that export promotion was of crucial importance, Thailand's economic progress though remarkably rapid in the 1960's had begun to decline in 1970, and special efforts should be made to promote investments of foreign private capital and to facilitate granting of aliens' work permits and residence permits. The new plan would require $1,000 million in foreign exchange, four-fifths of which must come from external sources. The need for international aid will increase in the future because more of the country's own resources will have to be diverted to defense.

Though not yet determined, funding would greatly exceed the approximately $2.8 billion allocated to the second plan. Emphasis will not be on building new infrastructure projects but rather bringing into full use the ones already created. Major improvements will be made in the distribution of electricity and water from existing dams. The highway network will benefit from better maintenance. Large amounts of capital and technology will be devoted to agriculture so as to raise living standards and increase exports. Minerals and industry in general will be given appropriate emphasis within the overall framework of priorities.

Attitudes towards the mineral industry were undergoing change, as Thailand moves from essentially tin-mining to large-scale mining of other minerals. The Board of Investment (BOI) became increasingly concerned with the problems of the mineral industries and the role of foreign investment. The Mining Act of 1967 was still the law. Areas south of the eleventh parallel have been open to foreign concessionaires for years, whereas areas north of this demarcation have been "closed" with the stipulation that 51 percent of the stock in firms operating in the area must be held by Thai nationals. Since most potential mineral deposits are in the north and Thais do not have much capital and know-how to develop them, progress in exploiting resources has remained slow.

A source [4] noted that it costs only about $100,000 to open a tin mine as compared with perhaps $25 million for a base metal mine; fluorspar mines are really working from outcrops; foreigners are restricted from operating in the north where Thais do not yet have the capability; too many concessions so far awarded are sitting idle for lack of serious intentions; "miners" are often not able to get concessions; tax laws

[1] Supervisory physical scientist, Division of Nonmetallic Minerals.
[2] Where necessary values have been converted from Thailand bahts (B) to U.S. dollars at the rate of B$20.8=US$1.00.
[3] The Investor (Bangkok). V. 2, No. 12, December 1970, pp. 1241–1243.
[4] The Investor (Bangkok). V. 3, No. 3, March 1971, pp. 204–207.

are too complicated and favor quick-exploitation and high-yield industries; a special tax system might be devised for the mining industry in place of the Revenue Code; to attract foreign investment, a mining tax write-off policy could be adopted and repatriation of capital and profits should be facilitated; laws should be revised to fit the long-term needs of large-scale mining rather than short-term needs of small-scale tin operations; and private enterprise and government objectives should be resolved. There was more pressure to revise the Mining Act, now that new petroleum legislation has been enacted (see below under Petroleum). A committee for the Development of the Mining Industry chaired by the Minister of National Development was set up by the Cabinet early in 1971. In the private sector, the Mining Council was established to promote closer cooperation with the Government.

The world famous Billiton Company of the Netherlands made news. In September it bought out half the shares of the Thailand Smelting & Refining Co. Ltd. (Thaisarco) and its subsidiary, the Thailand Exploration and Mining Co. (TEMCO) in order to become "equal" partners with the U.S. firm Union Carbide Corp. in controlling tin smelting and offshore exploration for tin in Thailand. Fluorspar producers enjoyed substantial price increases, which began late in the year when the Soviets started to buy fluorspar in competition with the Japanese. A U.S. joint venture pioneered barite production that reflected the intensification of offshore oil drilling in Southeast Asia. The BOI started to promote an integrated iron and steel project to meet Thailand's growing construction needs. Development of potential copper and lead deposits was at a standstill because of the unfavorable environment for foreign investment in the north. The Japanese made an offer to finance a preliminary reconnaissance survey to determine the feasibility and possible route for an oil pipeline across the Kra Isthmus in Southern Thailand.[5]

A comprehensive energy study made in 1970[6] predicts that the electric power demand for Thailand which stood at 5 million megawatt-hours at the close of 1970 would reach 11 million in 1974 and 21.5 million in 1978. The investment in the facilities required to meet forecast demand for power was estimated at $60 million per year during 1970–76. The Thailand Electricity Generating Authority (EGAT), which controls the country's power production and distribution, would provide most of the funds, with the remainder coming from the World Bank and foreign countries.

Thailand's electric power capacity at yearend 1970 was about 880,000 kilowatts, including 420,000 kilowatts at the Bhumibol hydroplant and 238,000 kilowatts at the North Bangkok thermal plant. Average power costs have been about $3.40 per 100 kilowatt-hours. Work has begun on half a dozen significant projects, including 710,000 kilowatts (three stages) at the South Bangkok thermal-plant, 720,000 kilowatts at the Quae Yai hydroplant in Ban Chao Nen, Kanchanaburi, and 500,000 kilowatts (two stages) at the Sirikit hydroplant in Amphoe Tha Pla, Changwat Uttaradit. EGAT had trouble with low reservoir level difficulties at hydroplants and has had to build gas turbine standby generating units in a few cases. Thailand's first atomic powerplant, costing an estimated $125 million, was planned for completion by 1977–78 in Ban Aow Phai, Amphoe Si Racha. A contractor for the nuclear plant will be selected by yearend 1971 from four applicants—General Electric Co., Westinghouse Electric Corp., Marubeni Iida Co. (representing the Japanese firm Hitachi Ltd.), and a German-British partnership.

PRODUCTION

Thailand maintained its position as the free world's third largest tin producer, with output about the same as in 1969 and value down more than 5 percent. Excluding cement, salt, and value added from processing oil and steel, Thailand's mineral output value in 1970 has been estimated by the Thai Department of Mineral Resources at 1.88 billion bahts or just over $90 million.[7] Tin accounted for two-thirds of this or approximately $60 million.

[5] The Investor (Bangkok). V. 3, No. 1, January 1971, pp. 19–21.

[6] The Investor (Bangkok). V. 2, No. 12, December 1970, pp. 1233–1238.

[7] U.S. Embassy, Bangkok, Thailand. State Department Airgram A–138 (Industrial Outlook Report: Minerals), Apr. 1, 1971, pp. 1–5.

Fluorspar with 11 percent, tungsten concentrate with 9 percent, and antimony (mainly as ore) with 7 percent, were next in importance.

Comparing Thailand's leading mineral products in terms of tonnages for 1969 and 1970, tin showed little change, cement rose by 3 percent, fluorspar increased 7 percent, tungsten gained by 9 percent, and antimony (mine output) rose sharply—by approximately 220 percent. High prices for antimony and, to a lesser degree, for tungsten and fluorspar, greatly stimulated exploration and extraction. Output of petroleum products also surged ahead. Barite production was started during the year to meet the oil-drilling needs in Southeast Asia. On the negative side, iron ore production dropped to insignificant quantities and output of marl also declined radically. Manganese continued to lose ground, because of reduced Japanese purchases.

Table 1.—Thailand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Antimony:			
Ore	423	1,560	5,545
Mine output, metal content e	202	750	2,400
Metal	380	246	155
Columbite	40	26	56
Iron and steel:			
Iron ore, 55 percent iron ..... thousand tons	500	477	23
Pig iron ..... do	17	11	12
Lead, mine	2,720	1,798	1,289
Manganese:			
Battery grade, 75 percent manganese dioxide	5,855	4,226	6,474
Metallurgical grade, 46 to 50 percent manganese dioxide	35,213	25,595	17,391
Rare-earth minerals, monazite	40	65	108
Tin:			
Tin-in-concentrate ..... long tons	23,678	20,786	21,435
Metal ..... do	24,662	22,049	21,690
Tungsten concentrate, 65 percent tungsten trioxide	965	1,267	1,378
Zircon	3,220	250	865
NONMETALS			
Barite	--	--	16,490
Cement ..... thousand tons	2,365	2,403	2,473
Fluorspar, 80 to 85 percent calcium fluoride	245,107	297,560	318,227
Gypsum	128,094	92,034	144,250
Marl (used for cement) ..... thousand tons	1,624	1,534	623
Salt (sea), 85 to 90 percent sodium chloride e ..... do	150	200	200
Talc and related materials, pyrophyllite	3,363	1,982	--
MINERAL FUELS AND RELATED MATERIALS			
Coal, lignite e ..... thousand tons	305	348	400
Petroleum:			
Crude ..... thousand 42-gallon barrels	26	16	70
Refinery products:			
Gasoline ..... do	3,022	3,523	4,342
Kerosine ..... do	992	1,002	1,071
Jet fuel ..... do	1,197	1,591	2,092
Distillate fuel oil ..... do	5,405	6,471	7,196
Residual fuel oil ..... do	5,127	6,375	8,083
Lubricating oil ..... do	63	1	1
Other ..... do	1,534	2,690	1,410
Refinery fuel and losses ..... do	3,032	4,111	5,224

e Estimate. p Preliminary.

TRADE

Tin exports, valued at $77.7 million in 1970, were down by 2.4 percent, as compared with 1969. In terms of tonnage, 68.2 percent of the tin went to the United States, 27.7 percent went to the Netherlands, and the rest to Japan. Fluorspar exports, mainly to Japan, ranked a distant second to tin in 1970, with tonnage nearly a third higher than in 1969 and value, more than a half. Tungsten and antimony, exported primarily to Japan and Western Europe, were Thailand's only two other indigenously produced minerals topping $5 million in exports. During 1970, exports of semiprecious stones reached $6.6 million but much of this was processed from $3.6

million worth of imported semiprecious stones.

Although no corresponding up-to-date figures for 1970 are available on mineral and metal imports, petroleum imports were on the order of $100 million, comprised mainly of refined products rather than crude. The bulk of the oil came from the Middle East. Iron and steel imports were about $65 million, mostly from Japan. Thailand's imports of copper, lead, zinc, aluminum, and gold bullion were in the $5 to $10 million range for each of these metals. Fertilizer and pesticide imports were also sizable, possibly $30 million for the two combined.

Thailand's estimated foreign trade account in 1970 shows $712 million for exports and $1,217 million for imports. The large imbalance no doubt was made up primarily by invisible foreign expenditures directly or indirectly related to the Vietnam conflict. The relative importance of mineral and metal products in overall trade can be seen from comparing values. Clearly, tin exports and oil and steel imports were most significant.

Table 2.—Thailand: Exports of selected mineral commodities

(Metric tons unless otherwise stated and million dollars)

Commodity	1969 Quantity	1969 Value	1970 Quantity	1970 Value
METALS				
Antimony ore [1]	1,426	$0.37	4,566	$5.36
Iron ore	492,645	3.79	4,001	.03
Lead ore	4,508	.56	2,886	.36
Manganese ore	11,262	.35	7,860	.17
Tin ... long tons	23,061	79.60	21,511	77.70
Tungsten concentrate	1,061	2.82	1,536	7.85
NONMETALS				
Fluorspar	260,157	6.67	340,599	10.52
Gypsum	33,224	.54	39,860	.43
Salt	123,790	1.08	p 182,076	.84

p Preliminary.
[1] Includes 175 tons of metal in 1969 and 108 tons of metal in 1970.

Source: U.S. Embassy, Bangkok, Thailand. State Department Airgram A-138 (Industrial Outlook Report: Minerals). Apr. 1, 1971, pp. 1-5.

Table 3.—Thailand: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	983	3,381
Metal including alloys:		
Scrap	36	59
Unwrought	5,231	5,986
Semimanufactures	3,580	4,476
Antimony:		
Ore and concentrate	7	13
Metal including alloys:		
Unwrought	18	11
Semimanufactured	10	2
Chromium ore and concentrate	6	--
Copper:		
Copper sulfate	203	58
Metal including alloys:		
Scrap	55	56
Unwrought	223	487
Semimanufactures	5,256	4,336
Iron and steel:		
Ore and concentrate and roasted iron pyrites	188	137
Metal:		
Scrap	75,105	129,195
Pig iron, ferroalloys, and similar materials	4,097	4,711
Steel, primary forms	7,972	9,478
Semimanufactures	647,077	616,705
Lead:		
Oxide	312	449
Metal including alloys:		
Scrap	4	108
Unwrought	2,932	2,801
Semimanufactures	256	291
Manganese:		
Ore and concentrate	366	256
Oxides	717	638
Mercury ... 76-pound flasks	256	6,989
Nickel:		
Matte, speiss and similar materials	1	8
Metal including alloys:		
Scrap	6	2
Unwrought	26	3
Semimanufactures	215	274
Platinum including alloys, all forms ... troy ounces	2,025	4,726
Silver:		
Waste and sweepings ... do	450	4,372
Metal including alloys ... do	53,917	27,392
Tin:		
Ore and concentrate ... long tons	20	--
Metal including alloys:		
Unwrought ... do	2	6
Semimanufactures ... do	6	5
Titanium ore and concentrate	45	108
Zinc:		
Oxide	1,070	902
Metal including alloys:		
Scrap	63	1,043
Unwrought	14,646	18,071
Semimanufactures	2,138	1,911
Other:		
Ore and concentrate of base metals, n.e.s	1,746	575
Ash and residue containing nonferrous metals	126	3
Nonferrous base metals n.e.s., unwrought and semimanufactures	6	2
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	1,094	1,259
Grinding and polishing wheels and stone	656	638
Asbestos, crude	19,534	24,504
Barite and witherite	4	18
Borates, crude natural	35	(1)
Bromine:		
Elemental ... kilograms	25,026	11
Compounds, n.e.s ... do	20,400	118
Cement	107,365	39,768
Chalk	1	8
Clays and products:		
Crude n.e.s.:		
Clay including kaolin	9,391	7,485
Andalusite, kyanite and sillimanite	307	693

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Clays and products—Continued		
Products:		
Refractory	11,730	13,906
Nonrefractory	11,571	15,416
Cryolite and chiolite	--	3
Diamond:		
Cut and uncut carats	42,693	33,567
Industrial do	r 2,525	10,106
Diatomite	65	123
Feldspar, fluorspar, leucite, and nepheline syenite	651	762
Fertilizer materials:		
Crude and manufactured:		
Nitrogenous	46,577	25,781
Phosphatic	134,293	125,754
Potassic	r 4,058	2,950
Mixed	80 760	111,346
Ammonia, anhydrous	538	919
Graphite, natural	1,021	1,006
Gypsum and plasters	202	214
Iodine	1	3
Lime	141	199
Magnesite and magnesite calcined	135	368
Mica:		
Crude including splittings and waste	36	38
Worked	1	--
Pigments, natural, mineral	40	11
Precious and semiprecious stones except diamond thousand carats	28,662	37,318
Salt	2,296	213
Stone, sand and gravel:		
Dimension stone:		
Crude	2,442	6,466
Worked	490	1,162
Dolomite	30	4
Gravel and crushed stone	2,537	540
Limestone and marl	831	376
Quartz and quartzite	745	1,932
Sand excluding metal bearing	47	265
Sulfur:		
Elemental:		
Collidal	401	55
Other than collidal	14,849	12,029
Sulfuric acid	13	92
Talc and steatite	2,162	2,727
Other nonmetals n.e.s.:		
Crude:		
Meerschaum and amber	1	--
Other	163	572
Slag, dross and similar waste, not metal bearing	470	742
Building materials of asphalt, asbestos, and fiber cement, and unfired nonmetals n.e.s	3,372	3,787
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	2,007	20
Carbon black	5,026	5,079
Coal and briquets of coal	48	163
Coke and briquets of coke	r 10,773	10,133
Petroleum:		
Crude and partly refined:		
Crude thousand 42-gallon barrels	20,238	18,160
Partly refined do	1,596	--
Refinery products: [2]		
Gasoline, aviation do	135	74
Gasoline, motor do	1,074	1,218
Kerosine do	252	194
Jet fuel do	702	401
Distillate fuel oil do	7,898	7,496
Residual fuel oil do	r 1,308	1,473
Lubricants do	r 660	703
Other:		
White spirits do	2	9
Petrolatum and wax do	41	48
Asphalt do	r 304	86
Pitch, petroleum coke, other petroleum residues and bituminous mixtures do	73	4
Liquefied petroleum gas do	r 90	59
Total do	r 12,539	11,765
Resin and other byproducts of coal, lignite, petroleum, and oil shale	1,254	534

r Revised.
[1] Less than ½ unit.
[2] Includes bunker.

COMMODITY REVIEW

METALS

Aluminum.—Alcan Aluminum, Ltd., had jointed with P. Piya Co., Ltd., to form an aluminum processing venture called Alcan Thai Co., Ltd. Reynolds Aluminum Co. (Thailand) Ltd., through Prayat Boonsoong a major shareholder, made an application to the Thailand's BOI to build a $5 million rolling mill to make foil and related products from 3,000 tons of aluminum ingot imported from the United States or the Philippines. Demand for aluminum products has been steadily rising, and imports in 1970 were well above 10,000 tons of ingots and semimanufactures combined.

Antimony.—Although antimony showings are found in many parts of Thailand, both in the north and south, production has been nominal until 1970 when world prices rose to a peak of $4 per pound in April. Comparing 1970 tonnage with that of 1969, mine output rose 220 percent to about 2,400 tons of contained antimony and value increased more than ten-fold to $5.36 million. Only one mining operation in southern Thailand, an American-Thai joint venture in Surat, can be considered modern in any sense. The rest are small operations, most of which got into the business simply because of the abnormally high prices. At yearend, antimony prices had dropped sharply to only 70 US cents per pound, signaling a difficult year ahead for the industry.

Copper.—The promise of large-scale copper production in Thailand became more distant during 1970. The Dillingham Corp. interests had drilled a copper property at Loei in the Northeast and determined the reserves to be possibly 80 million tons of 0.7 percent copper ore. The project came to a halt upon the withdrawal of the Thai partner. Unless another Thai partner is found or the Government gives special permission for a foreign company to operate along north of the eleventh parallel, it is unlikely that Dillingham will do further work.

Gold.—The Thai Cabinet took steps to revoke the law reserving to the Crown the right to explore for gold. As a result, more than a dozen firms made applications for various concessions around the country.[8]

Iron Ore.—Production dropped to insignificant quantities, because of depletion of the small, high-grade deposits. Although iron occurs in many areas, no large deposit has been uncovered as yet. The Japanese and other foreign interests probably will explore the country further before abandoning the hope that some worthwhile, high-grade deposit would be found.

Iron and Steel.—In 1970, Thailand had seven small steel plants which combined had approximately 230,000 metric tons of ingot capacity and 463,000 tons of rolling capacity.[9] Expansion programs were underway to raise ingot capacity to 270,000 tons and rolling capacity to 535,000 tons by 1972. Most of the ingot capacity was comprised of electric furnaces for melting domestic and imported scrap. Only one plant produced pig iron—from small charcoal furnaces. The bulk of the raw materials for making steel products came from abroad in the form of steel semimanufactures for further processing. In terms of final products, Thailand was capable of turning out annually about 340,000 tons of steel rods, 154,000 tons of galvanized sheets, 25,000 tons of tinplate, and 15,000 tons of steel pipes. Programs are already underway to raise capacity of steel rods to 520,000 tons, and steel pipes and tin plates to 75,000 tons each.

Foremost among the steel firms was G. S. Steel Company, Ltd., a 60-percent Japanese joint venture capable of producing 105,000 tons of ingot (to be raised to 158,000 tons) and 165,000 tons of rolled products. Next is the Siam Iron and Steel Co., Ltd., owned by Siam Cement Co. Ltd., with plant at Lop Buri. At yearend 1970, this plant had three 20-ton charcoal blast furnaces (two 300-ton furnaces will be added shortly), a 70,000-ton-per-year ingot capacity to be doubled with oxygen converters, and a 165,000-ton-per-year rolling capacity. Other lesser steel companies were Bangkok Iron and Steel Works, Thai India Steel Co., and Bangkok Steel Industry Company, Ltd., among others.

Early in 1971 the BOI decided to promote the eventual development of an integrated iron and steel industry to cope with the rapidly growing demand for iron and

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[8] The Investor (Bangkok). V. 1, No. 10, September 1969, p. 751.

[9] The Investor (Bangkok). V. 2, No. 11, November 1970, pp. 1145–1147.

steel products.[10] Priority will be given by BOI to first establishing a plant to produce flat steel products, with plans for backward integration down to the processing of iron ore. Only one applicant with a proposal to initially produce at least 500,000 tons of cold-rolled steel and eventually 1 million tons of pig iron per year will be accepted, and this producer will have "promotion privileges" for 10 years after production begins. As of January 1971, two applications were in—a Thai-Japanese joint venture and a Thai-Singapore joint venture. Subsequently, the Thai Government invited a consortium of leading Japanese steel companies to make a preliminary investigation on the feasibility to construct an integrated iron and steel plant in Thailand.[11]

Lead and Zinc.—Kanchanaburi has been the only lead-producing Province in recent years, furnishing about 2,000 to 3,000 tons of lead-in-concentrates annually. The Mae Sod nonsulfide zinc deposit near the Burma border, although proven to be sizable in reserves, has not yet been developed. Meanwhile, consumption of lead and zinc is rising. At the end of 1970, the Siam Battery Industry Co. Ltd. was granted a certificate to establish a battery plant in Bangkok. The lead needed will be imported or recovered from local battery scrap.

Manganese.—Thailand produced manganese of various types from the Provinces of Lamphun, Songkhla, Yala, and Chiang Mai. The battery-grade manganese finds a local market in making dry cells so that production can be maintained. On the other hand, metallurgical manganese relies on the Japanese market which, of late, has not found the product attractive in competition with other sources. In fact, Thailand's production and exports of metallurgical manganese during 1970 had dropped to below one quarter of the 1967 levels.

Tin.—Despite the dropping of export controls by the International Tin Council early in 1970, Thai tin exports failed to make any gains during the year. In fact, Thai tin exports were down 6.8 percent to 21,511 long tons, although valuewise the decline was much less.

A large and apparently rich deposit was found in the Andaman Sea off the western coast of Phuket Island, Thailand's chief tin-producing area. This deposit is in water deeper than most dredges can operate in, so there was a question as to how to design equipment to do the work. A large suction cutter dredge ordered by TEMCO from the Japanese was not yet in operation. The Billiton Company started a new offshore exploration program for tin off the northern coast of Ko Phangan and plans also to explore off the coast of Ranong, Takuapa, and Phuket.

Thaisarco, as well as TEMCO its subsidiary, underwent reorganization in September. Originally Thaisarco was 70 percent controlled by the U.S. firm Union Carbide Corp. but it became half owned by Billiton Company when the latter purchased the shares of the Eastern Mining Development Co. Ltd. as well as shares from Union Carbide. The two companies organized a sales company in Switzerland which will market all the production after January 1, 1971, when all arrangements will become fully effective. During the period of transition, the Thaisarco smelter on Phuket apparently suffered from interruptions, which explains in part the slight decline in refined tin production. With the infusion of new blood from one of the world's most famous tin companies, the new joint venture promises increased activity in exploration and more efficient smelting.

Tungsten.—Thailand's tungsten concentrate is primarily a byproduct of tin mining. About one-third of the national output of about 1,378 tons of concentrates in 1970 came from the central region of Kanchanaburi, followed by Nakhon Si Thammarat in the south as the next largest producing district. High tungsten prices continued to stimulate production.

NONMETALS

Barite.—Thailand started to produce barite in 1970, reportedly extracting 16,490 metric tons. The first barite enterprise in Thailand—Barite Thailand Co. Ltd. is a joint venture, with the Huey Yai Mining Company Ltd. holding a 51-percent interest and the National Lead Co. and Paul F. Scholla & Associates holding the rest. This new firm was building a $1 million mill in the southern Province of Songkhla where

[10] The Investor (Bangkok). V. 3, No. 1, January 1971, pp. 22–23.
[11] Japan Metal Bulletin (Sangyo Press, Osaka). Apr. 6, 1971, p. 3.

there are large reserves of barite. Additional reserves have also been found in Yala and Nakhon Si Thammarat Provinces.

Endeavor Oil NL acquired a barite operation in the Tha Sala district of Songkhla. The deposit covers 237 acres and contains high-grade ores. The plan is to mine 20,000 tons annually by opencut methods. Preliminary drilling indicates reserves sufficient for 5 years, and the company is hopeful that far more reserves will be found.[12] The ore is to be shipped to Singapore, where Endeavor Oil proposes to establish a grinding mill of 50,000-ton annual capacity. The company expects a satisfactory cash flow from the overall project by mid-1971.

In view of the intensive exploration for offshore oil in the Far East, particularly Southeast Asia, Thai producers appear well placed to take full advantage of the rapidly growing market for drilling muds.

Cement.—The Siam Cement Co., Ltd., with principal facilities at Ta Luang, remained as the dominant factor within the Thai cement industry, producing 2,098,500 metric tons of cement in 1970 or nearly 85 percent of the country's total. During the year this company was building an additional plant at Ta Luang rated at 1,500 tons per day. Jalaprathan Cement Co. Ltd. was the only other producer of ordinary cement in the country. It too was expanding facilities, having contracted with the Japanese firms to build a 1,500-ton-per-day dry process plant at Cha-am, a suburb of Bangkok to supplement the 1,000-ton plant at Takli which was built to supply cement to the Bhumiphol Dam. The Siam City Cement Co. was constructing another new plant with a 500,000-ton capacity at Tambol Tabkwang off the Friendship Highway in Saraburi Province. The Universal White Cement Company rated at 32,000 tons was Thailand's sole producer of white cement.

The Siam Cement Co., Ltd., is the heart of the Siam Cement group, which includes the Siam Fibre Cement Co., the Concrete Products and Aggregate Co., the Construction Material Marketing Co., the Siam Iron and Steel Co., Ltd., and the Siam Industrial Credit Co. Upon completion of a third plant, Siam Fibre Cement Co.'s annual production capacity in asbestos cement products will be 265,000 tons of roofing materials, 125,000 tons of flatsheets and siding, and 45,000 tons of high-pressure and low-pressure asbestos cement pipes. Concrete Products and Aggregate has an annual capacity of 40,000 cubic meters of prestressed concrete in the form of piles, bridge girders, beams, and telephone poles; 13,000 cubic meters of footings and slabs, ordinary and reinforced concrete pipe; 4,000,000 concrete blocks; 500,000 cubic meters of ready-mixed concrete; and 450,000 tons of crushed rock.

There was apprehension on the part of the Siam Cement Co. that a cement-surplus situation may develop unless the BOI screens potential producers more carefully. Imports have steadily declined to only nominal tonnages in 1970.

Fertilizer Materials.—During 1968–70 Thailand's imports of fertilizers attained a new plateau of about $30 million annually, including pesticides. Combined imports of all fertilizers have been about 300,000 tons per year, headed by the phosphatic and mixed types which are in greater demand than the nitrogenous type. Overall fertilizer consumption has steadily risen, and most of the requirements are met by imports.

Thailand has only one fertilizer plant of consequence—the $17 million Mae Moh plant in Lampang Province owned by the quasi-government firm Chemical Fertilizer Co. Ltd. Rated at 60,000 tons of ammonium sulfate and 30,000 tons of urea per year, the plant uses local lignite as feed stock and hence is high cost. In fact, production cost may be 20 to 30 percent more than imports from Japan and West Germany. Imports of ammonium sulfate and urea became restricted in July 1968. To give the local fertilizer industry further protection, imports of two other general categories of fertilizers also became restricted by early 1970. Marketing difficulties have held Mae Moh's production to roughly two-thirds of capacity. The situation may improve, however, in that a sodium sulfate–ammonium chloride plant was scheduled to be built by the Siam Chemicals Co. Ltd. in the Samut Prakan area that would use local ammonium sulfate as raw material.

In 1969 Mitsui and Co. Ltd. interests were given permission by the BOI to build a complex fertilizer plant in Thailand and

[12] Industrial Minerals (London). No. 39, December 1970, p. 41.

they were planning to go ahead with the project. This would help compensate for reduced exports of fertilizers by the Japanese. Much more uncertain was a proposal by the Iranians to build a joint venture plant in Thailand to use Iran's petrochemical feedstock for conversion into fertilizers.

Fluorspar.—Thai fluorspar has attained great world prominence in only a few years' time, and production is still rising. Output in 1970 totaled 318,227 tons and Japan, the main purchaser and consumer, imported 257,674 tons of Thai fluorspar during the year as compared with 254,610 tons in 1969. Japan was getting competition from an unexpected source late in the year, namely the Soviet Union which helped move prices up to the benefit of the Thais. Thai fluorspar prices were quoted for 80-percent grade f.o.b. Bangkok. In the latter part of 1970, prices went up to about $35 per metric ton. The Soviets contracted small tonnages of fluorspar for delivery in 1971 at $45 and offered subsequently to pay $48 to $50. The Japanese matched the Soviet bids at each turn and managed still to buy most of the output. Japan's trade statistics show that the average c.i.f. price for Thai fluorspar in 1970 was $38.90, as compared with $41.10 in November and $43.70 in December. Thailand also exported fluorspar to Europe, India, and Taiwan, among others. Australia started to show interest in buying Thai fluorspar.

Most output comes from the north, headed by the Lamphun district near Chiang Mai. Universal Mining Co. provided roughly two-fifths of Thai fluorspar from the Ban Hong and Mae Tha mines, both in Lamphun. Thai Fluorspar and Minerals Co., with mine also in Ban Hong, produced in excess of 3,000 tons monthly. At least four other companies mined more than 1,000 tons monthly. National reserves, scattered around the "tin-barren granite" areas of Thailand, were estimated at a minimum of 10 million tons recoverable fluorspar. Present simple mining and handsorting methods are wasteful, and efforts were underway to increase the beneficiation capacity.

The Kaiser Cement & Gypsum Corp. explored a fluorspar-bearing area in Petchburi, Southern Thailand and concluded that a modern mining operation and processing plant would be warranted. Apparently, within 2 years output could be substantially increased over the approximately 2,000 tons of hand-cobbed product recently extracted each month, according to Kaiser engineers.[13]

Gem Stones.—Thailand maintained its status as one of the world's leading centers for cutting gems other than diamond. Thailand not only cuts stones produced domestically but also imported stones. The bulk of Australia's blue sapphires is sent to Thailand for cutting. During 1970, Thailand imported $2.45 million worth of uncut sapphire and exported $3.68 million worth of "cut but not set" sapphire plus $280,000 worth of uncut sapphire. Another large item of gem exports in 1970 was "cut but not set" ruby at $1.65 million; in this case, however, imports of uncut ruby were small. Of secondary significance was Thai zircon, exports totaling about $100,000 during the year.

Gypsum.—Gypsum has been produced from Nakhon Sawan in the north, Surat in the south, and Phichit in the north, mainly by the Thai Gypsum Co. Ltd. Output from the north has gone to domestic cement plants, and that from the south has been exported to Malaysia. Near the beginning of 1970, the Republic of Korea was negotiating for the purchase of 100,000 tons of Thai gypsum. More than a fourth of Thailand's 1970 output of 144,250 metric tons of gypsum was exported, and the Thais would be most happy to sell more if markets were available.

MINERAL FUELS

Lignite.—Thailand's lignite production has been 300,000 to 400,000 tons annually in recent years from Krabi in the south and Mae Moh in the north. Krabi's output goes entirely to the local 60,000-kilowatt power station, whereas Mae Moh's output is consumed by 12,500-kilowatt power station and a fertilizer plant rated at about 40,000 metric tons of equivalent nitrogen both near the mine. The former Lignite Authority, which controlled production, was merged into EGAT in May 1968.

Petroleum.—During 1970 the six international oil companies that had been granted offshore exploration rights did not undertake drilling to supplement their initial seismic work because of the pending new Petroleum Act. One of the companies,

[13] World Mining (San Francisco). V. 6, No. 11, October 1970, p. 68.

Continental Oil Co., farmed out a 50-percent interest in its offshore acreage to the Japanese Mitsui interests on the condition that the latter would do additional exploration and drilling work. Tenneco Oil, Inc., had acquired three partners. The remaining four concessionaires were three additonal American companies—Gulf Oil Corp., Union Oil Co., and American Oil Co.—and the British Petroleum Co., Ltd.

The Petroleum Act was passed on February 24, 1971, and sent to the King for signature. The Minister of National Development will enforce the Act and chair the Petroleum Board formed to advise him. The Board will deal with concessions, price of natural gas, crude oil for local use, export bans in the national interest, method of royalty payments, and other matters. Rights belong to the state, and concessionaires are required to have satisfactory credentials in capital and expertise and submit periodic reports. Survey concessions will be granted for a maximum of 8 years, renewable for 4 years; survey areas are defined in size and most of the acreage must eventually be returned to the state. Production concessions will last up to 30 years, starting from the expiry of the survey concession, and renewable for up to 10 years. A concessionaire of either type can transfer all or part of the company's concessions to another company which is in one way or another 50-percent related to the original concessionaire. The production concessionaire will be exempted from all duty, taxes, and fees except if these are stipulated by the Petroleum Income Tax Act. Royalties will be one-eighth by value or one-seventh in kind (payment with petroleum). The income tax rate shall be as prescribed by Royal Decree but not less than 50 percent nor more than 60 percent of the net profits. Despite heavy penalties and complexity of the laws, the Petroleum Act and the complementary Petroleum Income Tax were well received by the oil companies prospecting in Thailand.

Virtually all of Thailand's oil requirements have been met by imports. Production of natural crude oil is negligible, and domestic shale oil is too expensive to develop. Both crude and refined petroleum products are imported, with the latter hitherto much greater in value than the former. To cut down on foreign exchange needs on the order of $100 million in 1970, refinery capacity was being expanded. Not counting a very small facility run by the Ministry of Defense in the north and an asphalt plant at Si Racha worked by ESSO, Thailand had two refineries in operation during 1970, both in the process of expansion.

The privately Thai-owned Thai Oil Refinery Co., Ltd. (TORC), originally had a $33 million, 35,000-barrel-per-day [14] refinery in Aow Udom, Amphoe Si Racha, about 80 miles from Bangkok on the Sukhumvit Highway, where 65,000-ton tankers could be accommodated. About the end of 1970, the TORC plant was expanded to 65,000 barrels per day at a cost of $29 million by international firms headed by Royal Dutch-Shell and run by an Australian manager. TORC's products are distributed by Shell, Esso, and Caltex who specify the types desired, such as 83 and 95 octane gasoline. TORC has a unique arrangement with the Government (originally, the Ministry of Industry) whereby it has the right to run the refinery for only 10 years (refinery came on stream in 1964) even though it furnished all the capital. Furthermore, TORC is required to pay 25 percent Corporation Profit Tax on profits in addition to another 30 percent profit share to the Government. Before the expansion, TORC was already paying $34 million annually in taxes.[15]

The Summit Industrial (Panama) Co., Ltd. (Summit), probably a subsidiary of the British holding firm Utramar Co., Ltd., operated a 20,000-barrel-per-day refinery in the Bang Chak district of Bangkok. Summit first leased a 5,000-barrel-per-day refinery belonging to the Ministry of Defense in 1965 for 15 years, which it subsequently expanded to the present capacity. In mid-1969 Summit was awarded a 10-year extension of the lease so that it could go ahead with plans of expansion. Summit with the help of Toyo Engineering Corp. and Mitsui and Co. Ltd. of Japan was in the process of installing another 50,000-barrel-per-day capacity (equivalent to another refinery) at a cost of $6.5 million which should be completed in 1971.

Petroleum products are freely imported into Thailand except for fuel oil, which the local refineries were producing in adequate quantities. TORC tried to get gov-

[14] Capacity in barrels per day times 50 roughly equals metric tons per year.
[15] The Investor (Bangkok). Supplementary Issue, Dec. 12, 1970, 30 pp.

ernment approval to raise oil prices on the grounds that transport costs were soaring. This was turned down, however, for the time being. Investigations were being made on the construction of a pipeline from Si Racha to Nakhon Ratchasima in the Northeast at a cost of possibly $18 million. The need was apparent, but the route was not decided upon.

The Mineral Industry of Tunisia

By Roland W. Merwin [1]

Tunisia's gross domestic product (GDP) was approximately $1,235 million,[2] an increase of 5.1 percent over that of 1969. The mineral share of GDP rose slightly, to above 10 percent in 1970, as a result of output increases in petroleum, phosphate, and other mineral products. Not only is the mineral segment of GDP significant by world standards, but it is of particular importance to Tunisia as a source of foreign exchange. Crude petroleum production was valued at approximately $65 million and phosphate rock and manufactured phosphatic fertilizers, at approximately $40 million. Most of Tunisia's mineral products were exported, as in the past. However, some nonmetallics like cement, lime, clays, and petroleum products were locally consumed.

The phosphate and iron ore industries were faced with the problem of reestablishing normal operations following the disastrous floods in the autumn of 1969, which completely disrupted rail transportation facilities for a long period. Normal operations were not resumed until almost the middle of the year.

The petroleum industry continued to be the most important sector of the mineral industry. Production and exports both increased, with the principal source of crude being the El Borma field. There was a substantial increase in exploration activities, with good showings indicated in at least two new areas. There was an increasing interest in offshore exploration.

The Government of Tunisia pressed ahead on a program for the revitalization of the phosphate industry, which is potentially the country's most valuable natural resource. An important phase of this project is the establishment of a chemical industry complex at Gabes, which will include facilities for the production of phosphoric acid for export. Favorable trade agreements with the European Economic Community (EEC) makes this an attractive method of upgrading the low-tenor phosphate ores.

A contract was let for the construction of a 185-mile pipeline to bring natural gas from the El Borma field to the industrial complex at Gabes, at a cost of approximately $13 million. The foreign exchange requirements for the pipeline were covered by a $7.5 million loan from the World Bank and an advance of $2.5 million from the Kuwait Fund.

The nonferrous mineral industry received increasing attention under the auspices of the Government-owned mining company, Société Tunisienne d'Expansion Minière (SOTEMI). Particular emphasis has been placed on increasing the production and the exportation of lead, zinc, and fluorspar minerals.

PRODUCTION AND TRADE

The available data for mineral production and trade are given in the following tables:

[1] Mining engineer, Division of Nonmetallic Minerals.

[2] Where necessary, values have been converted from Tunisian dinars (TD) to U.S. dollars at the rate of TD1=US$1.905.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Iron and steel:			
Iron ore and concentrate ---- thousand tons	1,016	946	774
Pig iron ---- do	128	131	e 130
Steel, crude ---- do	80	100	e 100
Steel semimanufactures ---- do	80	NA	NA
Lead:			
Mine output, metal content	r 16,000	23,400	20,300
Metal:			
Primary } Antimonial }	14,024	16,132	21,600
			1,201
Mercury, primary ---- 76-pound flasks	309	244	100
Silver, primary ---- troy ounces	e r 37,000	e 43,000	57,518
Zinc mine output, metal content	r 3,960	9,120	12,240
NONMETALS			
Cement, hydraulic ---- thousand tons	r 509	603	538
Clays, construction ---- do	220	e 250	e 230
Fertilizer materials:			
Crude (natural) phosphate rock ---- do	3,444	2,685	3,016
Manufactured:			
Hyperphosphate ---- do	15	14	28
Superphosphate ---- do	35	33	e 30
Triple superphosphate ---- do	376	333	382
Fluorspar, all grades	5,450	12,397	30,700
Gypsum and anhydrite, crude ---- thousand tons	e 10	10	--
Limé, hydraulic ---- do	e 170	e 170	168
Salt, marine ---- do	360	283	300
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural, marketed ---- million cubic feet	r 334	329	316
Petroleum:			
Crude oil ---- thousand 42-gallon barrels	24,539	27,942	34,296
Refinery products:			
Gasoline and naphtha ---- do	1,867	1,799	1,627
Kerosine ---- do	428	428	e 500
Distillate fuel oil ---- do	2,318	2,276	e 2,120
Residual fuel oil ---- do	2,501	2,761	e 2,900
Liquefied petroleum gas ---- do	r 241	223	e 220
Refinery fuel and loss ---- do	271	1,287	e 1,260
Total ---- do	r 7,626	8,774	8,627

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

[1] In addition to commodities listed, construction materials such as sand and gravel, and quarried stone are also produced, but quantitative data are not available.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Copper including alloys, all forms	689	867	France 260; Italy 237; West Germany 171.
Iron and steel:			
Iron ore and concentrates	617,996	654,249	Italy 502,262; United Kingdom 112,408; Greece 39,579.
Pig iron and ferroalloys	24,006	20,128	Italy 18,297; France 1,831.
Steel, primary forms	3,045	2,321	All to Italy.
Semimanufactures	15,795	8,685	Italy 4,845; Spain 3,840.
Lead unwrought	6,472	10,744	France 5,271; Italy 4,610; Greece 501.
Mercury [2] 76-pound flasks	NA	350	All to Belgium and the Netherlands.
Silver value, thousands	$51	$110	All to France.
Zinc ore and concentrate	12,358	15,378	Italy 11,200; France 4,178.
NONMETALS			
Cement	23,303	89,039	Italy 82,239; Spain 6,800.
Diatomite	2,270	NA	
Fertilizer materials, phosphatic:			
Crude phosphate rock [2] thousand tons	2,460	1,852	France 491; Greece 227; Bulgaria 184; Yugoslavia 168.
Manufactured do	117	108	Sweden 41; France 37; Italy 16.
Fluorspar [2]	4,220	4,545	NA.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum: [3]			
Crude thousand 42-gallon barrels	16,463	22,082	NA.
Refinery products:			
Gasoline do	9	24	NA.
Kerosine and jet fuel do	--	2	NA.
Distillate fuel oil do	--	61	NA.
Residual fuel oil do	--	39	NA.
Total do	9	126	NA.

NA Not available.

[1] Except where otherwise noted, 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, the United States, and Yugoslavia.

[2] Source: Bureau de Documentation Miniére (of France). Annales des Mines, Sept. 1970, pp. 66–67.

[3] Source: U.S. Bureau of Mines. International Petroleum Annual, 1968 and 1969.

Source: Except where otherwise noted: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 814–819; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 579–582.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	514	478
Copper including alloys, all forms	371	1,492
Iron and steel:		
Pig iron and ferroalloys	1,005	681
Steel:		
Primary forms	--	1,396
Semimanufactures	44,569	51,464
Lead including alloys, all forms	75	51
Tin including alloys, all forms ... long tons	22	35
Titanium oxide	60	100
Zinc:		
Oxide	80	187
Metal and alloys, all forms	91	222
NONMETALS		
Asbestos	150	1,451
Cement, hydraulic	14,433	8,546
Clays and products:		
Crude	692	1,004
Products:		
Nonrefractory	1,429	1,525
Refractory	4,084	3,821
Feldspar and fluorspar	--	649
Fertilizer materials manufactured:		
Nitrogenous	14,196	2,524
Potassic	4,243	5,757
Pyrites, gross weight	7,917	7,697
Stone, sand and gravel:		
Dimension stone:		
Crude	4,495	2,736
Worked	1,125	550
Other	210	423
Sulfur, elemental	50,613	40,097
Talc and related materials	1,102	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades	23,782	41,345
Coke	101,221	102,491
Petroleum refinery products: [2]		
Gasoline:		
Aviation ... thousand 42-gallon barrels	6	--
Motor ... do	16	7
Kerosine and jet fuel ... do	20	76
Residual fuel oil ... do	65	155
Lubricants ... do	91	77
Other ... do	95	47
Total ... do	293	362

[1] Except where otherwise noted, compiled from export data of Australia, Austria, Belgium-Luxembourg, Canada, Denmark, Finland, France, West Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, U.S.S.R., the United Kingdom, the United States, and Yugoslavia.

[2] Source: For the U.S.S.R.: Official trade returns of that country; for other countries: Statistical Office of the United Nations. 1968 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1970, pp. 820–836; 1969 Supplement to the World Trade Annual. V. 3 (Africa), Walker and Company, New York, 1971, pp. 583–594.

COMMODITY REVIEW

METALS

Iron and Steel.—Iron ore production was adversely affected by disastrous floods in the autumn of 1969. These floods caused a 6-month disruption in rail shipments from the major iron mine at Djebel Djerissa to both the export shipping ports and the El Fouladh Iron and Steel Mill at Menzel-Bourguiba, near Bizerte. By the time full shipments were resumed in the spring of 1970, producers' stocks of iron ore were equal to 8 months of production. As a result, production was restricted to allow for liquidation of these stocks. The El Fouladh Iron and Steel Mill maintained normal production during this period of suspended rail shipments from the Djebel Djerissa, by the use of stocks and the receipt of shipments from a subsidiary source, the Tamera-Douaria iron mine. Iron ore exports, when resumed, went to the usual consuming countries. During 1969, exports went mainly to Italy (502,262 tons) and the United Kingdom (112,408 tons).

Lead and Zinc.—Production of lead and zinc was substantially greater, continuing a trend begun in 1967 and constituting an increasing important element of mineral production and exports. Mining operations are controlled by SOTEMI, which is actively engaged in expanding current operations and opening new mines. SOTEMI expects that these expansions will more than double the current production. A private foreign company, Peñarroya Tunisia, operates a lead smelter at Mégrine, and rated capacity is 40,000 tons per year. Zinc ores and concentrates are exported to foreign countries for smelting. Exports of processed lead during 1970 were primarily to Italy (9,561 tons) and France (6,052 tons). Zinc ores and concentrates were exported principally to Italy (7,787 tons) and Yugoslavia (4,566 tons).[3]

NONMETALS

Fluorspar.—SOTEMI, is becoming increasingly interested in the production of fluorspar, with the expectation of developing a substantial export potential. Although present production is still relatively small, it has increased more than fivefold during the past 2 years.[4]

Phosphates.—The production and exportation of phosphate rock and manufactured phosphatic fertilizer products continued to be the second most important sector of the mineral industry, exceeded only by petroleum. Not only are the phosphate resources of Tunisia very large, but their development is considered to be essential to the economic life of southern Tunisia and as a major source of foreign exchange. However, the tenor of the ores is generally less than those in competitive countries, and the mining systems and beneficiation plants are outmoded. Therefore, difficulties were experienced in export marketing of crude phosphate rock.

The Government of Tunisia has committed itself to the revitalization of the mining industry. In April 1970, the National Assembly voted a credit of $2.57 million to the Government-controlled company Compagnie des Phosphates et du Chemin de Fer de Gafsa (Sfax-Gafsa) in the form of a subscription to an increase in the company's share capital. The company's investment program called for an expenditure of $12.33 million by the end of 1970, $4.48 million from the Government and the remainder from foreign sources.[5]

There was an emphasis on the production of triple superphosphate and phosphoric acid as export products. The availability of low-cost (but low-grade) phosphate rock, a projected cheap supply of sulfur, and favorable trade agreements with the EEC made exportation an attractive solution to the general problems of the phosphate industry. The two triple superphosphate producers, the Government's Société Industrielle d'Acide Phosphorique et d'Engrais (SIAPE) and its competitor, the private-sector NPK Engrais reattained normal production after early-year disruptions in supplies of phosphate rock caused by the floods of late 1969. SIAPE planned to initiate the production and exportation of phosphoric acid at the rate of 80,000 tons per year. Additionally, the long-planned phosphoric acid plant of Industries Chimiques Maghrébines S.A. (ICM) is expected to come on stream in late 1971 with an initial production capacity of 120,000 tons per year.[6]

In 1969 exports of phosphate rock amounted to 1.85 million metric tons valued at $16.5 million. The principal countries to which this product was exported were France (491,000 tons), Poland (310,000 tons), Greece (227,000 tons), Bulgaria (184,000 tons), and Yugoslavia (168,000 tons). The exports of triple superphosphate totaled 302,000 tons, valued at $15.5 million.[7]

MINERAL FUELS

Petroleum.—The El Borma field continued to account for the major portion of Tunisia's crude oil production. The present output is at the rate of approximately 80,000 barrels per day and is expected to increase as pipeline capacities are expanded. The field straddles the Tunisia-Algeria border, with the Tunisian portion being of major importance. A recent boundary agreement delineated the respective ownerships. The Tunisian portion of the field is op-

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[3] U.S. Embassy, Tunis. State Department Airgram A-101, June 4, 1971, p. 1.

[4] U.S. Embassy, Tunis. State Department Airgram A-176, Sept. 14, 1970, p. 6.

[5] Bureau of Mines. Mineral Trade Notes. V. 68, No. 1, January 1971, pp. 35, 36.

[6] Page 36 of work cited in footnote 5.

[7] Page 35 of work cited in footnote 5.

erated by Société Italo-Tunisienne d'Exploitation Pétrolière (SITEP), which is equally owned by the Tunisian Government and an Italian Government-owned company. SITEP estimated its share of El Borma crude reserves at about 250 million barrels; the Algerian reserves were estimated at about one-third of that.[8]

The balance of Tunisia's crude oil production was obtained from a small field at Douleb and a very minor field at Semmana. Natural gas production from the Cap Bon gas field was only moderate, and showed indications of declining productivity.

The pipeline of Compagnie des Transports par Pipelines au Sahara (TRAPSA) was expanded to a capacity of 315,000 barrels per day. This pipeline is primarily used for the carrying of crude oil from the fields in southeastern Algeria to the port of La Skhirra, Tunisia. Production from the El Borma field is also transported via this route. A 10¾-inch natural gas pipeline is to be built to carry gas from the El Borma field to Gabes, to be completed in 1972.

The capacity of Tunisia's single refinery at Bizerte, now 22,800 barrels per day, is to be increased by 11,400 barrels per day by 1971. Studies are continuing on the possibility of exporting liquefied natural gas to Italy and Yugoslavia.

Exploration activities have been expanded. SITEP made a discovery at El Couech, north of the El Borma field, that shows indications of being a more important field than El Borma. The prospective field is located well away from the Algerian border. The Compagnie Franco-Tunisienne des Petroles (CFTP) has encountered promising showings on its 15,000-square-kilometer Sfax-Kerkennah concession, and an active drilling program is being pursued. A number of foreign oil firms are seeking exploration concessions and are buying interests in existing concessions.

[8] Oil and Gas Journal. V. 68, No. 10, Mar. 9, 1970, p. 42.

The Mineral Industry of Turkey

By E. Shekarchi [1]

Turkey continued to forge ahead at a lively pace economically, as it pressed its efforts to redirect the economy from an agricultural base towards a productive and competitive industrial base. The Turkish economy is a mixture of public and private enterprise, each contributing roughly half of the combined industrial, mining, and energy production. Public sector investments are made in a variety of State economic enterprises, concentrated in utilities and capital-intensive industries including iron and steel, petroleum, metal and nonmetals mining, fertilizers, coal, and others. Private enterprise is concerned partially with mining but concentrates on manufacturing. The combined efforts of the public and private sectors in mineral production generated a gross mineral value of approximately $705.5 million [2] in 1970, an increase of 22 percent over the previous year. Turkey continued to make significant contributions to the world's supply of chromite, mercury, copper, and magnesite.

On August 9, 1970, the Turkish Government announced a devaluation of the lira from TL9 for US$1.00 to TL15 for US$1.00. The tourist rate of TL12 for US$1.00 which has been in effect for the last 3 years was abolished.

The impact of devaluation of the lira was softened by an input of $300 million from international agencies and nations, grouped, since 1962, in the Organization for Economic Cooperation and Development (OECD) consortium for aid to Turkey. Turkish workers in Western Europe, nearly 500,000 strong, responded to the new rate of exchange with an upsurge of foreign exchange remittances which totaled over $270 million by yearend.

In November a protocol was signed by representatives of six members of the European Economic Community (EEC) and the Turkish foreign minister to move Turkey, during the next 22 years, into a full customs union and membership in the common market. Special clauses regulate Turkey's affiliation with the EEC's coal and steel community and with Eurotom. A separate financial accord establishes a $220 million program of long-term loans from the European Investment Bank over the next 5 years, to assist in Turkey's development and adaptation to the economic conditions of the EEC.

Maden Tetkik ve Arama Enstitüsü (MTA), the mineral Research and Exploration Institute of Turkey, continued its efforts in exploration and development, including mapping of the bauxite and phosphate mineralization in central Anatolia. The beneficiation project on low-grade iron ores which was started in 1969, finalized during the year and a pilot plant, set up in the MTA, has developed a method to utilize all marginal ore deposits in the country.

Devlet Su Işleri (DSI), the Directorate General State Hydraulic Works, invited bids in the latter part of 1970 for construction of the Karakaya Dam and power station in the lower Euphrates Valley. Karakaya Dam will have a maximum height of 180 meters above the foundation, and a crest length of 394 meters. The powerplant will have 1,500-megawatts installed capacity consisting of six turbine generator units of 250 megawatts each.

Japan granted $27 million credit to Turkey in 1970 for construction of the Ayvacik Dam. The credit is for foreign exchange costs only with repayment at 5 percent over the next 20 years.

A bill to amend the petroleum law of Turkey was proposed in mid-1970. Under this proposal, if passed by parliament, duration of exploration licenses would be re-

[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from Turkish lira (TL) to U.S. dollar for the entire year, at the rate of TL1=US$0.15.

duced to 3 years, income taxes would be raised from 50 to 60 percent, and the percentage depletion provision would be abolished. Also, the bill would reduce from 10 to 5 years, the period over which losses could be carried forward. By the end of the year no significant progress toward passage was reported for the bill.

PRODUCTION AND TRADE

During 1970 the mineral industry of Turkey was characterized by a continuation of the growth and expansion sustained over the past 5 years. The emergence of magnesite, mercury, and lead-zinc among metals, as major contributors to foreign exchange earning, was accentuated by the growth in output of nonmetallics, such as abrasives, gypsum, and cement. Other salient developments were the decline of manganese, blister copper, and antimony production among the metals group and fluorspar and pyrite in nonmetallic minerals. Devaluation of the Turkish lira, although it took place in early August 1970, did not affect mineral and metals trade directly, because the international contracts were negotiated in the early part of the year.

Statistics on the production of mineral commodities are presented in table 1.

COMMODITY REVIEW

METALS

Antimony.—Ôzdemir Antimuan Bakir Isletmesi Company remained the main producer of antimony in 1970. Compared with 1969 figures, production of antimony in 1970 decreased 13 percent, as a result of a drop in ore grade. Rasih ve Ihsan's antimony mine in Nigde was a small producer in 1970 and exploratory work continued during the year.

Bauxite.—Construction work on the aluminum plant at Seydişehir, about 180 miles south of Ankara, financed and built by the Soviet Union, continued during the year. The completed plant is scheduled to produce 60,000 tons of aluminum annually. In preparation for the plant, 51,067 tons of bauxite was mined and milled during the year.

The construction of an aluminum sheet and foil plant, with an annual capacity of 22,000 tons was begun near Istanbul in the latter part of 1970. The plant is scheduled for completion in 1972 and will use imported aluminum ingots until 1975, when Turkey's first primary aluminum plant in Seydişehir is scheduled to go on stream. The company operating with a $25 million capital is jointly financed by a private group of Turkish investors and the International Finance Corporation of the World Bank.

Chromite and Ferrochromium.—The total chromite output of government and privately owned mines reached a new high in 1970. The increase of 5 percent over 1969 production, though small, was due to greater demand for Turkish metallurgical grade ore and concentrates, resulting from the imposition of United Nations sanction on Southern Rhodesian ore. Government owned, Etibank's Şark Kromlari, Guleman mine and Uç Kopru mines produced 279,439 tons and 56,359 tons, respectively, and the private sector produced the rest.

No new chromite findings were reported during the year in spite of intensive exploration efforts both by the MTA and private producers.

During the year, the Antalya ferrochrome complex, a joint venture of Etibank and Péchiney of France, collapsed financially, and consequently the entire plant was bought by Etibank. The financial arrangements and details of the transfer of shares were not available by yearend.

A proposal for a second ferrochrome complex, with an annual capacity of 50,000 tons, was under study during the year. The plant is to be built near the Keban-Elazig Dam site so as to utilize the energy from the dam now under construction. A Japanese firm apparently has shown some interest in the project, but final details were not available by yearend.

The production of ferrochrome showed a slight increase during the year and it is believed that 1970 output was close to maximum production capacity of the Antalya ferrochrome plant.

Table 1.—Turkey: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS			
Aluminum, bauxite	--	1,500	51,067
Antimony:			
Ore and concentrate:			
Gross weight	2,984	5,284	4,616
Metal content e	1,790	3,171	2,770
Regulus	89	35	NA
Chromite, salable product	418,805	453,903	[2] 477,400
Copper:			
Mine production, metal content	28,823	26,374	27,225
Metal (blister)	25,355	23,500	18,955
Iron and steel:			
Iron ore [3] thousand tons	1,836	1,987	e 2,190
Pig iron and ferroalloys:			
Ferrochromium	8,500	9,200	e 9,500
Pig iron and other ferroalloys thousand tons	910	943	1,034
Crude steel (excluding castings) do	1,109	1,170	1,312
Lead:			
Mine output:			
Gross weight of lead ore (excluding zinc-lead ore)	33,783	28,441	30,605
Metal content (including content of zinc-lead ore) e	7,000	7,200	10,700
Smelter output	200	200	200
Manganese ore	r 25,258	13,689	9,494
Mercury 76-pound flasks	r 4,676	6,544	8,592
Zinc ore and concentrate:			
Gross weight:			
Zinc-lead ore, hand-sorted	24,413	34,032	56,161
Zinc concentrate	r 11,724	35,882	22,204
Metal content e	10,100	22,800	21,200
NONMETALS			
Abrasives, natural, emery	30,864	43,457	116,020
Asbestos	r 3,543	5,169	1,685
Barite	r 22,203	33,074	29,042
Boron minerals	r 265,884	324,470	388,378
Cement thousand tons	r 4,728	5,796	6,371
Clays, all types e do	15,000	r 15,000	15,000
Fertilizer minerals:			
Crude, phosphatic, phosphate rock	--	1,500	--
Manufactured, chemical, all types	355,130	370,776	NA
Fluorspar	r 1,726	2,094	1,665
Gypsum e thousand tons	220	r 280	320
Magnesite (crude ore)	r 118,942	219,033	284,807
Marble e cubic meters	50,000	50,000	50,000
Meerschaum kilograms	82,350	41,250	20,250
Quartzite	NA	38,394	NA
Pyrite, cupreous:			
Gross weight	136,817	129,844	91,087
Sulfur content	65,207	61,884	43,412
Salt, all types e thousand tons	567	570	580
Sand, glass	12,800	17,352	NA
Sodium sulfate	11,039	13,785	e 14,000
Sulfur, refined	24,180	25,700	26,760
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	25,849	21,380	NA
Coal:			
Bituminous [3] thousand tons	4,312	4,748	[2] 4,370
Lignite [3] do	5,278	5,511	[2] 5,690
Total [3] do	9,590	10,259	10,060
Coke:			
Coke oven do	1,430	1,443	e 1,620
Gasworks e do	180	180	180
Semicoke e do	70	70	70
Total do	1,680	1,693	1,870
Fuel briquets e do	50	50	50
Petroleum:			
Crude thousand 42-gallon barrels	r 22,235	25,774	24,776
Refinery products:			
Gasoline, aviation do	--	10	NA
Gasoline, motor do	7,757	7,890	8,329
Jet fuel do	1,281	1,287	586
Kerosine do	3,666	3,277	3,383
Distillate fuel oil do	11,221	10,625	12,088
Residual fuel oil do	18,419	19,714	21,835
Other do	2,843	3,237	3,985
Refinery fuel and losses do	1,376	1,122	e 1,225
Total do	46,563	47,162	e 51,431

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

[1] In addition to the commodities listed, other crude construction materials including a variety of industrial stone are undoubtedly produced, but information is inadequate.

[2] Estimated from reported run-of-mine production.

[3] Sales.

Table 2.—Turkey: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Antimony ore and concentrate	2,014	3,542	NA.
Chromite including all grades	r 386,916	497,124	United States 102,865; Czechoslovakia 53,152; Hungary 40.
Copper metal including alloys, blister	r 15,139	6,540	Yugoslavia 3,492; Japan 2,540.
Iron and steel, ferrochromium	9,833	7,210	NA.
Lead ore and concentrate	8,364	17,223	Bulgaria 9,320; Belgium-Luxembourg 4,422.
Manganese ore and concentrate	r 9,508	4,393	United States 3,048.
Mercury ... 76-pound flasks	r 3,046	6,527	Netherlands 2,553; United Kingdom 1,421.
Zinc ore and concentrate	19,116	25,565	Belgium-Luxembourg 10,100; Bulgaria 6,864.
Other:			
Ore and concentrate	7,998	7,284	Mainly to West Germany.
Slag and other metallurgical residues	230	1,956	Belgium-Luxembourg 8.
NONMETALS			
Abrasives, natural	r 23,505	48,339	France 35,332; Netherlands 6,925; United Kingdom 6,082.
Barite	16,682	25,476	United States 11,900; West Germany 8,616.
Borates	r 232,055	292,971	Italy 81,630; France 69,060.
Magnesite	55,477	59,895	Austria 48,170.
Pyrite	r 66,180	88,586	Italy 62,586; West Germany 26,000.
Salt	--	33,441	Yugoslavia 21,432.
Stone, sand and gravel, marble	r 3,325	3,391	Italy 1,488.
Other	r 2,608	29,468	France 26,468; Netherlands 2,472.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	4,401	141,931	NA.
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	74	--	
Residual fuel oil ... do	990	2,006	Italy 1,169; Greece 344.

r Revised. NA Not available.

Copper.—Development and construction work on the Kardeniz Bakir Işletmeleri (KBI), (Black Sea Copper Co., Inc.), project continued during 1970. KBI is a joint venture of the State owned Etibank, which holds 49 percent of the shares, and other leading private Turkish banks. The project now is expected to be completed by 1972 at a final total cost of $100 million. The complex embraces the copper mines at Kure, Murgul, and Espiye, and a smelter in Samsun on the Black Sea coast. The eventual production of KBI will be 41,000 tons of blister copper, 365,000 tons of sulfuric acid, 6,817 kilograms of silver, and 234 kilograms of gold annually.

Production of copper increased 3 percent, whereas the blister copper output declined 19 percent in 1970 compared with 1969 figures. For the fourth consecutive year there was a decline in blister copper production mainly because of the low grade of ore and the mixing of marginal ore into the feed.

Iron and Steel.—Dravo Corp. of Pittsburgh, Pa., was awarded a $9.5 million contract by the Turkish Government to design, supply, and supervise construction of an iron ore sintering facility for Eregli Demir ve Celik Fabrikalari T.A.S. (Erdemir), the largest integrated steel mill in Turkey. In addition Dravo will design and fabricate the heart of the facility, a Dravo-Lurgi sintering machine and a sinter cooler. The sintering plant will produce 1.3 million metric tons per year of sized sinter from Turkish ore to provide a substantial portion of the blast furnace feed in Erdemir. Dravo Corp. will also design expansions of the existing iron ore and limestone storage and handling facilities and will be responsible for operator training and initial operation of the plant.

Erdemir is about 175 miles north-northeast of Ankara on the Black Sea and includes the largest blast furnace and the only basic oxygen furnace in the Middle East. The Dravo contract is a segment of an expansion program being financed in part by the U.S. Agency for International Development (AID).

Construction work on a new 1.2-million-ingot-ton per year steel mill, the third in Turkey, started in the early part of 1970 at Iskenderun, on the Mediterranean coast of southeastern Turkey. The contract, amounting to $265 million for the design and supply of equipment, was signed in October 1969 between Turkiye Demir ve Çelik, (Turkish State steel corporation) and Tiajpromexport of the Soviet Union.

Table 3.—Turkey: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys:		
Unwrought	r 12,645	13,255
Semimanufactures	r 2,981	6,150
Copper metal including alloys, all forms	380	323
Iron and steel:		
Scrap	64,374	38,919
Pig iron including cast iron	r 26,083	--
Ferromanganese and other ferroalloys	8,772	13,871
Primary forms, blooms, billets, slabs, sheet, bars	r 167,853	--
Semimanufactures	80,111	90,777
Lead metal including alloys, all forms	4,584	3,703
Nickel metal including alloys, all forms	r 174	95
Tin metal including alloys, all forms ... long tons	r 1,090	808
Zinc metal including alloys, all forms	r 9,499	8,588
Other:		
Ore and concentrate of molybdenum, vanadium, etc	395	--
Oxides, hydroxides, and peroxides of metals n.e.s	101	121
Base metals including alloys, all forms	406	13
NONMETALS		
Asbestos	8,311	10,072
Cement	360,650	270,449
Clays and products	r 2,688	1,626
Feldspar and fluorspar	r 1,266	2,612
Fertilizer material, crude, phosphatic	r 105,180	125,519
Graphite	247	328
Mica	--	612
Stone, sand and gravel, quartz and quartzite	r 661	--
Sulfur	r 9,483	14,405
Other, crude	r 3,066	144
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	r 9,300	10,915
Coke	16,091	18,914
Petroleum:		
Crude ... thousand metric tons	r 2,969	2,558
Refinery products:		
Gasoline ... thousand 42-gallon barrels	304	347
Kerosine and white spirit ... do	413	440
Distillate fuel oils ... do	1,264	2,312
Residual fuel oils ... do	490	564
Lubricants ... do	876	695
Mineral jelly and wax ... do	27	28
Total ... do	3,374	4,386

r Revised.

The feasibility study and site selection survey by John Miles and Partners, Ltd., of London who also are acting as consulting engineers to the Turkish Government, was made in 1969.

The Iskenderun steel mill will be composed of an extensive raw material preparation plant, two blast furnaces, a Linz-Donowitz steel plant, and continuous casting and rolling facilities to produce billets, sections, and rods. Completion of the project will take 5 years. However, the original design includes provisions for subsequent expansion of the capacity to 2 million tons per year.

Most of the cost will be paid for in Turkish exports over a period of 15 years, at an annual interest rate of 2.5 percent, through a mechanism of trade between Turkey and the Soviet Union.

During 1970, production of iron ore, pig iron and ferroalloys, and crude steel increased 10 percent, 9 percent, and 12 percent, respectively, compared with 1969 level of output.

Lead-Zinc.—The feasibility studies carried out on the lead-zinc deposits near Kayseri, in central Anatolia by the State Planning Organization (SPO), have proven an ore body of 3.5 million metric tons of high-grade lead-zinc ore. To develop this deposit, a private company known as Cinkur was formed in 1970. Cinkur's planning includes a zinc and lead smelter and a refining plant with an annual capacity of 20,000 tons of electrolytic zinc, 10,000 tons of zinc plates, 4,000 tons of galvanized zinc, and 2,000 tons of refined zinc. No information was available on lead production.

Foreign investment needs for the project was estimated at around $10 million. Discussions were initiated with the International Finance Corporation of the World Bank and a private concern in Belgium, but due to a dispute about the concession boundaries, negotiation with both organizations had ceased by yearend.

Production of lead-zinc ore was 55,040 tons in 1970, as against 61,514 tons in 1969. Etibanks Keban mine produced 26,850 tons of the 1970 total, and the remaining ore was produced by Rasih ve Ihsan and other private mine operators.

Manganese.—Output of manganese ore in 1970 registered a 31-percent decrease from the production level of 1969. The main producers during the year continued to be the Silivri mine in Thrace, northwestern Turkey and Cöplerköy mine, northwest of Erzincan in central Anatolia.

The lower level of manganese production was attributed to depletion of ore reserves of metallurgical grade in many operating mines, and the lack of intensive exploration activities by both the public and the private sector in Turkey.

Mercury.—The State economic enterprise Etibank completed construction of new mercury retorting facilities in the early part of 1970. The production of mercury ore and metallic mercury during 1970 was characterized by significant increases of 23 and 31 percent, respectively. Mercury ore production from both private and state enterprises totaled 138,929 tons compared with 112,907 tons in 1969. The total number of 76-pound flasks amounted to 8,592, of which 5,492 flasks were produced from Etibank's Sizma and Halikay retorting plants.

NONMETALS

Abrasives.—Both production and export of natural emery increased, production by 167 percent and export by 97 percent during 1970. Because of the high quality of Turkish natural emery, its availability to the European market, as well as the lack of much competition, Turkish authorities anticipate a substantial increase in its production in the future. The gross value of emery production was approximately $1 million in 1970.

Barite.—Production of barite in 1970 decreased 12 percent compared with the 1969 output. The decrease was due to the reduction in exploration for petroleum both by foreign and domestic companies.

Boron.—The gross value attributed to boron in the overall economy of Turkey was $6.5 million in 1970. Production was 20 percent higher than in 1969. Etibank remained the most significant producer, followed by Rio Tinto Zinc Co., Rasih ve Ihsan Ltd., and Haşmettin Yakal Company.

Most boron minerals produced in Turkey are exported. A few thousand tons are used in the boric acid plant at Bandirma, a port on the Sea of Marmara.

Cement.—According to United Nations sources, production of cement in 1970 increased 9.9 percent compared with 1969 output. The construction of the Hostas Cement Plant and the Hostas Cement Product Plant in the southeastern part of Turkey continued in 1970. Both of these plants are expected to go into production by 1973 and it is anticipated that the output of cement will meet the total domestic demand as well as supply some for the export market in Europe. In the second 5-year development plan, Turkish domestic consumption of cement was expected to be about 8 million metric tons.

Clays.—*Bentonite.*—The Çankiri bentonite deposits, discovered by MTA in 1969, 70 kilometers northeast of Ankara, were further developed in 1970. A small pilot plant was erected near the deposit to investigate ore beneficiation and examine possible usage of bentonite in the foundry industries of Turkey. By yearend no detailed information on the economical reserves was available.

Fertilizers.—The construction of Mersin fertilizer plant, owned 80 percent by Cukobirlik, a cotton growers association of Turkey, and 20 percent by an unknown French company continued during the year. The plant, scheduled for completion in 1971 at a cost of $13.3 million, will have an initial capacity of 180,000 tons annually, rising to 200,000 tons after 1 year of operation.

Turkey's only superphosphate production plant under construction since 1969, for Azot Sanayii at Elazig, came into limited operation during 1970. Initially, this plant will deliver only 100,000 tons per year, approximately half of its planned capacity, but this output will subsequently be increased to meet the design specification of 220,000 tons per year.

Gypsum.—The gypsum production of Turkey increased 14 percent during 1970, satisfying increased demand by the cement and building industry. There is no accurate record of the number of gypsum producers or of plant locations in Turkey; however, it is estimated that hundreds of small backyard kilns operated seasonally so that local demands could be met.

Magnesite.—Production of crude magnesite ore showed an increase of 30 percent in 1970 over the 1969 output. Most crude ore and some calcined ore was exported to Austria with small amounts to Belgium-Luxembourg. Contribution of magnesite mining during 1970 to the Turkish economy was more than $2.5 million.

The chrome-magnesite refractory plant at Konya, a joint venture of the State-owned Sumer Bank and Maruhendi Idla Company Ltd. of Japan, produced about 12,000 tons of chrome-magnesite firebricks, building material, and dead-burned magnesite. Most of the years production was exported to Japan.

Pyrite.—Pyrite output in 1970 was 30 percent below 1969 production. The decrease was the second successive decline from the record high production of 1968. Development work on the Bakir Baba deposits and the Cure and Espia deposits continued during the year. Upon completion of the Black Sea Copper project and smelter in Samsun, it is expected that pyrite production will substantially increase.

MINERAL FUELS

Coal.—Coal, primarily lignite, was mined from the Zonguldak basin at about the same rate as in 1969. Overall coal production in 1970 showed a decrease of 2 percent compared with 1969 output.

The main Elbistan lignite deposits located in Eastern Turkey in the Province of Maraş, covering approximately 100,000 square meters, were opened for exploitation and development in 1970. The Elbistan lignite deposit has a proven reserve of 3.2 million tons with an average calorific value varying between 1,050 and 1,200 kilocalorie per kilogram.

Two U.S. manufacturing companies, Lake Shore Mines Ltd. and Nordberg Company, were awarded the contract for complete hoisting and shaft equipment to be installed at the new Asma coal mine in the Zonguldak basin. Asma mine, when in operation, will produce 10,000 tons of bituminous coal per day from a depth of 1,174 feet.

Natural Gas.—The natural gas pipeline from Iraq to Turkey, which had been in the blueprint stage, was modified significantly during 1970. The new project will include a 400-kilometer pipeline costing $50 million and will run from Kirkuk in northern Iraq to Batman in southeast Turkey. By yearend financing of the project was still under discussion.

Turkiye Petrolleri Anonim Ortakligi (TPAO), (Turkish Petroleum Corp.) reported in November 1970 that natural gas discoveries in Thrace, northwest of Istanbul, had tested favorably. The gas was found at about a 3,000-meter level. However, further tests were underway before commercial reserves could be confirmed.

Petroleum.—Crude petroleum production during 1970 was 3.9 percent below the 1969 output level. The leading producer was Shell, followed by TPAO, a State-owned petroleum company, and Mobil Oil Company.

TPAO and Gulf Oil Corp.'s joint exploration activities in the offshore areas of the Bay of Iskenderun continued during the year. Preliminary geological and geophysical work was completed in May 1970, and drilling followed immediately. Apparently three wells were drilled in the area at a cost of $6.5 million without promising results. The company was debating continuation of exploration in the area at yearend.

As a result of a contract between TPAO and Westates Petroleum Co. of Los Angeles, Calif. signed in 1969, two dry wells were drilled in an offshore area of the Black Sea Coast near the Bulgarian border. By yearend a decision on future activities under this contract was pending, the outcome to be determined by evaluation of the information obtained from the two drilled holes. Under agreement, Westates Petroleum Co. has contracted to spend $2.3 million on exploration and drilling and has already advanced TPAO a $1 million bonus when it decided to drill.

Shell Oil Co. has discovered a new field, Malatepe, 25 kilometers north of Diyarbakir. Detailed information on this discovery was not available by yearend. The company's Piyankoy finding, in the Gaziantep district, proved to be disappointing, with an output of less than 50 barrels per day.

Geological and geophysical surveys during 1970 by various international petroleum companies were intensified. Index Geophysical Survey ran a refraction seismic survey of districts 5 and 6 in southeastern Turkey, near the Syrian-Iraqui border for International Resources Corp; Gulf Oil Corp. conducted stratigraphic work on district 7;

and Beach Petroleum Co. made gravity surveys in district 5.

In December 1970, the Petroleum Administration announced a grant of 25 Black Sea offshore exploration permits to Texaco, Inc. If commercially exploitable amounts of petroleum are found, the contract calls for a joint development venture with TPAO.

An announcement in the early part of 1970 by the Petroleum Administration stated that the Canadian firm of Peyto Oils Ltd. received an exploration permit for the area around Erzurum in eastern Turkey. By yearend no details of the exploration activities were available.

Refineries.—Construction work on the Soviet-provided petroleum refinery at Aliaga, near Izmir, continued during 1970. Badger Turkey, Ltd., a Turkish subsidiary of British Badger, is handling all construction at the site with the exception of the tank farm being erected by a Turkish engineering firm. Badger was also constructing the adjacent lube oil plant for the TPAO under the general engineering supervision of Foster Wheeler Italiana. The project employed some 4,000 laborers and technicians including over 100 Soviet citizens. The completion date is slated to be early in 1972. When the refinery is completed, it will be capable of producing 3 million tons of refined products and will require 65,000 tons of crude oil imports.

Crude petroleum processed in refineries in Turkey increased 10 percent in 1970 over 1969 output. The origin of crude petroleum processed in Turkey from 1969 to 1970 as feed for the refineries and individual refinery production is presented in the following tabulation in metric tons:

Refinery plant and location	Origin	1969	1970
Turkiye Petrolleri Anonim Ortakliqi (TPAO): Batman	Domestic	922,540	799,313
Istanbul Petrol Refineresi A.S. (IPRAS): Izmit	do	983,718	858,559
	Imported	1,044,741	1,257,580
Anandolu Tasfiyehanesi A.S. (Ataş): Mersin	Domestic	1,741,171	1,795,770
	Imported	1,893,853	2,507,462
Total		6,586,023	7,218,684

The Mineral Industry of the U.S.S.R.[1]

By V. V. Strishkov [2]

In the U.S.S.R., the world's second largest producer of industrial products, 1970 marked the end of the eighth 5-year plan (1966–70). Compared with 1969 performance, production (in millions of tons) [3] has increased for raw coal by 16; oil, by 25; pig iron, by 4.3; steel, by 5.6; finished, rolled, ferrous metal, by 3.2; mineral fertilizers, by 9.5; cement, by 5.4; and natural gas by 17.2 billion cubic meters. Output of many base and precious metals, particularly nickel, aluminum, cobalt, gold, and platinum was higher than in 1969.

The U.S.S.R. was the world's leading producer of cement, iron ore, manganese ore, chrominum ore, platinum-group metals, and potassium salts. It occupied second place, following the United States, in world output of aluminum, smelter lead, steel, petroleum, natural gas, coal, and phosphate rock; it ranked second, after Canada, in the production of mine zinc, nickel, and asbestos; and it followed only the Republic of South Africa in gold production.

Practically all mineral commodity exports rose in 1970, with fuel exports showing the fastest growth. Oil and gas exports are expected to continue rising, despite increasing home demand and reported production and transportation difficulties. Despite the rise in exports, however, there were shortages of many mineral raw materials needed by Soviet consumer industries. Exports of mineral commodities produce foreign exchange to help pay for imports, even though all mineral commodities exported could be consumed within the country.

During 1970 there were significant developments in all branches of the mineral industry, and many new facilities became operational. Exploration for all metals, fuels, and nonmetallic minerals continued, including offshore prospecting for oil and gas in the Caspian Sea. The commissioning of production capacities through new construction and expansion or renovation of existing facilities in 1970, in million tons except as noted, follows:

Iron ore, crude	39.0
Coal, raw	28.8
Pig iron	1.0
Steel	3.6
Semimanufactures, ferrous	4.9
Mineral fertilizers	9.8
Cement	6.5
Powerplants, million kilowatts	12.2

Plans for new construction and renovation of existing enterprises were not met in 1970, including projects for iron ore, coal, natural gas, steel, mineral fertilizers, cement, and many other projects.

Mineral industry expansion continued to be achieved mainly by the inputs of labor and capital rather than by advancing technology. It is estimated that 2 to 3 times more capital and labor in real terms were required in the U.S.S.R. than in the principal countries of the West to achieve a given increase in mineral output. The productivity of labor and equipment was much below planned levels. More than half of the machinery employed in the mineral industry was idle. This was related to the quality of the machines and the unsatisfactory supply of spare parts and materials at the mines and plants.

Practically all sectors of the mineral industry maintained greater numbers of production personnel than called for by plan targets. According to Pravda,[4] 17 blast furnaces, 23 open hearth furnaces, 7 converters, and 43 different mills, which were put into operation after 1960, employed 18,000 workers above the number envisaged in the plan. The Dzhezkazgan copper-metallurgical complex employed 20

[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.
[3] All tons in this publication are metric tons.
[4] Pravda (Moscow). Jan. 18, 1971, p. 2.

percent above the number of workers called for by the plan.[5]

At many mines and plants, up to half of the production workers were employed in manual labor, including surface loading and unloading. At polymetal mines in Kazakhstan, the proportion of mechanized labor did not exceed 34 percent, with the majority of auxiliary operations performed manually.[6] In underground coal mining, over 50 percent of the workers were nonmechanized. From 50 to 65 percent of the workers were engaged in ancillary jobs in all branches of the Soviet mineral industry in 1970.

The U.S.S.R. continued to experience considerable difficulty in the construction of mineral industry projects because of shortages of equipment, materials, and labor.

Efforts were dispersed over a large number of projects, with the work taking 1½ to 2 times as long as specified by the U.S.S.R. State Construction Committee. The 10- to 15-year lead time required to develop a mine with a capacity of 1 to 2 million tons per year contributed to disparities between capacities of mines, concentration plants, and metallurgical plants. Large copper and lead smelters, and the Pavlodar alumina plant in Kazakhstan were operating well below full capacity because not enough ore was mined.[7] Already delayed startups of the Sayak, Karagalinsk, Orlovsk, Irtysh, Glubokiy, and Tishinsk nonferrous mines in Kazakhstan were rescheduled for still later dates.[8]

Owing to the development difficulties, many new mines and plants operated at lower capacity than originally planned. On January 1, 1969, planned capacity goals had not been reached at 64 blast furnaces, 84 open hearth furnaces, and 35 rolling mills. On January 1, 1971, designed goals had not been at•ined at all coal mines of the Karaganda basin in Kazakhstan.[9] Stocks of material and equipment were reported to be 50 to 80 percent above planned levels, and those surpluses, without adequate storage, resulted in additional losses through deterioration.

The turnover of personnel in individual mineral industry operations ranged from 25 to 80 percent per year. This was caused mainly by the lag in building houses and in providing public and medical services, by low material incentives, and by heavy manual work and unsafe working conditions.[10] Turnover of personnel in the nonferrous metals industry increased from 20.1 percent in 1967 to 30 percent in 1969 and was 40 percent in the chemical industry.[11] An especially large number of workers in the coal industry were released for violating labor discipline. The proportion of these workers in the total turnover of the Ukraine coal industry is 2.6 times higher than the proportion for the republic's industry as a whole.[12]

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 1970, fatal injuries occurred at 45 percent of the Soviet coal mines.[13] There were at least three coal (methane) explosions in the Soviet Union in 1966; four in 1967; five in 1968; and four explosions in 1969.[14]

Reportedly, the average monthly earnings of Soviet workers and employees was 122 rubles,[15] or 4.3 percent above those in 1969.

Government Policies and Programs.— The Soviet mineral policy continued to be based on the principle of maximum self-sufficiency at any price. With State-owned and State-operated enterprises and low-wage labor, the U.S.S.R. has become the most self-sufficient of the world's leading industrial nations in minerals and metals. Furthermore, the actual or estimated cost of production of a given commodity in the U.S.S.R. may not play as great a role in the structure of the selling price on the

[5] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. March 1971, No. 3, p. 24.

[6] Tsvetnye metally (Nonferrous Metals), Moscow. January 1971, No. 1, p. 6.

[7] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 2, 1970, p. 22.

[8] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 3, 1971, pp. 55–56.

[9] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 3, 1971, p. 24.

[10] Kommunist (Yerevan, in Russian). February 25, 1970, p. 1

[11] Ekonomicheskaya gazeta (Economic Gazette), Moscow. 1969, No. 47, pp. 4–5.

[12] Eknonomika Sovetskoy Ukrainy (Economics of the Soviet Ukraine), Kiev. March 1971, No. 3, pp. 22–28.

[13] Bezopasnost' truda v promyshlennosti (Labor Safety in Industry), Moscow. March 1971, No. 3, p. 4.

[14] Bezopasnost' truda v promyshlennosti (Labor Safety in Industry), Moscow. March 1971, No. 3, p. 11.

[15] Official exchange rate 1 ruble = US$1.11. Approximate buying power of 1 ruble, relative to prices in the United States for hard goods and food, ranges from about 20 to 50 cents.

domestic or international market because of overriding priorities or more dominant interests. In the Soviet economy, therefore, the selling price of a given commodity may be set at any reasonable level which could yield the desired overall results. Such tradeoffs over a wide 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.

Reportedly, considerable progress was made during the eighth 5-year plan period (1966–70). The national income was 41 percent higher in 1970 than in 1965, and industrial output had risen by 50 percent for the same period. Increases in output claimed for key industries included 45 percent for oil, 54 percent for gas extraction, 27 percent for steel, and 8 percent for coal. The share of oil and gas in the Soviet fuel production balance rose from 52 to 59 percent.

Despite these impressive figures, planned production goals and demand estimates proved to be somewhat off the mark. Compared with the announced original objectives of the 5-year plan, the production of iron ore, pig iron, steel, coal, natural gas, cement, mineral fertilizers, and many other mineral commodities were below both industrial needs and planned targets. Although new goals were set and efforts were directed to fulfilling quantitative targets in the mineral commodities, there were reports that a considerable part of the industrial output did not meet established quality standards.

The new (ninth) 5-year plan was drafted in 1970 and approved by the 24th Congress of the Communist Party of the Soviet Union in April 1971. The plan foresees an increase in gross industrial production of 42 to 46 percent, or slightly less than that of the previous 5-year plan; envisages an 18- to 20-percent reduction in consumption of rolled ferrous metals by the machine-building and metal-processing industries; and not less than a 7- to 10-percent decrease in industrial fuel consumption. The plan calls for savings in rolled metal of 9 to 11 percent and in cement of 8 to 10 percent.

The level of Soviet industrial production in 1955, 1960, 1965, 1970, and planned production for 1971 and 1975, in million metric tons unless otherwise specified, follows:

Commodity	Production			1970		Planned production		Percent of increase	
	1955	1960	1965	Original 5-year plan target	Reported production	1971	1975	1970–65	1975–70
Iron ore	71.9	105.9	153.4	211.5	194.2	NA	254	26.6	30.8
Pig iron	33.3	46.8	66.2	94–97	85.9	NA	NA	29.8	NA
Steel	45.3	65.3	91.0	124–129	116.0	NA	142–150	27.5	22–29
Semimanufactures, ferrous	30.6	43.7	61.7	NA	82.1	NA	101–105	33.1	23–28
Steel pipes	3.5	5.8	9.0	14–15	12.4	NA	NA	37.8	NA
Cement	22.5	45.5	72.4	100–105	95.2	99.9	122–127	31.5	28–33
Mineral fertilizers (Soviet standard units)	9.7	13.9	31.3	62–65	55.4	61.3	90	77.0	62
Coal, raw (bituminous, anthracite, and lignite)	389.9	509.6	577.7	665–675	624.0	633.0	685–695	8.0	10–11
Natural gas (billion cubic meters)	10.4	47.2	129.4	225–240	200.0	211.0	300–320	54.6	50–60
Peat, fuel	50.8	53.6	45.8	92.0	57.3	NA	NA	25.1	NA
Petroleum, crude	70.8	147.9	242.9	345–355	353.0	371.0	480–500	45.3	36–42
Oil shale	10.8	14.1	21.3	28.0	23.5	NA	NA	10.3	NA

NA Not available.

The following data are the principal goals for the individual mineral commodities in the coming 5 years:

1. In the iron and steel industry special attention is to be devoted to improving the quality of iron and steel, expanding the range of products, and speeding up processing. Technological changes to be emphasized include increasing use of open-pit iron ore mining, erection of large-size (5,000 cubic meters) blast furnaces, and increased smelting of pig iron, using oxygen and natural gas. The plan calls for improvement of preparation of iron ore raw material and the more extensive (by four times) adoption of pelletization. Also, additional and larger (up to 350-ton capacity) oxygen converters are to be installed, and output of oxygen-converter steels is to be increased by 30 percent.

2. Priority has been given to raising output of nonferrous alloy metals, the output of natural diamonds, and to development of the raw material base, particularly for production of alumina, lead, tungsten, molybdenum, antimony, tin, and mercury. Aluminum output is to be increased 50 to 60 percent, and copper production is to be increased 35 to 40 percent.

3. Coal (and particularly coking coal) production is to be increased although the number of workers is to remain unchanged. Surface mining is to account for up to 30 percent of the total coal output as compared with 26 percent in 1970.

4. The growth rate of petroleum and natural gas production is to be somewhat retarded although the addition of productive capacity at the new oil and gas production centers in West Siberia and West Kazakhstan, together with a considerable increase in output at the existing installations, is regarded as a high-priority goal. A 30,000-kilometer-addition to trunk and branch gas pipelines is also planned. The share of oil and gas in the national primary energy production balance is to increase from 59 percent in 1970 to 67 percent in 1975. Petroleum refineries are to raise their output 50 percent above the 1970 level.

5. The production of high-quality, concentrated, and complex mineral fertilizers is to be raised to 80 percent of the total mineral fertilizer output by 1975.

6. Some 65 to 67 million kilowatts of generating capacity, mostly large thermal electric stations, are to be installed under the plan and will account for most of the additional electric power supply in 1975.

7. The plan calls for intensified prospecting for oil and gas, particularly in the European part of the U.S.S.R., and for coking coal, high-grade bauxite, diamond, and mineral fertilizers; prospecting for oil and gas deposits and alluvial minerals is to be carried on in offshore zones.

8. Capital investment in the U.S.S.R. for the next 5 years has been set at 480 to 490 billion rubles, compared with 352 billion under the 1966–70 plan. In 1971 alone, some 11 billion rubles are dedicated to fuels and energy enterprises, a 12-percent gain over the investments of 1970. One of the most important developments under the new 5-year plan, however, is the geographic shift in new energy projects. In the coming 5 years, there is to be an accelerated development in the regions east of the Urals, particularly in Siberia, where new fuel and power centers are to be installed.

PRODUCTION

Because mineral production statistics for many commodities are not reported in official Soviet publications, much of the output data in the production table is estimated, and at best represents an order of magnitude and an indicated trend from that of the previous year. The increase in Soviet mineral production in 1970 was mainly caused by additional investment of capital and labor rather than by higher productivity. Production capacity for almost all mineral commodities rose during the year.

The Soviet Union produced 70 elements during 1970. The Asian part of the U.S.S.R. (east of the Urals) provided 43 percent of the total Soviet coal output, 30 percent of the natural gas, 18 percent of the crude oil, and over 26 percent of the electric power. The Russian Soviet Federated Socialist Republic (R.S.F.S.R.) continued to rank first among the Soviet Republics in mineral production and produced more than 80 percent of the petroleum, over 50 percent of the coal and steel, and 66 percent of the electric power in 1970.

The Ukraine ranked first in the output of coking coal, manganese, and iron ore and second in natural gas. It provided over one-third of the total Soviet coal and natural gas production, about 57 percent of the output of iron ore, 48 percent of pig iron production, 42 percent of the output of steel and rolled ferrous metal products, and nearly half the metallurgical equipment produced in the Soviet Union.

The Asian republic of Kazakhstan, one of the most important base metal producing areas in the U.S.S.R., occupied third place in Soviet mineral production and was the leading producer of lead, zinc, chromite, and rare metals. Coal production was also important, ranking third in the Soviet Union. The metallurgical enterprises in the Altay region were held back by raw material shortages in 1970 stemming from a lag in mine expansion and from the delayed introduction of advanced beneficiation facilities. Large amounts of rhenium and osmium were irretrievably lost in slag and dumpings, especially at the Dzhezkazgan and Boshchekul copper deposits. Great amounts of gold were also lost in extracting and processing rich Altay ores.[16]

At the beginning of 1971, the Soviet steel industry continued to operate 43 outdated blast furnaces, 80 open hearth furnaces, and 97 rolling mills at which the production expenses were 2 to 5 times higher than on the modern units.[17]

[16] Kazakhstanskaya pravda (Alma-Ata, in Russian). March 14, 1971, p. 2.
[17] Stal' (Steel), Moscow, March 1971, No. 3, pp. 193–198.

Table 1.—U.S.S.R.: Estimated[1] production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970
METALS			
Aluminum:			
Ores and concentrates:			
Bauxite, 26 to 52 percent alumina	5,000	5,000	5,000
Nepheline concentrate, 25 to 30 percent alumina	1,000	1,000	1,000
Alunite ore, 16 to 18 percent alumina	1,000	1,000	1,000
Metal, smelter:			
Primary	1,000	1,050	1,100
Secondary	100	120	120
Antimony mine output, metal content ... metric tons	6,500	6,600	6,700
Arsenic, white (As_2O_3) ... do	7,050	7,100	7,150
Beryl, cobbed, 10 to 12 percent BeO ... do	1,200	1,250	1,300
Bismuth mine output, metal content ... do	45	50	50
Cadmium ... do	2,250	2,300	2,350
Chromite ore, 30 to 56 percent Cr_2O_3	1,650	1,700	1,750
Cobalt mine output, metal content ... metric tons	1,450	1,500	1,550
Copper:			
Ores, gross weight, 0.5 to 2 percent Cu	r 52,000	r 55,000	57,000
Blister:			
Primary	r 520	r 550	570
Secondary	r 135	r 140	140
Gold ... thousand troy ounces	5,900	6,250	6,500
Iron and steel:			
Iron ore, 55 to 63 percent Fe[2]	176,616	r 186,134	194,200
Iron ore sinter[3]	128,235	r 132,988	138,152
Pellets[3]	7,186	r 9,371	10,620
Pig iron and ferroalloys:[3]			
Pig iron for steelmaking	67,792	r 71,521	75,648
Foundry pig iron	9,588	r 8,930	9,160
Spiegeleisen	75	r 86	102
Ferromanganese	944	r 879	968
Other blast furnace ferroalloys	389	r 219	55
Total	78,788	r 81,635	85,933
Steel:[3]			
Ingots	99,741	r 103,263	108,538
Steel for casting	6,791	r 7,053	7,335
Total	106,532	r 110,316	115,873
Semimanufactures:[3]			
Sections	29,983	r 30,564	31,639
Wire rods	6,589	r 6,868	6,946
Pipe stock	4,232	r 4,320	4,611
Tubes from ingots	1,310	r 1,441	1,497

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	1968	1969	1970
METALS—Continued			
Semimanufactures—Continued [3]			
Plates and sheets:			
More than 4.75 millimeters thick	9,232	r 9,644	10,604
Other	12,181	r 12,686	13,898
Total plates and sheets	21,413	r 22,330	24,502
Strip	6,901	r 7,009	7,548
Railway track material	3,370	r 3,528	3,568
Wheels, tires, and axles	829	r 852	925
Unspecified for sale	584	r 649	794
Other	98	r 81	69
Total semimanufactures	75,309	r 77,642	82,099
Selected end products: [4]			
Welded pipes and tubes	6,412	r 6,530	7,041
Seamless pipes and tubes	4,803	r 5,021	5,391
Total	11,215	r 11,551	12,432
Cold-rolled sheets	4,208	r 4,533	5,124
Tinplate	497	r 505	510
Galvanized sheets	451	r 481	507
Electrical sheets	921	r 940	952
Wire, plain	2,778	r 2,879	2,954
Lead:			
Primary	420	440	440
Secondary	85	90	90
Magnesium metal including secondary	42	45	50
Manganese ore [2]	6,564	r 6,551	6,841
Mercury metal including secondary ... 76-pound flasks	45,000	47,000	48,000
Molybdenum mine output, metal content ... metric tons	7,000	7,500	7,700
Nickel metal including secondary	100	105	110
Platinum ... thousand troy ounces	2,000	2,100	2,200
Silver including secondary ... do	35,000	37,000	38,000
Tin:			
Primary ... long tons	26,000	27,000	27,000
Secondary ... do	8,000	10,000	10,000
Titanium metal	11	12	12
Tungsten concentrates, contained tungsten ... metric tons	6,200	6,500	6,700
Zinc:			
Recoverable metal content of domestic ores	540	610	610
Metal:			
Primary	575	610	610
Secondary	65	70	70
NONMETALS			
Asbestos	820	960	1,065
Barite	260	280	285
Boron materials and compounds, B_2O_3 content	69	70	70
Cement [2]	87,512	89,800	95,200
Kaolin (including china)	1,700	1,800	1,800
Corundum ... metric tons	6,000	6,000	6,500
Diamond:			
Gem ... thousand carats	1,400	1,500	1,600
Industrial ... do	5,600	6,000	6,250
Total ... do	7,000	7,500	7,850
Diatomite	360	360	370
Feldspar	240	250	250
Fertilizer materials:			
Crude:			
Nitrogen compounds, N content equivalent [2]	4,177	r 4,509	e 5,250
Phosphate:			
Apatite:			
Ore, 17.7 percent P_2O_5	[2] 24,000	r 25,500	[2] 27,200
Concentrate, 39.4 percent P_2O_5	[2] 9,700	10,500	[2] 11,330
Sedimentary rock:			
Ore, 13 percent P_2O_5	16,000	17,500	19,000
Concentrate, 19 to 25 percent P_2O_5	8,000	8,750	9,500
Potash, K_2O equivalent [2]	r 3,123	r 3,244	e 4,450
Manufactured: [2]			
Nitrogenous, gross weight	20,375	r 21,979	e 26,000
Phosphatic, gross weight	10,343	r 11,077	e 12,600
Potassic, gross weight	r 7,508	r 7,787	e 10,700
Phosphatic meal	5,169	r 5,076	e 6,000
Others	r 83	r 22	e 100
Total	r 43,478	r 45,941	55,400

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	1968	1969	1970
NONMETALS—Continued			
Fluorspar	380	400	410
Graphite	70	70	75
Gypsum [2]	4,697	r 4,565	e 4,700
Lime, dead burned [2]	20,716	r 21,341	e 21,500
Magnesite	3,000	3,100	3,100
Mica	36	37	38
Pyrite:			
Gross weight	3,500	3,500	4,000
Sulfur content	1,850	1,850	2,100
Refractories: [2]			
Shamotte	6,080	r 6,048	e 6,100
Dinas (quartzite-lime)	630	r 635	e 650
Magnesite and chrome magnesite	1,443	r 1,402	e 1,450
Magnesite powder	1,352	r 1,246	e 1,350
Total	9,505	r 9,331	e 9,550
Salt, all types [2]	11,000	r 12,100	e 13,000
Sulfur (excluding sulfur content of pyrite)	1,500	1,600	1,600
Talc	370	380	380
MINERAL FUELS AND RELATED MATERIALS			
Coal: [5]			
Brown [2]	138,299	r 140,486	e 150,000
Hard:			
Coking [2]	154,498	r 161,448	165,000
Anthracite [2]	76,896	r 76,824	e 79,000
Undifferentiated	r 224,487	r 229,044	e 230,000
Total hard coal	r 455,881	r 467,316	e 474,000
Total [2]	r 594,180	r 607,802	624,000
Coke, oven and beehive [2]	71,505	73,500	75,400
Crude oil [2]	309,150	r 328,299	353,000
Fuel briquets [2]	6,976	r 6,776	e 7,000
Oil shale [2]	21,868	r 23,020	e 23,500
Peat, agricultural use	130,000	130,000	130,000
Peat, fuel use [2]	r 49,100	r 44,800	57,300
Natural gas [2] billion cubic feet	6,039	r 6,445	7,063

e Estimate. r Revised.
[1] Estimate except where noted.
[2] Reported in Soviet sources—except for estimates in column 1970 (where indicated).
[3] United Nations Quarterly Bulletin of Steel Statistics for Europe. V. 21, No. 4, 1970, p. A–22.
[4] Items listed 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 19.7 percent and average calorific value was a little more than 5,000 kilocalories per kilogram in 1970.

TRADE

In the Soviet mineral economy international trade ranks high among the industry's priorities. Since the value and volume of trade are outlined in the national 5-year plan and are 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 continued to be oriented toward the importation of needed production machinery and equipment including complete industrial plants. Exports of minerals produced foreign exchange to help pay for imports. The U.S.S.R. sells practically nothing that could not easily be sold and consumed in the country.

Tables 2 and 3 are derived from official statistics of the Ministry of Foreign Trade for 1968 and 1969. Official detailed figures by country for 1970 are not yet available, but much the same general pattern can be expected. The volume of Soviet foreign trade has increased by over 50 percent between 1966 and 1970. The value of total Soviet trade turnover (exports plus imports) expanded from 19.8 billion rubles in 1969 to 22.1 billion rubles in 1970.

The value of total commodity trade with various groups of countries in 1965, 1969, and 1970, in billion rubles, follows:

	1965	1969	1970	Percent of increase 1970–65	1970–69
Group of countries:					
CMEA countries [1]	8.5	11.2	12.3	45.0	9.8
Other Communist countries	1.6	1.7	2.1	31.2	23.5
Total Communist countries	10.1	12.9	14.4	42.6	11.6
Developed non-Communist countries	2.8	4.4	4.7	67.9	6.8
Developing non-Communist countries	1.7	2.5	3.0	76.5	20.0
Total non-Communist countries	4.5	6.9	7.7	71.1	11.6
Total Soviet trade value	14.6	19.8	22.1	51.4	11.6

[1] CMEA (CEMA)—Council for Mutual Economic Assistance comprising the following countries: Bulgaria, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Romania, and the U.S.S.R.

Table 2.—U.S.S.R.: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum metal:			
Unwrought	287,600	320,000	East Germany 85,900; Czechoslovakia 57,900; Japan 40,400; Hungary 26,500; Poland 25,500.
Semimanufactures rolled only	79,500	102,800	East Germany 19,700; Czechoslovakia 15,500; Poland 6,400; United Arab Republic 5,700; Bulgaria 5,035; Cuba 4,800.
Antimony unwrought	800	r 1,225	All to Bulgaria.
Cadmium unwrought	700	743	Netherlands 340; East Germany 200.
Chromium, chromite ore and concentrate thousand tons	1,048	1,144	United States 387; Sweden 139; Japan 138; West Germany 124; France 95; Poland 83; Czechoslovakia 70.
Copper and copper alloys:			
Unwrought:			
Unalloyed	109,300	107,400	Czechoslovakia 37,800; Hungary 13,800; Romania 4,100; Poland 3,900.
Alloyed	5,700	4,800	East Germany 2,000; West Germany 1,546.
Semimanufactures rolled only:			
Unalloyed	7,900	8,200	Cuba 3,100; Bulgaria 1,911; Czechoslovakia 900; Romania 900.
Alloyed	r 4,300	7,500	Bulgaria 3,911; Cuba 1,300; Romania 800.
Iron and steel:			
Iron ore thousand tons	32,201	33,071	Poland 9,977; Czechoslovakia 9,168; Romania 3,832; Hungary 2,780; East Germany 2,464; United Kingdom 1,345; Japan 1,341.
Scrap do	664	1,325	Italy 298; East Germany 228; Sweden 224; Japan 163; Poland 103.
Pig iron do	4,522	r 4,692	Poland 1,205; East Germany 723; Czechoslovakia 700; Romania 517; Japan 443; Bulgaria 254; Hungary 193; Italy 148.
Ferroalloys:			
Ferrochrome	33,300	37,800	NA.
Ferromanganese	97,200	107,500	NA.
Ferrosilicon	111,800	118,400	NA.
Ferrovanadium	2,000	1,400	NA.
Silicomanganese	2,600	3,100	NA.
Other (unspecified)	20,400	24,100	NA.
Total	267,300	292,300	Czechoslovakia 88,100; Romania 75,200; Hungary 26,900; United Kingdom 24,800; Netherlands 24,400; West Germany 14,600; Bulgaria 11,800.
Ingots and other primary forms [2] thousand tons	959	1,125	Romania 274; Hungary 167; Spain 110; Turkey 96; East Germany 89; United Kingdom 79.

See footnotes at end of table.

Table 2.—U.S.S.R.: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Iron and steel—Continued			
Steel semimanufactures:			
Angles, shapes and sections [2] thousand tons	1,453	1,606	Bulgaria 368; East Germany 367; Poland 143; Hungary 127; Czechoslovakia 67.
Wire rod [2] do	369	493	Romania 155; Bulgaria 105; East Germany 86; Hungary 40.
Plate [2] do	1,824	2,090	East Germany 980; Poland 246; Czechoslovakia 232; Bulgaria 101.
Sheet:			
Tinplate [2] do	96	108	Bulgaria 47; Cuba 25; East Germany 14.
Other [2] do	499	740	East Germany 351; Poland 124; Bulgaria 57; Czechoslovakia 47.
Railway track materials [2] do	349	379	East Germany 198; Poland 77; Bulgaria 31.
Wheels, tires and axles [2] do	42	47	Poland 24; East Germany 22.
Pipes, tubes and fittings do	294	328	East Germany 162; Bulgaria 64; Cuba 22.
Wire do	66	72	Cuba 16; Bulgaria 15; East Germany 14.
Lead:			
Ingots and equivalent primary forms	90,900	97,900	East Germany 49,800; Czechoslovakia 25,000; Hungary 10,500; Finland 6,000.
Semimanufactures rolled only [3]	45	45	All to North Vietnam.
Magnesium metal, primary forms	14,500	15,000	West Germany 4,400; Netherlands 3,500; East Germany 2,500; Czechoslovakia 1,600.
Manganese:			
Ore and concentrate:			
Metallurgical grade thousand tons	1,150	1,197	Poland 364; East Germany 177; Czechoslovakia 150; Bulgaria 97; France 89; Japan 50.
Battery and chemical grade do	19	18	Netherlands 9; East Germany 3; Poland 2.
Metal [3]	400	200	All to Sweden.
Nickel semimanufactures rolled only [3]	149	170	Netherlands 130; mainland China 40.
Silicon metal	3,000	--	
Titanium minerals, ilmenite [3]	14,800	400	All to Italy.
Vanadium slag	41,700	34,600	NA.
Zinc ingots and equivalent, primary forms	78,700	97,400	East Germany 42,000; Czechoslovakia 23,000; India 9,800; Hungary 7,900; Netherlands 6,100.
Other nonferrous metals:			
Ingots and equivalent, primary forms	29,800	40,700	NA.
Semimanufactures rolled:			
Bimetal	1,528	1,600	Bulgaria 1,151.
Nickel-copper alloy [3]	5	--	
Other	1,971	2,280	NA.
NONMETALS			
Abrasives, hard alloys	89	143	NA.
Asbestos	r 303,600	346,500	France 42,400; East Germany 39,600; Japan 39,200; Poland 28,300; Bulgaria 24,600; West Germany 22,900; India 18,600; Czechoslovakia 17,300; Yugoslavia 14,800; Hungary 14,400.
Cement, hydraulic thousand tons	2,641	2,959	Hungary 586; Libya 395; Czechoslovakia 370; Poland 367; East Germany 156; Turkey 156.
Clays and products:			
Kaolin	r 13,200	NA	NA.
Refractory clays and baked slate	23,800	35,300	NA.
Refractory products including magnesite products	118,200	125,200	Poland 17,900; Bulgaria 16,500; Cuba 13,300.
Fertilizer materials:			
Crude, phosphatic:			
Apatite ore thousand tons	61	47	All to East Germany.
Apatite concentrate do	r 5,108	5,608	East Germany 1,134; West Germany 886; Poland 591; Romania 507; Czechoslovakia 498; Hungary 421; Finland 419.
Manufactured:			
Nitrogenous:			
Urea do	211	198	India 45; Pakistan 29; United Arab Republic 25.
Other do	953	958	Czechoslovakia 318; Cuba 218; Hungary 110; India 106.

See footnotes at end of table.

Table 2.—U.S.S.R.: Exports of mineral commodities [1]—Continued

Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Fertilizer materials—Continued			
Manufactured—Continued:			
Phosphatic ---thousand tons--	446	443	Hungary 150; Turkey 104; Bulgaria 92; Cuba 53.
Potassic ---do---	1,722	1,679	Japan 271; Hungary 263; Belgium 182; Czechoslovakia 132; Yugoslavia 126; United Kingdom 103.
Fluorspar and cryolite, cryolite only ---	5,400	5,400	Poland 1,600; Hungary 1,100; Yugoslavia 700.
Graphite ---	10,200	12,100	East Germany 2,700; Poland 2,400; West Germany 1,800; Hungary 1,700.
Gypsum [3] ---	9,100	16,100	All to Finland.
Salt ---	275,400	222,000	Czechoslovakia 97,900; Hungary 52,200; Finland 36,300; Denmark 28,600.
Sodium and potassium compounds, n.e.s:			
Caustic soda ---	35,800	27,800	Cuba 25,900.
Soda ash ---	72,500	70,200	Czechoslovakia 25,000; Turkey r15,800; Cuba 6,800; Finland 6,200.
Sulfur and pyrites:			
Pyrite, gross weight ---thousand tons--	1,532	1,533	Italy 474; West Germany 327; East Germany 257; Hungary 124.
Sulfur, elemental ---do---	291	363	Cuba 111; Hungary 71; Czechoslovakia 68; Bulgaria 26; Yugoslavia 25.
Sulfuric acid ---do---	183	156	Hungary 50; Czechoslovakia 43; Romania 41.
Talc [3] ---	16,600	8,600	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black ---	28,400	39,100	East Germany 13,300; Bulgaria 7,500; Czechoslovakia 5,100; Hungary 4,415; Cuba 3,000.
Coal:			
Anthracite ---thousand tons--	3,198	4,045	France 1,258; Italy 317; Czechoslovakia 288; Belgium 204; Yugoslavia 144; Finland 129.
Bituminous ---do---	17,939	19,194	East Germany 3,169; Japan 3,138; Czechoslovakia 2,354; Italy 1,757; Poland 1,085; Yugoslavia 934; Austria 735.
Unspecified ---do---	113	60	Czechoslovakia 30.
Total ---do---	21,250	23,299	
Coke ---do---	3,824	3,996	East Germany 1,181; Romania 783; Hungary 588; Finland 583.
Gas, natural ---million cubic feet--	61,062	94,081	Poland 35,096; Czechoslovakia 31,380; Austria 27,605.
Petroleum:			
Crude ---thousand 42-gallon barrels--	435,236	469,573	Italy 11.8 percent; Czechoslovakia 11.0 percent; East Germany 9.7 percent; Poland 9.0 percent; Finland 8.9 percent; Bulgaria 7.2 percent; West Germany 6.4 percent; Cuba 6.3 percent. [4]
Refinery products:			
Gasoline ---do---	28,489	28,257	
Kerosine ---do---	10,242	11,417	
Distillate fuel oil ---do---	75,261	74,221	
Residual fuel oil ---do---	77,803	77,182	
Lubricants ---do---	2,086	2,264	
Other:			
Asphalt and bitumen ---do---	230	227	
Paraffin ---do---	187	220	
Petroleum coke ---do---	777	680	
Liquefied petroleum gas ---do---	447	370	
Unspecified ---do---	421	442	
Total ---do---	195,943	195,280	
Crude chemicals from coal, gas and oil distillation thousand tons--	424	398	Italy 103; East Germany 73; France 60.

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] Source: Economic Commission for Europe. Statistics of World Trade in Steel 1968 and 1969. United Nations, New York, 1969 and 1970, 57 pp. and 60 pp. (Data therein reported as derived from official Soviet statistics).

[3] Data possibly incomplete; total not reported. Totals given represent sum of quantities reported under individual countries.

[4] Details on destinations 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	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite [1] thousand tons	r 1,233	1,400	Yugoslavia 827; Greece 529; Guinea 44.
Alumina do	388	596	United States 354; Hungary 169; Greece 38.
Metal and alloys semimanufactures	2,200	1,500	West Germany 748.
Cadmium, primary forms	235	217	Poland 174; North Korea 43.
Copper metal:			
Unwrought, unalloyed	9,400	400	NA.
Semimanufactures:			
Powder [1]	754	560	All from West Germany.
Rolled:			
Unalloyed	4,300	5,100	Yugoslavia 4,100.
Alloyed	2,400	6,000	NA.
Iron and steel:			
Pig iron thousand tons	63	48	All from North Korea.
Ferroalloys do	9	7	Norway 5.
Semimanufactures:			
Pipe do	r 766	1,043	Romania 151; Japan 146; West Germany 78; East Germany 57.
Other, rolled only do	r 1,410	1,723	Poland 237; West Germany 235; Romania 230; India 217; Bulgaria 151.
Lead:			
Ore [1]	45,300	52,300	All from Iran.
Metal unwrought	39,100	24,800	Yugoslavia 20,200; North Korea 3,400.
Mercury [1] 76-pound flasks	r 2,321	2,901	All from Yugoslavia.
Tin metal unwrought long tons	r 6,988	r 6,693	United Kingdom 3,642; Malaysia 2,657.
Zinc:			
Ore [1]	10,600	11,500	All from Iran.
Concentrate [1]	18,100	7,700	All from North Korea.
Metal:			
Unwrought:			
Unalloyed	36,400	50,100	Poland 32,100; North Korea 15,700.
Alloyed	3,900	4,100	All from Poland.
Semimanufactures:			
Dust	2,200	1,300	All from Poland.
Rolled	800	3,800	Poland 2,400.
Other metals n.e.s.:			
Unwrought	15	2,583	NA.
Semimanufactures rolled	--	200	NA.
NONMETALS			
Barite	179,800	142,700	North Korea 44,600; Romania 29,700; Bulgaria 25,600; Yugoslavia 25,100.
Cement, hydraulic thousand tons	r 296	378	North Korea 375.
Fertilizer materials manufactured:			
Nitrogenous, ammonium nitrate [1]	30,600	15,400	All from North Korea.
Phosphatic, superphosphate [1]	---	115	Netherlands 60; Sweden 55.
Fluorspar	102,000	134,100	Mongolia 75,800; Japan 34,600; mainland China 17,600.
Magnesite powder [1]	r 211,300	276,200	All from North Korea.
Mica	160	417	All from India.
Quartz crystal, optical kilograms	3,420	5,194	All from Switzerland.
Sodium and potassium compounds n.e.s.:			
Caustic soda	221,900	242,200	Belgium 111,100; Netherlands 30,200; Japan 30,000; Romania 29,800.
Soda ash	502,400	570,200	Belgium 351,000; Poland 54,100; Italy 54,000; Romania 39,100.
Caustic potash	6,200	7,200	Czechoslovakia 3,000; West Germany 2,800.
Sulfur	9,400	24,800	NA.
Talc	50,800	82,700	North Korea 45,700; Japan 37,000.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	1,700	6,400	United States 3,300; Romania 1,900; East Germany 1,100.
Coal, bituminous thousand tons	r 6,928	r 7,226	All from Poland.
Coke do	658	659	Poland 653.
Gas, natural [1] million cubic feet	52,972	71,678	All from Afghanistan.
Petroleum:			
Crude oil [1] thousand 42-gallon barrels	955	10,903	United Arab Republic 6,937; Algeria 3,821; Saudi Arabia 145.

See footnotes at end of table.

Table 3.—U.S.S.R.: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum—Continued			
Refinery products:			
Gasoline. thousand 42-gallon barrels	5,896	5,470	Romania 55.1 percent; East Germany 27.6 percent.[2]
Kerosine do	55	823	
Distillate fuel oil do	1,387	1,306	
Residual fuel oil do	211	142	
Lubricants do	656	781	
Other:			
Asphalt and bitumen do	132	145	
Paraffin do	50	57	
Solvents do	88	106	
Unspecified do	67	150	
Total do	8,542	8,980	

[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 destination, but are not convertible to a barrel basis owing to the varying specific gravity of the different commodities that constitute the total.

The volume of Soviet foreign trade with Communist countries increased by over 43 percent in the 1966–70 period. In 1970, almost two-thirds of Soviet foreign trade was transacted with Communist countries. The largest turnover was achieved in trade with East Germany (3.3 billion rubles), Poland (2.3 billion rubles), Czechoslovakia (2.2 billion rubles), Bulgaria (1.8 billion rubles), and Hungary (1.5 billion rubles). The trade turnover with Cuba increased during 1966–70 by almost 62 percent, from 646 million rubles to 1,045 million rubles. There was a further reduction in trade turnover with mainland China, from 375 million rubles in 1965 to 51.1 million rubles in 1969 and to 41.9 million rubles in 1970. Mainland China was the Soviet Union's most insignificant trading partner within the Communist camp. The trade turnover between the U.S.S.R. and its smaller European Communist trade partner, Yugoslavia (with 520 million rubles), during 1970 was about 12½ times as large as that with mainland China.

The value of Soviet trade with non-Communist developed countries expanded from 2.8 billion rubles in 1965 to 4.7 billion rubles in 1970. In 1970, Japan was the developed country with the largest trade turnover (652.3 million rubles) with the U.S.S.R., followed by the United Kingdom (641.4 million rubles), West Germany (544.0), Finland (530.7), Italy (471.8), France (412.8), Sweden (234.9), the Netherlands (222.9), and the United States (160.9 million rubles). A 33- to 35-percent increase of Soviet foreign trade with non-Communist developed countries is planned for 1971–75.

Trade with the developing countries grew through the expansion of the economic and technical assistance that is now given to some 35 countries. The developing countries shared in 13.5 percent of the Soviet foreign trade in 1970. Compared with 1969 figures, Soviet trade turnover with developing non-Communist countries increased by about 470 million rubles. The large Soviet turnover was achieved in trade with the United Arab Republic (606.4 billion rubles), followed by India (364.9), and Iran (231.2).

Fuels, metals, and mineral raw materials continued to play a dominant role in Soviet exports and have reflected a gain in the influence of Soviet trade with the free world. The export goals established in the 5-year plan, and the high priorities placed upon achieving the goals, lend a decided advantage to the Soviet State Trading enterprises in the form of a wider margin of price flexibility and alternatives not available to an exporter of any given commodity in the West. The overriding need to export to meet established goals thus may result in commodity sales below world price levels and production costs.

In 1970, some 37 percent of the total officially recorded Soviet exports were mineral commodities. There was an increase in exports of metals and metallic ores from 19.4 percent of the total Soviet export in 1969 to 19.8 percent in 1970. The Soviet Union remained a significant exporter of mineral fuels, manganese, iron and chromite ores, steel ingots, aluminum, precious metals, and apatite concentrate. Official foreign trade statistics do not include exports of precious metals and stones. The annual total value of known exports of these commodities, as measured by recorded imports of other countries, has been consistently high, not withstanding an appreciable annual fluctuation.

Most of the U.S.S.R.'s 1970 export trade in minerals was with Europe and Japan. Mineral trade between the United States and the U.S.S.R. was insignificant. Over 60 percent 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 percent in crude oil and pig iron, some 85 percent in iron ore, and about 75 percent of the demand in mineral fertilizers.

An even more intensive growth in the demand for oil, natural gas, pig iron, iron ore, and mineral fertilizers in the CMEA countries is expected during the 10-year period 1971–80. In 1971–75, Soviet crude oil deliveries to the CMEA nations are to be 77 percent higher than during the preceding 5-year plan period. According to agreements and coordinated 5-year plans, East European countries are to assist in developing Soviet natural resources in return for a share of the end product as follows: Czechoslovakia and East Germany, crude oil and natural gas; Poland and Hungary, expansion of the "Druzhba" oil pipeline; Bulgaria, natural gas and metallurgical products; Romania, extracting and beneficiation iron ore; and Hungary, asbestos, raw materials containing phosphorous, and fertilizers.[18]

Mineral commodity imports in 1970 included ferrous and nonferrous semimanufactures, steel pipe, bauxite, and alumina, tin, tungsten concentrate, barite, fluorspar, talc, and mica. Soviet purchases of machinery and equipment, including complete equipment for a chemical industry complex, accounted for more than a half of all Soviet imports from Italy (177 million rubles), France (156 million rubles), West Germany (122 million rubles), Finland (120 million rubles), and the United Kingdom (99 million rubles). The U.S.S.R. imported large quantities of pipe from West Germany, Italy, Japan, Sweden, and Czechoslovakia. A large part of the imports from developing countries were goods delivered in payment for loans from the U.S.S.R.

Soviet exports of selected mineral commodities by group of countries are presented in table 4.

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[18] Pravda (Moscow). Mar. 27, 1971, p. 4.

Table 4.—U.S.S.R.: Exports of selected mineral commodities by group of countries

(Thousand metric tons)

	1969						
	CMEA countries	Other Communist countries	Total Communist countries	Developed non-Communist countries	Developing non-Communist countries	Total non-Communist countries	Total exports
Coal	11,700.0	1,800.0	13,500.0	9,300.0	500.0	9,800.0	23,300.0
Crude oil and products	38,200.0	9,400.0	47,600.0	39,500.0	3,700.0	43,200.0	90,800.0
Iron ore	29,100.0	--	29,100.0	4,000.0	--	4,000.0	33,100.0
Manganese ore	805.0	49.0	854.0	343.0	--	343.0	1,197.0
Chromium ore	186.0	22.0	208.0	936.0	--	936.0	1,144.0
Pig iron	3,592.8	193.6	3,786.4	730.0	175.1	905.1	4,691.5
Rolled steel	5,042.2	316.9	5,359.1	440.0	660.4	1,100.4	6,459.5
Steel pipe	254.3	36.3	290.6	14.5	23.3	37.8	328.4
Copper	102.4	.7	103.1	4.3	--	4.3	107.4
Lead	89.8	1.6	91.4	6.5	--	6.5	97.9
Aluminum	209.9	18.4	228.3	87.5	4.2	91.7	320.0
Fertilizers:							
Phosphorous	3,887.3	52.8	3,940.1	2,110.4	106.1	2,216.5	6,156.6
Potassium	539.6	249.8	789.4	846.2	42.8	889.0	1,678.4
Nitrogen	455.6	326.3	781.9	--	176.5	176.5	958.4
	1970						
	CMEA countries	Other Communist countries	Total Communist countries	Developed non-Communist countries	Developing non-Communist countries	Total non-Communist countries	Total exports
Coal	13,000.0	1,800.0	14,800.0	9,200.0	500.0	9,700.0	24,500.0
Crude oil and products	40,600.0	9,900.0	50,500.0	41,500.0	3,800.0	45,300.0	95,800.0
Iron ore	31,700.0	--	31,700.0	4,400.0	--	4,400.0	36,100.0
Manganese ore	788.0	52.0	840.0	403.0	--	403.0	1,243.0
Chromium ore	203.0	21.0	224.0	956.0	--	956.0	1,180.0
Pig iron	3,983.1	181.7	4,164.8	478.1	171.9	650.0	4,814.8
Rolled steel	5,571.3	475.2	6,046.5	294.0	654.2	948.2	6,994.7
Steel pipe	269.3	41.9	311.2	6.9	23.0	29.9	341.1
Copper	103.1	.7	103.8	19.3	--	19.3	123.1
Lead	84.3	2.1	86.4	6.0	--	6.0	92.4
Aluminum	259.0	26.7	285.7	78.5	4.7	83.2	368.9
Fertilizers:							
Phosphorous	4,236.6	82.9	4,319.5	1,956.2	27.7	1,983.9	6,303.4
Potassium	1,906.2	256.0	2,162.2	977.6	7.4	985.0	3,147.2
Nitrogen	533.7	388.8	922.5	--	126.2	126.2	1,048.7

Source: Vneshnyaya torgovlya (Foreign Trade, Moscow), No. 7, July 1971, pp. 54–59.

COMMODITY REVIEW

METALS

Although not all of the planned 1966–70 goals were attained, growth of the ferrous industry during the period was as follows: pig iron, 29 percent; steel, 27 percent; rolled metal, 31 percent; and iron ore, 28 percent. In the nonferrous industry, output of many metals, particularly aluminum, nickel, copper, cobalt, titanium, magnesium, zinc, mercury, and platinum, increased in comparison with that of 1965. About 67 percent of the total nonferrous metals output came from opencast mining. The production of alumium increased substantially at the Irkutsk and Novokuznetsk aluminum plants; platinum and nickel at the Norilsk complex; copper at the Balkhash complex and the Pyshma plant; and tungsten and molybdenum concentrates at the Tyrnauz and Kadzharan combines. In the 1966–70 period, capital investment in the Soviet nonferrous industry totaled almost 6.7 billion rubles—40 percent more than in the 1961–65 period.

With regard to metal production, the U.S.S.R. continued to conduct a quantitative drive, and product quality seemed to be of secondary importance; nevertheless, metal output fell short of demand. To meet requirements it will be necessary to increase process efficiency at existing mines and plants as well as to provide new capacity. While production of metals and alloys continued to grow, beneficiation and metallurgical facilities still experienced poor metal recoveries.[19] As a result of unsatisfactory performance of the Kirovabad aluminum plant, Alaverdy and Solnechnyy mining and beneficiation combines, the Mtsensk secondary nonferrous metals plant and other enterprises, the 1966–70 5-year plan production quota for alumina, zinc, mercury, secondary aluminum, and other metals was not met.[20]

Many mining machines do not satisfy the miners. Idle time due to breakdowns of individual units and component parts was greater than operating time. The quality of drilling rigs and self-propelled equipment especially lagged. As a result, productivity was much below planned levels.[21]

During 1971–75, an increase in aluminum production capacity is to be provided through the building of electrolytic potlines at the Krasnoyarsk, Bratsk, and Tadzhik aluminum plants. Basic copper production growth is to occur through putting additional capacities into operation at the Dzhezkazgan and Norilsk complexes and the Severonikel' combine and the building of a new cooper smelter for processing secondary raw materials. New output capacities for other branches of nonferrous metallurgy are also to be introduced. Special attention is to be paid to accellerating the attainment of new capacities at the Achinsk, Almalyk, Norilsk, and Dzhezkazgan complexes.

Aluminum.—The U.S.S.R. was the world's second largest producer of aluminum in 1970, with an estimated output of 1.1 million tons. The aluminum industry operated 13 primary reduction plants with a total probable capacity (January 1, 1971) of 1.43 million tons.

Under the 1966–70 5-year plan, aluminum output in 1970 was scheduled to reach 1.9 to 2.1 times the 1965 level. Aluminum production quotas were not reached in either the 7-year plan (1959–65) or the 1966–70 plan, primarily because of problems at the Achinsk, Kirovabad, and Pavlodar alumina plants, the Turgay bauxite open pits, and the Severo-Ural'sk underground mines. Under the 1971–75 plan, aluminum output in 1975 is scheduled to reach 1.5 to 1.6 times the 1970 level. Siberia and Kazakhstan are planned as principal production centers, mainly at Krasnoyarsk, Irkutsk, and Bratsk in East Siberia; Novo-Kuznetsk (Kemerovo Oblast') in West Siberia; and at Pavlodar in Kazakhstan. Soviet forecasts indicate that more than two-thirds of Soviet primary aluminum will come from Siberia by 1975.

The U.S.S.R. is a large producer of low-grade bauxite, the main source of aluminum in the country, but supplies are insufficient to meet demand, both in quantity and quality, and considerable attention has been given to developing nepheline

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[19] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. No. 3, 1971, pp. 53–56; Kazakhstanakaya pravda (Alma-Ata, in Russian). March 4, 1971, p. 2.

[20] Tsvetnyye metally (Nonferrous Metals), Moscow. No. 1, 1971, pp. 1–13.

[21] Gornyy zhurnal (Mining Journal), Moscow. July 1970, No. 7, p. 6; Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata. March 1971 No. 3, pp. 53–56.

and alunite. The country continued to import substantial quantities of high-grade bauxite and alumina from Hungary, Yugoslavia, Greece, Guinea, and the United States. The Soviet Union wants long-term contracts for the supply of bauxite and alumina from Australia and Japan.

The northern Urals was the main bauxite and alumina producing region in 1970. The bauxite underground mines, Nos. 9, 13, 14, and 15, in this region were undergoing expansion. The opening of three new underground mines progressed slowly, and they were rescheduled for completion in 1971.

The second largest bauxite- and alumina-producing region was Kazakhstan, with the Pavlodar alumina plant No. 1 among the nation's largest in 1970. Plant No. 2 was under construction. Development of the Ayat-2 bauxite open pit in Kazakhstan was in progress. This will be the fourth supplier of raw material for the Pavlodar alumina plant. It is planned to increase production of alumina in Kazakhstan by 5 percent in 1971.

Development of a bauxite open pit continued near Savinsk settlement on the banks of the Onega River in Archangel Oblast' with the first stage due for completion in 1973. Bauxite prospecting was a major feature of Soviet mineral industry activity in 1970. Funds for this activity were increased over 40 percent above the previous year's allocation.

The first section of the Achinsk alumina-from-nepheline plant in West Siberia began operating in April. This plant, which took 15 years to complete, will provide alumina for the Krasnoyarsk aluminum plant. The second and third sections of the plant, under construction during 1970, were scheduled for completion in 1971. Ore for the Achinsk alumina plant will come from the Kiya-Shaltyrsk (Belogrosk) nepheline open pit, the first stage of which was put into operation in January.

Alunite deposits were being exploited in Azerbaydzhan, the principal producer being the Zaglik open pit. At the Kirovabad alumina plant, alunite was processed into alumina but did not reach its planned output because of the installation of equipment which had not been fully tested. A new kiln was put into operation at this plant in February.

The aluminum works in Kandalaksha has increased its output by nearly one-third in the last 5 years. A new rolling mill was being assembled. The Volgograd aluminum plant had completed its 5-year production plan in December. Throughout the period its output has increased at the rate of 1,000 tons per year.

The fifth potline of the Bratsk aluminum plant, the largest in the country, began operating in October, with four units working at about 80 percent of capacity in 1970. The first wire-rolling mill at Bratsk began production in July, and construction of a second mill continued during the year. At the Krasnoyarsk aluminum plant, the anode mass section started production in May and the fourth potline went into operation in December The Sumgait aluminum plant in Azerbaydzhan underwent renovation with completion due in 1971. Expansion of the Yerevan aluminum plant in Armenia continued.

Construction programs continued on the Bratsk, Krasnoyarsk, and Irkutsk aluminum plants, and at another in the Gissar valley in Tadzhikistan, with a new target for completing the first potline in 1972. It will be powered by electricity from the Nurek G.E.S. (Nurek hydroelectric power station) and with natural gas from Afghanistan.

Antimony.—Deposits of antimony occur at Kadamzhay in Kirghiz S.S.R., Dzhidzhikrut in Tadzhikistan, Turgay in Kazakhastan, and at Tazhdolinsk and Sarylakh in Siberia.

The Kadamzhay combine in Kirghiz S.S.R. remained the principal Soviet antimony center, with integrated facilities producing most of the country's refined products. A new antimony production section was commissioned at this combine in February. The combine has increased its output by 50 percent in the last 5-year period. Eight grades of antimony are produced.

The Dzhidzhikrutskiy mining and concentrating combine in Tadzhikistan was under construction; on completion, it will be the main Soviet producer of antimony and mercury. Reportedly, the first section of this combine was accepted for operation on December 31.

An antimony ore deposit associated with gold was under development at Sarylakh in Yakut A.S.S.R., near the polar circle. A rich antimony-arsenic-mercury deposit is reported to have been found in the Balkhash steppes, the first such deposit in Kazakhstan.

Arsenic.—Arsenic ore reserves are estimated at some 12 million tons containing 0.2 to 0.5 percent As_2O_3. All output in 1970 was obtained as a byproduct from the smelting or roasting of metallic ores.

Beryllium.—Production rates for beryl, beryllium alloys, and metal, were being rapidly increased. During 1966–70, estimated output rose by about 30 percent. The increase indicated a probable production level of 1,300 tons of beryl (10 to 12 percent BeO) in 1970.

There are numerous beryl deposits in the U.S.S.R., mainly in the Soviet Far East, Transbaykal, Urals, and the Kola Peninsula. Reserves in 1970 were estimated at about 5,000 tons of contained BeO, chiefly in low-grade ores, probably averaging 0.2 to 0.5 percent BeO.

Bismuth.—As in previous years, bismuth was recovered as a byproduct of lead smelting in Kazakhstan and other areas of the Soviet Union, from dust and crude lead at the Balkhashskiy and Mednogorskiy copper complexes, and from tungsten and molybdenum ores. Recovery of metal in final bismuth concentrates was less than 50 percent of the metal content of ores.

Cadmium.—Cadmium was produced at various lead and zinc smelters as a byproduct. In 1970, the Ust'-Kamenogorsk lead and zinc complex in Kazakhstan increased its cadmium output by almost one-third over the 1969 level. It is planned to obtain a large quantity of cadmium from lead slag.

Chromium.—With an estimated output of 1.75 million tons, the U.S.S.R. was the leading world chrome ore producer and exporter in 1970. According to the 5-year plan, 1966–70, Soviet chrome ore output should be increased by 30 percent. The planned goals were overfulfilled by 3 percent. Chrome ore output by 1975 is expected to be about 18 percent higher than in 1970. Exports totaled 1.18 million tons in 1970, with about 90 percent going to non-Communist countries. Approximately one-third of the output was consumed or stockpiled in the Soviet Union.

The unofficial Soviet figure for 1970 marketable chromite output, 3 million tons, appeared in the January 1971 issue of the Mining Journal (Gornyy zhurnal). The magazine also said that production in 1965 was 2.53 million tons. According to the Exploration and Conservation of Mineral Resources (Razredka i okhrana nedr [Moscow, No. 6, June 1970, p. 6]), output of crude chromite in 1970 was 3.4 million tons. It is planned to produce 4 million tons of crude ore in 1975 or 18 percent more than in 1970.

The Soviet Union's deposits of chromium ores are situated in Kazakhstan and in the Ural Mountains, where the mining of these ores was entirely concentrated. Geological reserves[22] of the U.S.S.R. were estimated at about 100 million tons of ore containing 15 to 63 percent Cr_2O_3 of which 20 to 25 million tons are measured. There are over 20 known, mainly small, deposits of chrome ore in Aktyubinsk Oblast' in western Kazakhstan, of which the Molodezhnoye, Millionnaya, and Almaz-Zhemchuzhina are the largest with a total geological reserve of some 60 million tons.

The Donskoye mining administration at Khrom-Tau in Aktyubinsk Oblast', which produced over 90 percent of the Soviet output, is the only supplier 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 percent), as well as a low Cr_2O_3:FeO ratio, for which reason they are mostly used in the chemical and refractory industries. The Donskoye mining administration produced 22 grades of chrome ores, mainly from small open pits. The productivity of labor and equipment was below planned levels, and more than half the time the machinery employed in these open pits was idle.[23]

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 1970.

Two new mines are planned in the region of the Molodezhoye, Millionnaya, and

[22] Geological reserves as defined by the Soviets include measured (Soviet category "A") plus indicated (Soviet category "B"), plus inferred (Soviet categories C_1 and C_2); the major categories correspond directly to those used in the United States.

[23] Narodnoye khozyaystvo Kazakhstana (National Economy of Kazakhstan), Alma-Ata No. 4, 1971, p. 68.

Almaz-Zhemchuzhina deposits during the 1971–75 period. The first Soviet chromite concentration mill, with an annual capacity of 1 million tons of crude ore (300,000 tons of concentrate), was under construction at Donskoye in 1970 and scheduled for completion by 1975.

Cobalt.—Cobalt production continued to be concentrated at the Norilsk (West Siberia), Severonikel Pechenganikel (Kola Peninsula), and Yuzhuralnikel' (Urals) complexes; at the Ufaley and Rezhsk nickel plants in the Urals; and also at some copper plants. The first stage of the Khovu-Aksinsk mining and concentration combine in Tuva Autonomous Republic was commissioned in June 1970. The estimated 3.3 percent rise in output of metal in 1970 was mainly due to initial production of concentrate at the Khovu-Aksinsk combine. Extraction from ore rose by a few percent in the 1966–70 period, but losses in slags remained high. The 1971 plan provides for nearly doubling the output of cobalt by the Yuzhuralnikel' combine in Orsk.

Gross cobalt reserves were estimated at around 100,000 tons of metal content, chiefly in nickel-cobalt ores. This estimate included the high cobalt content in arsenic-cobalt ores of the Khovu-Aksinsk deposit.

Copper.—In 1970, the Soviet Union produced an estimated 710,000 tons of copper, including 570,000 tons of primary and 140,000 tons of secondary metal. An estimated 4-percent increase in metal output being due to initial production of refined copper from the new facilities at Norilsk and from the Alaverdy copper-chemical combine in Armenia. The 1966–70 plan scheduled Soviet copper output to rise by 60 to 70 percent to a probable planned level of 825,000 to 875,000 tons of primary and secondary copper by 1970, but actual output was 16 to 23 percent less. The Dzhezkazgan smelting and refining complex in Kazakhstan was not completed in 1969, but was rescheduled to go into operation in 1971. Under the new 5-year plan, copper output in 1975 is scheduled to be 35 to 40 percent over the 1970 level. The plan provides for a 30-percent increase in copper production in Armenia and a 70-percent increase in Kazakhstan. If the 35-percent growth in copper output projected for the 5-year plan 1971–75 is achieved, the U.S.S.R. will produce close to 1 million tons of primary and secondary copper by 1975, with some 40 percent coming from Kazakhstan and 35 percent from the Urals. The projected 1975 output would enable the country to meet domestic requirements and possibly allow some "surplus" for export outside the Soviet bloc.

Gross Soviet copper ore reserves in 1970 were estimated at 40 million tons of contained metal, with cut-off varying from 0.4 percent at the Kounrad open pit in Kazakhstan to 1 percent copper at underground mines in the Urals. About 75 percent of primary copper output in 1970 came from open pits.

Soviet expansion plans focus on two large copper sandstone deposits, which account for about 35 percent of total Soviet copper reserves. One deposit is at Dzhezkazgan in Kazakhstan, and the other is at Udokan, northeast of Lake Baykal in East Siberia. The development of this latter deposit was the subject of negotiations with Japanese, French, and British concerns during 1970.

In 1970, about 96 percent of total copper ore was concentrated. The balance was smelted directly. Copper from the Urals and Kazakhstan accounted for about 80 percent of the 1970 total.

The Urals region continued to be the main center of copper production in 1970. The Pyshma electrolysis plant, one of the few Soviet producers of copper powder, started to supply the Tolyatti automobile plant in October. Construction began on the first rolling mill to produce nonferrous alloy sheets at Gay in Orenburg Oblast'. This output will also go to Tolyatti.

Kazakhstan was the second largest copper-producing region. A 90-percent increase in output over the 1965 level was envisaged by 1970. A new concentrating mill was started at the Balkhash complex. The ore deposit, extending beyond the limit of present mining operations and reported to be of satisfactory grade, will extend the life of the Kounrad pit at Balkhash to the year 2000. The first stage of the Sayak copper open pit, 200 kilometers from the Balkhash complex, was put into operation in December, and a concentrating mill was being built at Sayak in 1970. The first stage of the large Nikolaevskiy ore mining and beneficiation combine was under development. The deposit contains copper, lead, zinc, gold, silver, and other metals and will become the main raw material supplier for the East Kazakhstan copper-chemical complex. A new copper smelter was being constructed at the Irtysh copper smelting plant.

Kazakhstan's refined copper output is planned to increase by 14.8 percent in 1971. The Chetyrkal'skoye copper deposit in Dzhambal Oblast', a detailed survey of which was completed in 1970, is planned for development during 1971–75. The first use of oxygen in a Soviet copper blast furnace smelter was at Irtysh.

In Armenia, new facilities were commissioned at the Alaverdy copper-chemical combine. Production of molybdenum and copper concentrates increased 2.7 times during the last 10 years at the Kadzharan copper mining and concentrating combine, while ore output rose threefold. A smelter at this combine was under construction in 1970. The fifth section of the Almalyk copper concentrating plant in Uzbekistan was completed in April with the sixth section under construction in 1970. At the Norilsk plant, the second electrolysis plant was commissioned and the third was being built. The Krasnyy Vyborzhets "850" rolling mill in Leningrad started producing copper sheet in August. The Madneuli mining and concentrating combine in Georgia was under construction in 1970. Three technological lines at this combine are to be installed. The combine is to produce five kinds of concentrates—copper, pyrite, barite, zinc, and lead. The first section of the plant is to be put into operation by 1973.

Despite improvements in recent years in the Soviet copper industry, the situation with respect to utilization of complex raw materials remained unsatisfactory. Large amounts of metal were lost at the concentrating plants; capacity of shops for processing smelter flue dust was inadequate; and there were no facilities for reprocessing dumped slags.[24]

Gold.—In 1970, the U.S.S.R. produced an estimated 6.5 million troy ounces of gold and was the world's second largest producer. The growth of Soviet gold production reportedly resulted mainly from expansion of placer mining in the northeast of the Asian part of the country. About 75 percent of the total output came from East Siberia and the Soviet Far East (mainly placer deposits at Kolyma, Aldan, Indigarka, Yana, and Chukotka); most of the rest came from gold and polymetallic ores in Siberia, Kazakhstan, the Urals, and Armenia.

Geological reserves (measured, indicated, and inferred) of gold in ore and placer deposits were estimated at about 200 million ounces in 1970. Explored reserves were reportedly sufficient for a 16- or 17-year operation at the current production rate. Extensive prospecting continued; deposits in Armenia (near Stepanavan), Uzbekistan (Sanarchuk), the Kola Peninsula, and the Kirghiz S.S.R. and a new placer deposit in the Far East at the Lantar River were reportedly discovered.

Magadan Oblast' continued to be the main center of gold production in the country. During 1966–70, gold output in this oblast' rose over 40 percent. Capital investment in 1970 for construction projects there was set at above 60 million rubles, 13 percent higher than in 1969. The Vostochnyy placer mines in this oblast' was being developed; a concentrating and washing mill with a capacity of 2,500 cubic meters per day was started up at the Shturmovoy placer mine. The 1971 plan calls for the construction of a similar sized mill at the Bukhara placer mine in Magadan Oblast'. A concentrating mill was under construction at the Leningradskiy placer mine. Gold extraction started on the banks of the Kantar River, which flows into the Sea of Okhotsk. Gold output in Magadan Oblast' by 1975 is expected to be 18.9 percent higher than in 1970.

The output of gold in Yakut A.S.S.R., the second largest Soviet gold-producing region, increased by 35 percent in 1970, compared with that of 1965. All four combines in this region, Yakut, Dzhugudzhur, Aldan, and Indigarka, reached planned targets; at Indigarka, a new 250-liter dredge was put into operation in April. Within Yakut A.S.S.R. and Irkutsk Oblast', the Lenzoloto Trust was a leading gold-dredging enterprise. During 1966–70, it was planned to increase production at this Trust by 60 percent and to launch seven dredges, including the world's largest. Reportedly, this Trust increased gold output

[24] Kommunist (Yerevan, in Russian). Feb. 17, 1971, p. 2; Kazakhstanskay pravda (Alma-Ata, in Russian). Mar. 14, 1971, p. 2.

only by 35 percent in the 1966–70 period. Gold extraction began on the Marakan River in Irkutsk Oblast', where a 600-liter dredge was commissioned, and in the same oblast', the "Kamustyag" underground mine was being developed.

Kazakhstan gold output during 1966–70 rose 14 percent. In this republic, at the Yubileynoye deposit in Aktyubinsk Oblast', the first stage of production reached operation. The first section of a dressing mill was commissioned at the Bukurchik mine in July, and the exploitation of the gold-zinc-lead-barite deposit at Maykain was begun. New underground gold mines are to be developed at the Bestube and Maykain deposits; the first of these (890 meters deep) is to be one of the deepest in the Soviet gold industry.

The first stage of the Chadak mining and concentrating combine in Namagan Oblast' in Uzbekistan was put into operation in May and the Muruntau and other deposits were under development in 1970. The Angren gold extracting plant is to be build on the basis of the newly discovered Kyzyl, Arnasay, and Sanarchuk deposits in this republic. A mine and experimental concentration plant were being built at Zod in Armenia, and it is planned to complete construction of the Zodskiy gold-ore combine by 1975. Construction continued at the Terek-Say antimony-gold combine in Kirghiz S.S.R.

The 1966–70 period saw gold output increased in Amur Oblast', Khabarovsk Kray, the Transboykal area, the Urals, Armenia, and other regions. New refineries are planned for Uzbekistan, Tadzhikistan, and Armenia.

Iron Ore.—In 1970, 70 underground mines and 59 open pits, with a total capacity of about 250 million tons per year, produced 194.2 million tons of usable ore (direct smelting ore plus concentrates) or 352 million tons of crude ore; over 78 percent came from open pits and the rest from underground mines. About 52 percent of the open pits and 53 percent of the underground mines had a rated capacity of less than 1 million tons of crude ore per year. About 20 percent of the open pits produced more than 5 million tons per year, and only 4 percent of the underground mines produced more than 4 million tons of crude ore per year. The largest underground mine was the Giant mine in Krivoy Rog, with a designed crude ore capacity of 7 million tons per year. In 1970, the average capacity of underground mines was about 0.6 million tons and about 2.6 million tons of usable ore for open pits. Production capacity was increased by 39 million tons in 1970, compared with a planned increase of 45.1 million tons of crude ore. Capital investment totaled 588.5 million rubles, 10 percent more than in 1969. Production of usable ore is scheduled to reach 254 million tons (478 million tons of crude ore) in 1975. To achieve the planned goals, capacity for crude iron ore is to be increased by 192.5 million tons. Capital investment in the Soviet iron ore industry for the next 5 years has been set at a level of 4.5 billion rubles.

At yearend 1970, iron ore reserves in the U.S.S.R. totaled 111,400 million tons, averaging 34.8 percent iron. These were distributed as follows: the Ukraine (31 percent); European center (24.4); Urals (15.7); Kazakhstan (15.0); Siberia (7.4); Northwest (3.0); Soviet Far East (2.5); and others 1.0 percent.

Total national reserves, divided into categories "A" (measured), "B" (indicated), and "C_1" (part of inferred), were estimated at 58,800 million tons averaging 38.4 percent iron. This figure included 10,300 million tons of ore averaging over 55 percent iron, which does not require dressing, and 34,800 million tons of easily dressed iron ore. Output of usable ore rose 8 million tons, or 4.3 percent above the 1969 total. Direct-shipping ore averaged 54 to 55 percent iron, and ore for beneficiation averaged 33.2 percent iron. The average grade of usable ore rose from 56.7 percent in 1965 to 58.8 percent iron in 1970. Agglomerate output reached 137.2 million tons in 1970; and pellets, 10.6 million tons. Concentrates came from 90 plants, of which 29 had sintering facilities and two had pelletizing facilities; 76 percent of the total iron ore produced was beneficiated, and 62.3 percent of total usable ore was in concentrates.

The level of U.S.S.R. iron ore production during 1965–70 as follows:

	1965	1966	1967	1968	1969	1970
Output, million metric tons:						
Crude ore	237.5	260.2	281.0	305.7	326.6	352.0
Usable ore	150.3	157.0	164.8	[1] 175.7	[1] 185.2	194.2
Concentrates	80.7	88.5	94.5	102.7	109.7	120.8
Sinter	111.3	115.6	123.1	128.2	132.9	[1] 137.2
Pellets	.3	1.6	2.9	7.2	9.4	[1] 10.5
Iron content, percentage:						
Crude ore	40.8	39.8	38.8	38.4	37.9	37.3
Usable ore	56.7	57.5	58.2	58.4	58.6	58.8
Concentrates	59.0	59.9	61.0	61.4	61.6	61.8
Share of concentrates in usable ore, percentage	53.6	56.2	56.7	58.4	59.2	62.3

[1] U.S.S.R. official figures in million metric tons are: Usable iron ore: 1968—176.6, 1969—186.1; sinter: 1970—138.2; pellets; 1970—10.6.

Source: Gornyy zhurnal (Mining Journal, Moscow), March 1971, No. 3, p. 3.

Mechanization in the iron ore industry did not exceed 40 percent; most auxiliary operations were performed manually. In underground iron mining, less than half the work was mechanized. Drilling rigs and excavators at open pits worked at half their planned capacities in 1970.[25] There is a gap between the mechanization of basic processes and the failure to mechanize auxiliary operations. For example, the Krivoy Rog iron ore basin has been broadly mechanized, but it now employs more labor force than before mechanization.[26] During 1960–68, despite a general increase in productivity in iron ore mining, the return on capital invested fell by 25 percent. The growth of fixed assets grew 30 percent faster than productivity, while the production costs of ore mined underground rose by 21.8 percent and the costs of opencast ore by 6 percent.[27]

The Ukraine produced about 57 percent of Soviet iron ore in 1970, and the plan provides for an increase in output of 14 percent during 1971–75. Some 95 percent of Ukrainian output in 1970 came from the Krivoy Rog Basin. The Urals was the second largest producer, followed by Kazakhstan, West Siberia, the Kursk region, and the Kola Peninsula.

In Krivoy Rog, 1970 saw the commissioning at the Novokrivorozhskiy combine, of a new open pit the No. 2-Bis, with a planned capacity of 4 million tons of crude iron ore per year. In July construction was begun on its second stage, with designed capacity of 30 million tons of crude ore per year (12.5 million tons of concentrates). The second section of the Northern combine concentrating plant of 3 million tons of crude ore per year was also commissioned, and renovation of the Central combine's concentrating plant, which raised iron content to 63 percent, was completed in June. In September the first stage of the Artem-2 underground mine, with a 4.5-million-ton-per-year capacity was commissioned. With a total designed capacity of 12 million tons of crude ore per year, it will be the largest Soviet underground iron mine and the first where ore is hoisted by belt conveyor along two 3-kilometer sloping shafts.

Also in the Ukraine, the first stage of the Dneprovskiy iron ore combine near Kremenchug in Poltavskaya Oblast', rated at 5 million tons of crude ore per year (2.45 million tons of concentrates), went into operation in April with two more stages under construction. The combine will mine large reserves of 33 to 34 percent ore. Its final processing capacity will be 15 million tons per year, and it will employ more than 4,500 workers.[28]

The first stage of the Zaporozhskiy iron ore combine started in April with an annual capacity of 1 million tons.

In Kazakhstan, three sections of the third stage started up in January at the Sokolovsk-Sarbayskiy wet magnetic concentrating plant, which has a total capacity of 12 million tons of concentrate per year (26.5 million tons of crude ore). The capacity of this combine is to increase during the 1971–75 period, and construction of the Kacharskiy mining and concentration combine in this republic is to begin. In the Kola Peninsula, a new 0.5-million-ton-per-year (1 million tons of crude ore) beneficiation plant started up in December at the Kovdorskiy combine, an addition to the existing annual capacity of 2.4 million

[25] Gornyy zhurnal (Mining Journal), Moscow. July 1970, No. 7, p. 4.
[26] Pravda (Moscow). May 10, 1971.
[27] Pravda (Moscow). May 10, 1971.
[28] Pravda Ukrainy. (Truth of the Ukraine), (Kiev, in Russian). Sept. 11, 1970, pp. 1–2.

tons of concentrate (6 million tons of crude ore). The first stage of the Lebedinskiy combine, in Belgorod Oblast', with a capacity of 7.5 million tons of crude ore per year (3.4 million tons of concentrate), was not finished. Construction started in 1967 and completion has been rescheduled for 1971–72. In Siberia, where there are seven mines, both underground and open cast, and two beneficiation plants, with an annual output of 16 million tons of crude ore (8 million tons of agglomerates), the Atasuyskaya underground mine was under development.

Also in Kazakhstan, the Lisakovskiy mining and concentrating combine, the Mikhaylovskiy combine in the Kursk region, and other projects were under construction in 1970.

Discovery of the following new iron ore deposits was reported in 1970: near Novoselovka village on the Kerch Peninsula in the Ukraine; in the desert area of Karaganda Oblast' in Kazakhstan; in the region of Bol'shaya and Malaya Kabarga rivers in Maritime Territory; and in Belorussia.

In September, an agreement was signed to increase exports of iron ore, concentrates, and pellets to Romania in the 1972–90 period. Romania is to supply labor for the new operations. Exports of Ukrainian iron ores to Romania reached 3.85 million tons in 1969, up from 850,000 tons in 1960.

Iron and Steel.—In 1970 the U.S.S.R.'s output of pig iron rose by 4.3 million tons over the 1969 figure; steel increased by 5.6 million tons, finished rolled ferrous metals by 3.2 million tons, and steel pipe by 0.9 million tons, although original quotas were not fulfilled. The industry showed quantitative but not qualitative growth; production of rolled products, in particular, was not closely geared to market demand. Soviet steel trade was conducted mainly with Eastern European countries.

Additional capacity for pig iron was 1 million tons; for steel, 3.6 million tons; for finished rolled products, 4.9 million tons; and for steel pipe., 1.4 million tons. Some 2 billion rubles were invested in new iron and steel facilities in 1970.

In 1970 orders for about 1 million tons of rolled ferrous metal and steel pipe were unfulfilled. The Soviet Ministry of Ferrous Metallurgy fulfilled only 15 of 27 important targets for planning new products. Smelting operations at many plants were operating well below full capacity due to lack of ore. The steel industry had in operation 43 outdated blast furnaces, 80 open hearth furnaces, and 97 rolling mills at which the production expenses were 2 to 5 times higher than on modern units.[29]

The main centers of the iron and steel industry continue to be R.S.F.S.R. and the Ukraine. Output of commodities in these republics in 1970 was as follows, in percent of the national total:

Product	R.S.F.S.R.	Ukraine
Iron ore	34	57
Pig iron	49	48
Steel	54	42
Rolled products	52	42
Steel pipe	57	35

In 1970 there were 1.4 million "production workers" (19 percent more than in 1965), 75,000 university graduate engineers, and 125,000 graduate technicians in the Soviet ferrous industry. There were 1,526 graduate engineers (including 208 employed as workers) at the Lipetsk works alone.[30]

During 1966–70, some 10.8 billion rubles were invested to expand the iron and steel industry. The following new facilities were commissioned: seven blast furnaces (three of which were of 2,700-cubic-meter capacity); 19 oxygen converters; four electric furnaces; 16 continuous casting units with a total capacity of more than 4 million tons per year; 15 rolling mills; and 14 pipe mills. The ferrous industry did not invest all the funds projected for expenditure during the 1966–70 5-year plan.

Plans call for the investment of some 17.7 billion rubles in the ferrous industry in 1971–75. Investment in the ferrous industry is to grow almost twice as fast as overall investment in the Soviet economy in 1971–75. According to the plan, six blast furnaces, 12 oxygen converters, 35 rolling and pipe mills, and 15 electric furnaces are to be completed in 1971–75.

Construction of the Karaganda metallurgical complex is to be completed in the ninth 5-year plan period. New facilities which are to be installed at the Novolipetsk works under a program to double its

[29] Stal' (Steel), Moscow. No. 3, March 1971, p. 196.
[30] Sotsialisticheskaya industriya (Socialist Industry), Moscow. July 28, 1971, p. 3.

steel output by 1975 include a 3,000-cubic-meter blast furnace already under construction and later a 5,000-cubic-meter unit. Construction of the first stage of the Oskol metallurgical complex in Kursk Oblast' is planned for the 1971–75 period. Also in the 1971–75 period, the Ukraine is to increase output of pig iron by 13.4 percent, steel by 14.7 percent, and rolled ferrous metal by 10.6 percent. The fixed assets of the Ukrainian ferrous industry are to increase by 38 to 40 percent during 1971–75.

An investment of 2.5 billion rubles is planned for new iron and steel enterprises in 1971. Additional capacities in 1971 can be expected to increase the production of pig iron by 3 million tons, steel by 3.8 million tons, finished rolled products by 2.6 million tons, and steel pipe by 0.4 million tons.

Soviet metallurgical plants had a considerable proportion of auxiliary workers in production shops. Spare parts and components for machines and metallurgical equipment were produced in primitive workshops with obsolete equipment. As a result, there were many more repair workers than workers in operations comprising blast furnaces, smelters, and rolling mills.

In 1970, the U.S.S.R. handed over to Pakistan an economic-technical report, prepared by Soviet designers, for the construction of a metallurgical plant in Karachi. Iran and the Soviet Union were drawing up a plan of cooperation which covers the next 10 to 15 years. Under this plan, the U.S.S.R. will assist Iran in constructing the second stage of the Ishafan steel plant which will raise production from this facility to about 4 million tons per year. An agreement between the U.S.S.R. and Romania on Soviet technological assistance and delivery of equipment for building metallurgical projects in Romania from 1971–75 was signed in June.

Pig Iron.—In 1970, 36 enterprises, operating 134 blast furnaces, produced 85.9 million tons of pig iron, a 5-percent increase compared with 1969 figures. Average blast furnace capacity is reported at 1,133 cubic meters. About half of all blast furnaces used oxygen for enrichment, some 85 percent of the pig iron being produced by partial use of natural gas.

On January 1, 1971, planned capacity had not been reached at many blast furnaces. Basically, these were units where the iron content of agglomerates was much below planned levels.[31]

The Jenakievo blast furnace (1,386 cubic meters) was put into operation in 1970, but the No. 3 (3,000 cubic meters) unit in West Siberia, the largest in the U.S.S.R., and the 2,700-cubic-meter furnace at the Karaganda plant in Kazakhstan, were not completed and were rescheduled for 1971. The Uralmash plant in Sverdlovsk has completed plans for a 3,200-cubic-meter furnace at Novolipetsk.

Three 5,000-cubic-meter blast furnaces are to be built at the Novolipetsk works, in the Ukraine, and in the Urals by 1975. Production of each of them is to be 5 million tons per year of pig iron from 26,000-tons-per-day of raw materials.

Steel.—In 1970, 76 metallurgical works produced 116 million tons of steel, 5 percent more than in 1969. It is planned to produce some 120 million tons of steel in 1971 and 142 to 150 million tons in 1975. Distribution of production by process, in percentages, follows:

Process	1965	1967	1968	1969	1970 [e]
Oxygen converter	5.0	10.2	11.8	13.7	15.0
Electric steel	4.9	4.6	4.6	9.0	10.0
Open hearth	88.0	83.4	81.9	75.9	73.8
Bessemer	2.1	1.8	1.7	1.4	1.2
Total	100.0	100.0	100.0	100.0	100.0

[e] Estimate.

About 400 open hearth furnaces (averaging a 245-ton capacity) and 28 oxygen converters (averaging a 91-ton capacity) operated in 1970. About 50 million tons of steel were produced by oxygen consuming open hearth units, and around 80 percent of the total national output was produced with the application of natural gas. Electric furnaces of 100-ton capacity were in operation during the year and construction of a 200-ton unit was underway. There were 33 continuous steel casting works (with a capacity of 5 million tons), including the Cherepovets plant commissioned in 1970, which produced about 4.2 million tons. Some units had been working well below capacity. At the Novolipetsk plant, all production was by continuous casting. The proportion of steel from oxygen converters was relatively low, mainly

[31] Metallurgia i gornorudnaya promyshlennost' (Metallurgy and Metal Mining Industry), Dnepropetrovsk No. 6, June 1970, p. 69.

because of limited automatic equipment for process control. These plants did not reach rated capacity, their steel was more expensive to produce, and labor productivity was lower than in open hearth furnaces.

The two largest Soviet oxygen converters (250-ton capacity) were commissioned during the year at Karaganda and one 100-ton capacity converter was commissioned at Chelyabinsk. Construction of the No. 6 oxygen converter (130-ton capacity) in the No. 2 shop at the Krivorozhstal' plant in the Ukraine began in January. Two electric furances were put into operation at the Cherepovets plant in 1970. The No. 4 hearth furnace at the Amurstal' plant in the Soviet Far East was commissioned in August.

In 1971, production of steel in oxygen converters is to increase by 16 percent, and production of continuous casting is to be increased 27 percent, to 5.3 million tons.

Soviet oxygen-converter statistics are shown in table 5.

Rolled Products.—Total Soviet rolled steel output in 1970 increased, but despite the increases in most categories, production of some structural shapes has remained inadequate. Since planned output of rolled products is measured in tons, metallurgical plants prefer to produce heavy types of products and are reluctant to manufacture thin sheet and light sections because this reduces output and labor productivity.

The "2,000" sheet-rolling mill at the Novolipetsk steel plant was commissioned in April. Those under construction included the "3,000" thick-sheet mill at the Azov plant in Zhdanov, the "1,700" cold-rolling mill at Karaganda, the "250" at the Lenin plant in Krivoy Rog, and the "950/800" mill at the Orsk-Khaililovo combine in Orenburg Oblast'.

Steel Pipe.—In terms of tonnage, the Soviet Union was the largest world producer of steel pipe, with a total of 12.4 million tons in 1970, 8 percent above the 1969 total. The largest pipe had a diameter of 1,220 millimeters. Fabrication was, however, inadequate for internal demand, and some 10 percent of requirements had to be imported from Germany, Sweden, Italy, and Japan. Some 60 percent of the total Czechoslovak pipe production goes to the Soviet Union.

The deficit arose because of the unbalanced production of some types of pipe and customers involuntarily adjusted their requirements, taking not the pipe needed, but the pipe they were given.[32] Quality of pipe is poor and does not correspond to state standards.[33]

The first section of the Volzhskiy pipe plant was completed in February. The plant can produce pipe from 530 to 1,420 millimeters in diameter. Czechoslavak continuous-welding equipment is used. The second stage is under construction. The largest Soviet continuous pipe-rolling plant, at Nikopol in the Ukraine, was commissioned in March and a "450" pipe-rolling mill at the Chelyabinsk plant

[32] Pravda (Moscow). Mar. 6, 1969, p. 2.
[33] Izvestiya (Moscow). Mar. 4, 1971, p. 3.

Table 5.—U.S.S.R.: L-D oxygen steel shops, as of January 1, 1971

Plant	Location	Annual capacity (thousand metric tons)	Furnaces: Number	Furnaces: Output per furnace, per heat (metric tons)	Furnaces: Began operation
Petrovskogo	Dnepropetrovsk, Ukraine	600	3	30	1956–57
Krivorozhstal'	Krivoy Rog, Ukraine	1,200	3	55	1958
Krivorozhstal'	Krivoy Rog, Ukraine	4,200	5	100	1965–67–69
Zhdanov, Il'ich	Zhdanov, Ukraine	2,500	3	100	1964–66
Chelyabinsk	Chelyabinsk, Urals	2,500	3	100	1969–70
Yenakiyevo	Yenakiyevo, Ukraine	3,200	3	130	1968–69
West Siberian	Novokuznetsk, West Siberia	2,500	3	100	1969
Novotagil'skiy	Nizhniy Tagil, Urals	2,500	3	100	1963–67
Novolipetsk	Lipetsk, Central European U.S.S.R.	2,500	3	100	1966–67
Karaganda	Karaganda, Kazakhstan	4,200	2	250	1970
Total		25,900	31	XX	XX

XX Not applicable.

started up in October. At the Karl Libkneht works in Dnepropetrovsk in the Ukraine, the second stage of the No. 4 mill was under construction in 1970; the mill was rescheduled for completion in 1971. Construction of a new pipe-making shop began at the Novolipetsk complex. The Ministry of Ferrous Metallurgy has approved enlargement and renovation of the Azerbaydzhan pipe-rolling plant for the 1971–80 period.

The consumption of steel pipe in the Soviet Union in 1970 follows:

Consumer	Percent of total
Capital construction (including the building of trunk pipelines)	40
Machine-building and metal-working	23
Oil and gas industry	16
Other branches of industry and other needs	21
Total	100

Ferroalloys.—Three electric furnaces for producing silico-manganese were commissioned at the Nikopol ferroalloy plant in Dnepropetrovsk Oblast' (Ukraine) in 1970. Two additional electric furnaces were put into operation at the Yermak ferroalloys plant in Kazakhstan.

Lead and Zinc.—With estimated output of primary lead at 440,000 tons and zinc at 610,000 tons, the U.S.S.R. was probably the world's second largest producer in 1970. The 1966–70 plan envisaged zinc production in 1970 at 1.6 to 1.7 times that of 1965, but neither lead nor zinc output quotas were reached in that or the previous 1959–65 plan because of slow construction of new projects and low metal recovery. The Soviet Union is interested in buying some 50,000 to 60,000 tons of Bolivian zinc annually.

Reserves of ore were estimated in 1970 at 17 million tons of contained lead and 22 million tons of contained zinc. From 65 to 75 percent of the reserves of lead and zinc ores are located in Kazakhstan, chiefly in the Altay region and in the district of Kara-Tay. Large reserves of zinc were also found in the Urals.

Kazakhstan continued to be the leading lead and zinc producer. Capital investments were directed towards expansion and renovation of the existing Achisay, Tekeli, Zyryanovsk, and Leninogorsk complexes and the Chimkent lead plant, which plans to double capacity. A new electric furnace was installed at the Leninogorsk combine and development of the Tishinsk mine (the basic supplier of raw material to this combine) continued in 1970. The capacity of the combine is to be increased by 30 to 35 percent during the 1971–75 period. The Zyryanovsk concentrating mill will become the most highly automated enterprise in the Soviet lead and zinc industry in 1971. At the Tekeli lead and zinc combine in this republic, the tenth level of the mine was developed and a new crusher at the ore concentrator was installed in 1970. Kazakhstan plans to increase zinc output by 2.3 percent in 1971.

One of the largest Soviet zinc plants, at Almakyk in Uzbekistan, reached first-stage operation in October, with second-stage completion scheduled by 1972. Construction was started in 1958. Development of the Nikolalvskiy mine at the Sikhali combine in the Soviet Far East was continued and its shafts will be almost 1,000 meters deep.

The first Georgian S.S.R. nonferrous enterprise, the Madneuli mining and concentrating combine, to exploit the copper-lead resources around Bolnisi was under development. It is planned to start mining lead from the Gorevskiy deposit in East Siberia.

Surveying of the newly discovered zinc deposit in the Buryat A.S.S.R. began and deposits were reported to have been discovered in the Kopet Mountains in West Turkmenistan. The Uspenka deposit of lead, zinc, tungsten, and other metals in Central Kazakhstan is expected to be a major producer.

Magnesium.—Five magnesium plants, with a combined annual capacity of about 60,000 tons, produced an estimated 50,000 tons in 1970, 11 percent more than in 1969. The second stage at the Berezniki titanium magnesium combine in the Urals, which started in 1968, attained its planned capacity, becoming the largest Soviet magnesium producer. The plant of the Kalush chemico-metallurgical combine in West Ukraine became operational in March.

Manganese.—The Soviet manganese industry remained the largest in the world, with an estimated 1970 output of marketable ore at 6.8 million tons. Exports increased from 1.15 million tons of manganese ore in 1968 to 1.20 million in 1969, and 1.24 million tons in 1970. Run-of-mine ore output in 1970 was around 16 million tons, about 70 percent coming from the Ukrainian deposits at Nikopol and Bol'she-Tokakskiy. The second largest production center was the Chiatura basin in Georgia, with Kazakhstan, though undeveloped, third. It is planned to mine some 22 million tons of crude ore by 1975. At the year end, reserves of manganese ore were estimated at 2,500 million tons, averaging 23 to 26.4 percent Mn.

The principal Soviet manganese basin, the Nikopol in the Ukraine, has reserves many times greater than the Chiatura, but the ore bed is little more than 2 meters thick and lies under up to 80 meters of overburden. In 1970, 18 underground mines, 10 open pits, and eight concentration plants were in operation in this basin, more than 70 percent of the ore coming from open pit mines. Concentration by gravity and agglomeration yielded a recovery of 71 to 75 percent, with 45 to 48 percent Mn content concentrates, the balance containing around 34 percent. Tailings contained 12 to 15 percent Mn.

Mine No. 7, the largest in the Nikopol, reached planned capacity of 500,000 tons of crude ore in 1970. The Bogdanovskiy North open pit, with planned crude ore output of 1.1 million tons per year, was under development in this basin.

The Chiatura basin in Georgia, the richest Soviet manganese area, produced 1.5 to 2 million tons of concentrates from 19 mines (and from the first stage of the 100,000-ton-per-year Itkhvisi mine commissioned in May) and eight concentrators at the beginning of 1970. Over 80 percent was extracted from underground mines. Of the total beneficiated, 66 percent contained 48.7 percent Mn, and the rest, 25.6 percent Mn. New production facilities totaling 150,000 tons per year of crude ore were under development at the Dargveti and Itkhvisi mines, and the second stage of the central flotation plant was built in 1970.

Mercury.—Soviet mercury output in 1970 was estimated at 48,000 flasks (76-pound), sufficient for domestic demand. The 1966–70 plan had indicated output at 1.5 times the 1965 level, suggesting planned output of 60,000 (76-pound), and actual production was only 80 percent of this quota.

The largest Soviet mercury enterprise, the Khadarkan combine in Kirghizia, had four mines and a recovery plant operating in 1970. The second largest was the Nikitovskiy combine in the Ukraine. A new mercury complex at Khust, Transcarpathia in the Ukraine, started up in November. The largest Soviet mercury-antimony enterprise, in Tadzhik S.S.R., was under construction, as was a new mercury complex at Belovo-Osipovo in the Kuznetsk basin in West Siberia. The Aktashsk mercury deposit in the Altay region was under detailed exploration during the year. Mercury output in Magadan Oblast' by 1975 is expected to be 32.4 percent higher than in 1970.

Molybdenum.—Output of molybdenum concentrate (metal content) was estimated at 7,700 tons, 3 percent above that of 1969. About 30 percent of production was based on copper-molybdenum ores from Armenia, Kazakhstan, Sorskoye, and others in Siberia; over 30 percent was from molybdenite ore mined in Uzbekistan and at Umaltinsk and Chikoysk in Siberia; and the remainder came from the tungsten-molybdenum ores of Tyrny-Auz (Kabardin A.S.S.R. in North Caucasus) and Dzhida (Buryat A.S.S.R.) and from miscellaneous types. There are plans to construct the Zhirekenskiy mining and concentrating molybdenum combine in Chita Oblast', East Siberia, by 1975. Soviet reserves of molybdenum in ore may approach 200,000 tons.

Armenia was the largest producer of molybdenum concentrate from copper-molybdenum ores, but the concentrate was shipped out of the republic for further treatment. The Kadzharan copper-molybdenum combine in this republic supplied about one-third of the Soviet molybdenum in 1970. During the last 10 years, output of concentrates at this combine increased 1.7 times; opencast mining and the ore's high metal content made them the lowest cost molybdenum concentrates in the U.S.S.R.

The Tyrny-Auz tungsten-molybdenum combine at Kabardin A.S.S.R. was undergoing a 50-percent enlargement in 1970. The metal content of the deposit consists of 0.2 to 0.3 percent molybdenum and three times that amount of tungsten trioxide, with traces of copper, gold, and silver. The Balkhash metallurgical complex in Kazakhstan and the Dzhidinsk tungsten-molybdenum combine in Buryat A.S.S.R. increased output of molybdenum concentrates during the year. The Sorskiy molybdenum combine in Krasnoyarsk Kray in West Siberia became one of the leading Soviet molybdenum enterprises in 1970.

Nickel.—The U.S.S.R. retained its position as the world's second largest nickel producer, with an estimated 110,000 tons of smelter products. Of the six smelters in operation, Norilsk in West Siberia was the foremost producer; Ufaley, Rezh, and Khalilovo smelters in the Urals were a close second; and Monchegorsk and Pechenga smelters in the Kola Peninsula were third. The Soviet Union is an important supplier of nickel to the Western World, and it also trades directly with the biggest world producer, The International Nickel Co. Ltd., in selling the company large quantities in annual negotiated deals. The U.S.S.R. was negotiating with French, British, and Japanese companies for joint development of nickel deposits in the southern Urals and in Siberia. It is thought probable that the "surplus" will be available to non-Communist countries in increasing quantities.

Nickel resources recently have been found outside the Urals and the eastern regions of the U.S.S.R. Large-scale drilling operations have been in progress for some time in the Voronezh, Belogord, Kursk, and Rostov regions. Measured, indicated, and inferred reserves of ore are estimated to contain more than 5 million tons of nickel in nickel-copper sulfide and low-grade silicate ores.

Two open pits and one underground mine were in operation at the "Norilsk I" sulfide deposits, where the ore averages 0.5 percent Ni, 0.75 percent Cu, and up to 11 grams per ton of platinum-group metals—mainly palladium and platinum. Ore at the "Talnakh" deposit averages about 1.5 percent Ni, about 3 percent Cu, and up to 11 grams per ton platinum-group metals. The Mayak underground mine, in operation at the "Talnakh" deposit, produced two-thirds of the Norilsk total metal output in 1970, recovering 14 elements (11 elements as byproducts). Development of the Komsomol'skiy and Oktyabrskiy mines at this deposit continued. The fourth (Skalistyy) and fifth (Glubokiy) mines were being planned. Plans for a second nickel plant at Norilsk were approved in 1970. Construction of this plant will begin in 1971; the new plant is scheduled to begin operations in 1974.

Three open pits were in operation in the southern Urals and shipped ore to the Yuzhno-Ural'skiy nickel combine.

The Monchegorsk ore averages about 0.7 percent Ni, 0.4 percent Cu, and some precious metals. International Nickel Co. considered that the sulfide ore at Pechenga, prior to 1941, graded about 3.8 percent Ni and 0.08 percent platinum-group metals. The Kola ores were mined by both opencast and underground methods, and the Zhdanovskiy mining and dressing combine is the largest of the operations in this area. In the Ukraine, the Pobuzhye nickel combine was under construction in 1970.

Platinum.—The Soviet Union remained the largest world platinum-group metals producer and exporter, supplying 20 to 25 percent of international exports of platinum, and 70 to 75 percent of palladium, with reserves adequate to maintain current production for many years with increased exports.

The most important Soviet platinum deposits are the Norilsk (Talnakh) sulfide ores, with up to 11 grams per ton platinum-group metals, Severonikel and Pechenganikel combines in the Kola Peninsula, and some placer deposits in the Urals. Virtually all platinum and platinum-group metals were produced as byproducts, about 75 percent coming from Norilsk. The Soviet Union is steadily expanding production of platinum-group metals with 1970 output estimated to be about 50 percent higher than in 1965.

In 1970, construction was in progress at the Talnakh mining combine; the Mayak mine was approaching planned capacity; the Komsomol'skiy mine was being developed, with the first stage planned to start up in 1971; a third mine, Oktyabr'skiy, began development in 1969, with the first stage scheduled for completion in 1974; and planning proceeded on the Skalistyy and Glubokiy mines. In the Kola Peninsula, the second stage of the Zhdanovskiy concentration plant of the Severonikel combine was in progress, and construction of the new crushing plant of the Pechenganikel complex neared completion, but in 1970 the Severonikel and Pechenganikel combines were depending on ore and concentrates from Norilsk. In summer, the port of Murmansk continued handling Norilsk ore for these combines, some

200,000 tons of ore passing through during the navigation season.

Silver.—In 1970 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. During the year, 14 gold treatment plants extracted silver and the Norilsk complex and some of the Kola copper-nickel enterprises also produced silver.

Silver production from lead and zinc concentrates apparently increased at most mines during the year. The Sikhali ore combine in Maritime Kray, one of the largest silver producers fulfilled 1970 planned output. The Achisay lead-barite complex in Kazakhstan mined 15,000 to 20,000 tons per day of ore in 1970, one ton of concentrates from this complex's Kentau concentrator containing about 500 grams of silver. Metallurgical recovery of silver was 16 to 50 percent from complex ores with 6 to 16 grams per ton of Ag.

Tin.—Production of tin, amounting to an estimated 37,000 tons, was inadequate to meet internal demand, and about 20 percent of the requirements were imported in 1970. The 1966–70 plan envisaged an increase of 60 percent in Soviet tin output, indicating a probable planned level of around 48,000 tons. In June the Soviet trade agency, Raznoimport, signed a £ 3.3 million contract with Bolivian mining interests for the purchase of 800 tons of tin and 2,400 tons of tin concentrate in 1970, and a possible further £ 15 million worth of Bolivian tin for delivery in 1971. Under this contract, the U.S.S.R. was to help with scientific and technical cooperation in improving Bolivia's tin industry. The Soviet Union was negotiating with Indonesia regarding the possibility of setting up a tin processing plant in that country.

U.S.S.R. tin development was concentrated in Maritime Kray, Magadan Oblast', Khabarovsk Kray, Yakutia, and Transbaykal. The Maritime Kray continued to be the main center of tin production in the country in 1970. Three known tin refineries were operating during the year: the Novosibirsk, Ryazan', and the Podol'sk (near Moscow). Concentrates from Siberia and the Soviet Far East were shipped to Novosibirsk.

Expansion of the Khrustal'nyy mining and concentrating combine continued in Maritime Kray, Solnechnyy in Khabarovsk Kray, and the Sherlovskiy in the Transbaykal area. Construction of the Deputatskiy tin mining combine in Yakut A.S.S.R. was started, completion is planned by 1975. Tin output in Magadan Oblast's is expected to be 10.5 percent higher in 1975 than in 1970. The Ministry of Geology carried out intensive exploration programs and new small deposits were reported.

Titanium.—With an estimated 12,000 tons, the U.S.S.R. was the world's second largest producer of titanium in 1970. The Soviet titanium industry, developed mainly in the last 10 years, is based principally on Ukrainian and Siberian ilmenite and rutile, and on titaniferous magnetites and ironstones located in the Central Urals, the Kola Peninsula, and Kareliya. During the 1966–70 period, production of titanium in Kazakhstan increased by 426 percent.

The most important sources of ilmenite are newly discovered placer deposits on two right-bank tributaries of the Dnieper River in the Ukraine. Major producers continued to be the Samotkanskoye zirconium-titanium alluvial deposit and the Volchanskoye titanium deposit in Dnepropetrovsk Oblast'; the Irshanskoye, Streminogorskoye, and Zelenogorskoye titanium deposits in Zhitomirskoya Oblast'; and the Tarasovskoye deposit in Kievskaya Oblast'. Two combines, the Irshanskiy mining and beneficiation combine, where dredges are used for ilmenite extraction, and the Verskhnedneprovskiy combine, the main raw material supplier for the Soviet titanium industry, operate these deposits. The Nos. 3 and 4 concentrators in Irshansk and a plant for producing titanium dioxide in the Crimea were under construction during the year.

Tungsten.—Estimated production of tungsten in concentrate increased by 3 percent in 1970, with the North Caucasus, Transbaykal, Soviet Far East, Central Asia, and Kazakhstan remaining the principal producing centers.

The sixth section of the Tyrny-Auz tungsten and molybdenum combine in Kabardin A.S.S.R. (North Caucasus) was being built, and the Vostochnyy open pit of this combine was also being developed during the year, where the deposit averages up to 1.3 percent WO_3. The Nal'chik hydrometallurgical plant in Kabardin A.S.S.R., based on Tyrny-Auz ores, produced

1.5 percent more tungsten than in 1969. Output of tungsten concentrate rose by about 4 percent at the Dzhidinskiy tungsten and molybdenum combine in Buryat A.S.S.R., following installation of new equipment in 1969; a second beneficiation plant is planned there.

The first stage of the Vostok combine in Maritime Kray, one of the largest Soviet nonferrous metal enterprises, has been rescheduled to start up in 1971–72. In addition to tungsten mines, the combine will include a beneficiation plant. A second wolfram deposit has been discovered near Vostok in Maritime Kray. The Iultin mine in Magadan Oblast' is being modernized. Tungsten concentrate output in Magadan Oblast', by 1975, is expected to be 8.3 percent higher than in 1970.

Vanadium.—The principal sources of vanadium in 1970 continued to be vanadium-rich slag, coproduction with iron from the Kachkanar titaniferous magnetite deposit in the Urals, and iron ore from Lisakovska (0.6 percent vanadium) in Kazakhstan. Rated recovery was not, however, achieved because of metallurgical problems.

The first stage of the Kachkanar pellet plant, with a capacity of 1.4 million tons of iron ore pellets per year, came into operation in September. This output will be doubled when designed capacity is reached. At that time, the plant will process 32 million tons of crude ore into 5.6 million tons of pellets, to be supplied to the nearby Novo-Tagil works.

The Lisakovska combine in Kustanay Oblast', Kazakhstan, was under construction in 1970, and a new plant to produce ferrovanadium magnetite ore was also being built at the Serov steelworks in the Urals.

Minor Metals.—Although the U.S.S.R. began production of virtually all the rare metals during the 1959–70 period, extraction of many of them remains low.

The Balkhashskiy copper smelting complex in Kazakhstan first began recovering rhenium salts from reprocessed molybdenum plant products and from sulfuric acid plant washings in 1966, and by 1970 had increased output "substantially."

The main centers of selenium and tellurium extraction continued to be the Norilsk and the Kola complexes, where the metals are recovered at the electrolytic copper plants. Selenium is also produced at non-ferrous plants in Kazakhstan, the Urals, and Armenia.

The bulk of tantalum and columbium in the U.S.S.R. is in pyrochlore (Kola Peninsula, Urals) and in hatchettolite (Kola, Khiba, and elsewhere). Newly discovered deposits of low-grade tantalum-columbium ores in granites also contain other rare metals, and the growing need for tantalum necessitates processing ores and concentrate with very low tantalum content.

Among enterprises exploiting zircon alluvial deposits in 1970 were the Samotkanskoye deposit in Dnepropetrovsk Oblast' in the Ukraine. The Verskhnedneprovskiy combine, brought into operation in 1969 to mine this deposit, increased output of zircon concentrate in 1970.

Only 40 percent of total lead tailings were used for rare and precious metal extraction, and no processing was carried out on tailings from copper smelting in 1970.

NONMETALS

Asbestos.—In 1970, the U.S.S.R. produced an estimated 1.07 million tons of six grades of asbestos, 11 percent more than in 1969. 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 346,500 tons in 1969, and to an estimated 380,000 tons in 1970, with approximately two-thirds of the tonnage going to Western markets—principally to France, Japan, and West Germany. The new 5-year plan foresees increases in production capacities of 600,000 tons by completion of the second stages of the Dzhetygara and Tuvaasbest combines by 1975.

The Uralasbest combine (Bazhenovo deposit) accounts for some 73 percent of total chrysotile-asbestos output. The Kustanayasbest combine, exploiting the Dzhetygara deposit in Kazakhstan, which contains only medium- and low-grade asbestos, contributed over 24 percent (259,000 tons).[34] The planned 400,000-ton-capacity of this combine, not completed in 1970, has been rescheduled for startup in 1971. The third center, the Tuvaasbest at Ak-Dovurak, produced about 3 percent of Soviet output.

[34] Stroitel'nye materialy (Construction Materials), Moscow. No. 6, June 1971, p. 6.

This deposit is of the highest quality and has the longest fibre in known Soviet reserves. The second stage of this combine was also rescheduled for completion in 1971.

Anthophyllite and other nonchrysotile varieties of asbestos have been mined at the small Sysertsk deposit and elsewhere.

Construction of the first stage of the Kiembay asbestos combine in Orenburg Oblast' continued. The survey of the Molodezhnoye and Il'chirsk chrysotile asbestos deposits in Buryat A.S.S.R. were reported to have been completed, and their future development has been planned.

Barite.—About two-thirds of the Soviet barite needs were produced domestically, the remainder imported. The main center continued to be the Georgian S.S.R., which produced 70 percent of the total output. New barite deposits were found in Georgia, and construction of a 45,000-ton-per-year mining and concentrating combine was started in Khaishi in Svanetia in 1970.

Cement.—Cement output was 95.2 million tons, or 6 percent, higher in 1969. There were around 110 cement plants (including 83 plants under the Ministry of Construction Materials) in operation in 1970. Production is slated to rise to 122 to 127 million tons of cement in 1975. It is estimated, however, that production in 1975 will probably not be more than 120 million tons. The 1966–70 plan scheduled Soviet cement output to rise to a planned level of 100 to 105 million tons by 1970, but actual output was 5 to 10 percent less.

Poor quality of cement produced has remained virtually unchanged in the past few years. Sand and gravel, and other aggregates did not go through all the necessary stages of preparation. As a result, much of the cement was wasted. Therefore, the production figures for cement must be corrected for uneconomic use.

Diamond.—Soviet diamond mining continued to expand in 1970, with output mainly centered in Yakut A.S.S.R. Production was estimated very roughly at 6.25 million carats of industrial diamonds and 1.60 million carats of gem stones, mainly from the Mirnyy, Aykhal, Udachnaya, and Irelyakh deposits. Seven beneficiation plants were in operation during the year. The second section of the No. 8 concentrator at the Aykhal open pit and the No. 11 plant at the Udachnaya open pit were rescheduled to start up in 1971.

Output is 80 percent industrial stones and 20 percent gems. Sales of cut diamonds, mainly from Yakut, have risen steadily, and substantial increases in exports to Western countries are expected to start in 1975.

Small quantities of gem and industrial stones were produced from the Vishera River region in Perm Oblast', western Urals, where four dredges, and two separation plants were operated at two placer deposits in 1970. The large Smolensk diamond processing plant, opened in 1965, was being expanded, and a second plant in Kiev was scheduled to start up in 1971–72.

Production of synthetic diamond and of instruments utilizing these diamonds were centered in Yerevan, Kiev, and Moscow. Two new varieties of synthetic diamonds were manufactured at the superhard materials experimental institute in Kiev. For the first time in Central Asia, the Tashkent abrasive combine began the manufacture of artificial diamonds in December.

Fertilizer Materials.—Fertilizer production totaled 13.1 million tons in 100-percent nutrient content or 55.4 million tons in bulk fertilizer content[35] in 1970 but was well behind the original target of 65 million tons bulk content set by the 5-year plan. Nevertheless, compared with 1969 output, manufactured fertilizer production in 1970 increased 20.6 percent. This increase was obtained mainly through the commissioning of new capacities. In 1970 capacities (new construction and expansion or renovation of existing facilities) for 9.8 million tons of fertilizers per year were added, including those at the Novgorodskiy, Cherkasskiy, and Rustavskiy chemical combines; the Cherepovets nitrogen fertilizer plant; the Kuybyshev chemical plant; the first stage of Berezniki No. 2 (annual capacity of 1.7 million tons); the Solikamsk (renovation and addition of 270,000 tons); Soligorsk No. 1 (addition of 350,000 tons); and the first stage of Soligorsk No. 3 (capacity of 1.2 million tons). It is planned to produce 61.3 million tons of mineral fertilizers in 1971 and 90 million tons in 1975.

[35] The active ingredients (nitrogen, phosphorous, and potash) are expressed in terms of Soviet standard units which are not the same as those used in the United States. Nitrogen is expressed as ammonium sulfate, 20.5 percent N; phosphate is expressed as 18.7 percent P_2O_5; potash is expressed as 41.6 percent K_2O; and ground rock phosphate (phosphatic flour) is expressed as 19 percent P_2O_5.

There was a significant increase in exports of mineral fertilizers from the U.S.S.R. in 1970. Exports of phosphorous fertilizers, including superphosphate and apatite concentrate totaled 6.3 million tons, about 3.3 percent more than in 1969. Exports of potassic salts (41.6 percent K_2O equivalent) increased from 1.7 million tons in 1969 to 3.1 million tons in 1970 (more than two-thirds went to Communist countries). Exports of nitrogen fertilizers totaled 958,400 tons in 1969 and 1,048,700 tons in 1970. However, despite the substantial production and large exports, fertilizers were in short supply, and the quantity of mineral fertilizers produced did not meet domestic consumer demands. In 1970, the average percentage of nutrients in Soviet fertilizers was below 30 percent, considerably less than in the United States and Western Europe. A high percentage of superphosphate was not granulated and great difficulties were experienced in commissioning some new projects.

Over 97 percent of the fertilizers were shipped by railroad, mostly in bulk, causing loading losses, moisture penetration, and difficulties in loading and unloading. Unloading took place at almost 4,000 railroad stations with the help of manual labor. As a result, about 5 million tons (about 10 percent of the total shipped) of fertilizers were lost in 1970.[36]

The Soviet Union has agreed to loan the United Arab Republic £25 million to finance the construction of a 40,000-ton-per-year plant to produce elemental phosphorous from locally mined phosphate rock.

Phosphate.—Output of phosphate rock totaled 46.2 million tons in 1970, including 27.2 million tons of apatite (17.5 percent P_2O_5) and estimated 19 million tons of sedimentary rock (13 percent P_2O_5). The main centers of crude phosphate rock production were the "Apatit" combine on the Kola Peninsula, which produced about three-quarters of all raw materials for the production of phosphate fertilizers, and the phosphate deposits of Karatau in Kazakhstan, Kingisepp in Leningrad Oblast', Egor'evsk and Lopatino in Moscow Oblast', Upper Kama in the Urals, and elsewhere.

The apatite-nepheline deposits of the Khibiny in the Kola Peninsula comprised the Soviet's largest single phosphate source. Mined ore, averaging 17 to 18 percent P_2O_5 was concentrated up to 39.4 percent P_2O_5 with 92-percent recovery. During the 1966–70 period, some 10.5 million tons of apatite ore and 3.4 million tons of apatite concentrate production capacity was brought on stream at the "Apatit" combine. The two beneficiation plants had a combined annual capacity of 11.3 million tons, while the four mines had an annual capacity of 27 million tons of crude ore in 1970. Opencast mining was used to recover some 60 percent of the ore. The Tsentral'nyy open pit (capacity of 12 million tons) produced over 40 percent of the total ore recovered at the combine. Production of 14.5 million tons of concentrate is planned for 1975. During the period up to 1975, new capacities of 6.5 million tons of ore and 3.2 million tons of apatite concentrate are to be commissioned. It is planned to develop a new underground mine at Koavshinsk deposit and Saamskiy open pit by 1975. Apatite deposits estimated at nearly 900 million tons were reported near Ulan-Ude in Buryat A.S.S.R., close to the Trans-Siberian railway, and a combine is to be built there.

Four open pits at the Akasy deposit and two open pits at the Dzhantas deposit and the Molodezhoye underground mine at the Chulaktau deposit, with a total capacity of around 4.5 million tons of crude ore, were in operation in Karatau in 1970. The ore, containing up to 26 percent P_2O_5 was concentrated up to 28.5 percent P_2O_5 but, because of poor technology, only 35 to 40 percent of the planned capacity was achieved in 1970. The renovation of the recently constructed crushing and grinding mill began in 1968 and the first stage, with an annual capacity of 2.2 million tons of ore (650,000 tons of phosphatic flour), was put into operation in December.

Potassium.—The U.S.S.R. is one of the world's leading nations in potassium reserves, fertilizer output, and exports of potash salts. Estimated 1970 output of potash was 4.45 million tons, 37 percent higher than in 1969 and expansion continues. Under the original 5-year plan (1960–70) for mineral fertilizers, a target of 5.2 million tons K_2O equivalent was projected for 1970. But actual levels of output were considerably below those indi-

[36] Material'no-tekhnicheskoye snabzheniye (Material and Technical Supply), Moscow. No. 4, April 1971, p. 62.

cated in the 5-year plan for the fertilizer industry.

The four major potash producing areas are Solikamsk and Berezniki on the western side of the central Urals; Soligorsk in Belorussia; and Stebnikov and Kalush in West Ukraine. The following eight combines were in operation in 1970: Solikamsk; Berezniki No. 1 and the first stage of No. 2; Soligorsk Nos. 1 and 2 and the first stage of No. 3; and the first stage of Novo-Stebnikov and Kalush combines. The second stages of Berezniki No. 2, Soligorsk No. 3, and Novo-Stebnikov were scheduled to begin operation in 1971. Construction is planned for four more combines in 1971–75. Some of the plants have operated over long periods of time with lower capacities than originally planned. On July 1, 1970, planned capacity of the Kalush combine reached only 53.2 percent.[37]

Nitrogen.—Estimated nitrogen production was 26 million tons in 1970, 4 million tons more than in 1969. The bulk of the production was in the form of ammonium sulfate and ammonium nitrate fertilizers, although production of urea and liquid fertilizers has increased. Plants supplied by Western firms to Mashimport have started up at Nevinomysk and elsewhere, and three Japanese ammonia plants are to be built at Novogorod, Novomoskovsk, and Severodonetsk. Under the 5-year plan for the years 1966–70, 28 million tons of nitrogen fertilizers were to be produced in 1970.

Fluorspar.—Soviet output remained insufficient to meet domestic demand despite large reserves and development of new mines and facilities; imports of high-grade fluorspar continued. Primorskiy Kray, Chita Oblast', and Buryat A.S.S.R. were the main production areas in 1970. A concentrating mill at the Kalanguev mines in Chita Oblast', put into operation in 1969 with annual capacity of 20,000 tons, did not reach planned capacity in 1970.

Graphite.—The Zavalovskiy graphite combine in Kirovgrad Oblast', in the Ukraine, produced over 130,000 tons in the 1966–70 period. The foremost graphite producer in the U.S.S.R., this combine exceeded its 5-year production quota.

Mica.—Almost three-quarters of all muscovite mica production continued to come from the Mamsko-Chuyskiy region of Irkutsk Oblast'. The Mamsko-Chuyskiy mica exploration division of the Irkutsk geological administration employed about 2,000 persons.[38] Mica was also mined in Yakutsk A.S.S.R., in the Karelo-Murmanskiy region and elsewhere. Targets for 1966–70 were exceeded by the Irkutsk, Filinsk, and Kireyevsk mica plants. Strategic-grade mica continued to be imported from India for special industrial demands.

Salt.—The Donets Basin accounted for over 40 percent of the Soviet salt output in 1970. What is reported to be the world's largest salt mine started up near Artemovsk in the Donets Basin in 1970, with an output of over 7,000 tons of common salt per day mined from depths of 150 to 300 meters.

Sulfur.—The principal producers of native sulfur continued to be Rozdol (West Ukraine) and Gaurdak in Central Asia, which together produced the bulk of the country's requirements. New capacity is planned for the Gaurdak sulfur combine, which in 1974 is to increase output by 100,000 tons per year. Output of sulfur at this combine is to double during the 1971–75 period. Other deposits are at Shorsu and Changyrtash (Central Asia) and at Alekseyevsk, Vodninsk, and elsewhere in the Volga region. Some 30 percent of the Soviet sulfur was produced as a byproduct. A pilot installation using the Frasch process was put into operation at the Yavorov combine during the year.

Sulfuric acid production began at the Kirovabad aluminum plant in Azerbaydzhan, at the Korotchenko coke products plant in Krivoy Rog, and at the Rovno nitrogen fertilizer plant.

A sulfur production shop at the Rozdol combine, which was put into operation in 1969, attained less than 10 percent of the planned capacity in 1970.[39]

MINERAL FUELS

Production of primary energy derived from fossil fuels, fuelwood, hydroelectric, and nuclear generation rose from 699.1 million tons in standard fuel (coal) equivalent in 1960 to an estimated 1,264 million

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[37] Ekonomika Sovetskoy Ukrainy (Economics of Soviet Ukraine), Kiev, in Russian. No. 7, July 1970, pp. 21–29.

[38] Razvedka i okhrana nedr (Exploration and Conservation of Natural Resources). Moscow, No. 4, April 1971, pp. 9–12.

[39] Stroitel'naya gazeta (Construction Gazette), Moscow. Jan. 24, 1971, p 2.

tons in 1970, showing a compound annual growth rate of 6.2 percent. The production of petroleum during the same period increased at an average annual rate of 9.1 percent as output, in terms of standard fuel, rose from 211.4 million metric tons to 504.8 million tons in 1970, while natural gas production expanded at a compound annual rate of 15.9 percent as its contribution to the total Soviet energy output, again in terms of standard fuel, surged from 54.4 million tons in 1960 to 238 million tons in 1970. The share of petroleum and natural gas in the total Soviet primary energy production rose from 38 percent in 1960 to 59 percent in 1970, while the share of coal (anthracite, bituminous, and lignite) declined from 53.3 percent to 35.5 percent in the same period. The contribution of fuel peat and oil shale decreased from 3.6 percent in 1960 to about 2 percent in 1970.

Despite a continued, established trend towards increasing the share of natural gas and petroleum in the Soviet energy economy while the share of coal declines, coal is still the major source of energy consumed in the U.S.S.R. and is expected to retain its primacy in the Soviet energy consumption for years to come.

The growth in the share of petroleum and natural gas in the national energy supply resulted in a reduction in the overall average fuel costs. Energy production costs, in terms of standard fuel, averaged 6.28 rubles in 1968 as compared with 10.25 rubles in 1955. The comparative costs of one ton of standard fuel in the Ukraine in 1968 was reported as follows: natural gas, 1.26 rubles; crude oil, 3.34 rubles; and coal, 16.2 rubles.[40]

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 power and fuel were consumed in 1970.

The output of fuel and energy in the U.S.S.R. in 1975 is placed at 1,585 million tons of standard fuel. By 1980, Soviet primary energy production is to rise to 1,900 million tons. Compared with 1970 output, the 1980 production of gas is to rise by 85 percent, oil by 70 percent, coal by 15 percent, hydroelectric power by 77 percent, and nuclear power by 350 percent. By that time, nuclear power will be just about ready to come into its own. The 1980 outlook is for an extension of the 1975 programs with some concessions to light industry. Published information on Soviet investment policies, improvements in technology, and planned allocation of necessary manpower resources substantiate the projected growth rates.

In 1980, the share of petroleum and natural gas in the total energy production is to be about 68 percent, 27 percent is to be in the form of coal, and 5 percent is to be from all other sources.

Whereas there is a general agreement on the approximate level of future energy output among Soviet fuel specialists, opinions vary somewhat on the pattern of energy consumption. Clearly there will be a trend toward greater use of oil. It is expected, however, that the U.S.S.R. will make great efforts to substitute coal and natural gas for petroleum in order to make petroleum available for export. The Soviet Union, therefore, will still consume considerably less oil per capita than Western European countries.

Total consumption of all types of primary energy in the U.S.S.R. is to be equivalent to about 1,650 million tons of standard fuel in 1980, almost 1.5 times the 1970 consumption.

According to published long-term trade agreements between the Soviet Union and satellites and between the Soviet bloc countries and West European countries and Japan, and trade objectives announced in the various Communist 5-year plans (usually 1971–75), it has been estimated that fuel exports from the Soviet Union to the free world would be about 108 million tons of standard fuel in 1975 and 130 million tons in 1980.

Total primary energy balance of the U.S.S.R. for 1970 and estimates for 1975 and 1980 are shown in table 6.

Despite expansion of the Soviet primary energy production during recent years, the fuel and energy supply in the U.S.S.R. has not kept up with the demand of the Soviet economy which has experienced chronic energy shortages, particularly in the European part of the U.S.S.R. The Soviet economy sustains immense losses each

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[40] Neftyanaya i gazovaya promyshlennost' (Oil and Gas Industry), Moscow. No. 2, March–April 1970, pp. 8–12.

Table 6.—U.S.S.R.: Total primary energy balance for 1970 and estimates for 1975 and 1980 [1]

(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	Hydro-power	Nuclear power
1970:									
Production	1,264.0	[2] 448.0	[2] 504.8	[2] 238.0	[3] 21.4	[e] 8.1	[e] 28.0	15.3	0.4
Imports [e]	12.4	8.3	(4)	4.1	--	--	--	--	--
Exports [e]	170.8	29.2	137.5	3.6	--	--	--	.5	--
Apparent consumption [e]	1,105.6	427.1	367.3	238.5	21.4	8.1	28.0	14.8	.4
1975: [e] [r]									
Production	1,585.5	481.0	688.0	333.0	22.4	9.5	30.0	20.9	.7
Imports	31.7	9.1	7.1	15.5	--	--	--	--	--
Exports	247.7	30.4	188.8	27.4	--	--	--	1.1	--
Apparent consumption	1,369.5	459.7	506.3	321.1	22.4	9.5	30.0	19.8	.7
1980: [e] [r]									
Production	1,910.6	517.0	858.0	440.0	26.1	10.6	30.0	27.1	1.8
Imports	47.0	10.1	14.3	22.6	--	--	--	--	--
Exports	318.6	33.2	237.5	46.4	--	--	--	1.5	--
Apparent consumption	1,639.0	493.9	634.8	416.2	26.1	10.6	30.0	25.6	1.8

[e] Estimate. [r] Revised.

[1] Production data for 1960 and 1965 taken from the National Economy of the U.S.S.R. (Moscow), 1960 and 1965; trade data from Foreign Trade of the U.S.S.R. (Moscow), 1960 and 1965.

[2] Production data reported in Pravda (Moscow), Feb. 4, 1971.

[3] Peat production reported in The Peat Economy (Moscow), February 1971, p. 6.

[4] Insignificant.

year as a result of insufficient output and underutilization of energy. For example, an estimated 50,000 tons of coal per year alone, consisting mainly of "fines", have been reported lost through the cracks of railway cars on the 1,000-kilometer route between Karaganda and Magnitogorsk.[41] In many sectors of the Soviet economy more electric power and fuels are consumed per unit of product, than is required with modern technology.[42]

The Soviet Union's reported energy consumption per capita approaches that of Western Europe, although there is still a significant difference in the standard of living. One reason for the apparent difference is that the Soviet growth is measured in terms of energy "produced", not in terms of energy usefully consumed. In addition, fuel shortages often bring with them the production of substandard fuels, which are often marketed as standard quality fuels.

Coal.—In 1970 the U.S.S.R. produced 624 million tons of run-of-mine bituminous coal, anthracite, and lignite (or an estimated 357 million tons of "clean" coal), placing it second among world coal producers. This was 16.2 million tons (or 2.7 percent) more than was produced in 1969, but 41 to 51 million tons below the original plan of 665 to 675 million tons, and production has not met any targets from 1959 to 1970 which were revised down when they proved to be over optimistic. Of the total output, coking coal accounted for 165 million tons, or 2 percent more than in 1969. Despite a sharp growth in oil and gas production, coal still accounted for about 39 percent of the Soviet energy consumption in 1970. Ten major and numerous minor coalfields produced an estimated 474 million tons of run-of-mine hard coal (395 million tons of bituminous and 79 million tons of anthracite) and 150 million tons of brown coal or lignite. About 26.7 percent of the total output was surface-mined. The Donets, Kuznetsk, Karaganda, and Pechora coal basins produced over four-fifths of the total coal output in terms of calorific value and about 97 percent of the coking coal in the Soviet Union. The coal industry employed about 2.2 million men and women, including 1.2 million "production workers", 61,500 university graduate engineers, and 141,000 graduate technicians.

In 1970, there were about 1,000 underground coal mines (under the Ministry of Coal Industry) with an average annual capacity of some 460,000 tons (from 200,000 to 1,800,000 tons) and 69 open pits with average annual output of some 2.2 million tons of run-of-mine coal in operation. The average ash content of all marketable coal increased from 19.4 percent in 1965 to 19.7 percent in 1970. In some lower-grade home heating fuel, however, the ash content was as high as 45 percent. The calorific value of coal shipped averaged a little more than 5,000 kilocalories per kilogram (9,300 Btu per pound). The throughput of the Soviet Union's 173 preparation plants was 285 million tons of run-of-mine coal (175 million tons of clean coal), which represented about 46 percent of the total coal production.

The average working thickness of the coal seams, according to 1970 data, was 1.32 meters. The maximum depth at which underground coal production was carried out reached 1,100 meters in 1970, while the average depth was about 350 meters. Distribution of coal production by mining methods was as follows: longwall, 85 percent; slicing, 8 percent; shield, 3.2 percent; room and pillar, 1.7 percent; and others, 2.1 percent. In 1970, the average longwall length was 117 meters with an average advance of about 36 meters per month. The average capacity of each mining section (longwall) was 331 tons of raw coal per day (4 shifts) in 1970. The number of legally prescribed working hours per week was 41 on the surface and 36 underground.

In 1970, more than one-third of the coal mines and open pits did not meet production quotas and over one-quarter of the coal industry enterprises did not obtain the planned capacities.[43]

According to Soviet sources, mining conditions with respect to dust suppression, drinking water, lighting, and underground transportation of miners were poor.

The 1971–75 5 year plan calls for production to rise to 685 to 695 million tons of run-of-mine coal by 1975 from 633 million tons of raw coal in 1971. Reports of persistent and chronic labor shortages indi-

[41] Sotsialisticheskaya industria (Socialist Industry), Moscow. Dec. 16, 1970.
[42] Voprosy ekonomiki (Problems of Economics), Moscow. No. 12, 1970, pp. 27–38.
[43] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 26, June 1971, p 14.

cate that coal production will probably fall slightly short of planned targets. Estimated levels for 1975 and 1980, therefore, may be 670 million tons of raw coal (383 million tons clean coal) and 720 million tons of run-of-mine coal (412 million tons clean), respectively.

Over the next 10 years, the priority has been given to coal development in the Asian part of the country (chiefly in the Kuznetsk Basin) where planned coal production is to reach 228 million tons of run-of-mine coal in 1975 and 300 million tons in 1980. The largest surface mining development is to take place in the Kansk-Achinsk Basin and the Itat' deposit in Siberia, and the Ekibastuz and Maykuben deposits in Kazakhstan. In the European part of the U.S.S.R., most of the new coal production is to come from the Donets coal basin. The output of coal for coking will increase substantially in the Kuznetsk and Karaganda basins.

Reserves.—According to Soviet estimates, minable coal reserves (bituminous, anthracite, and lignite) categorized as proved, probable, and possible were 523.7 billion tons on January 1, 1968,[44] a sufficient supply for the foreseeable future at the present production levels, assuming 50 percent recovery. Estimated proved coal reserves were around 30 billion tons in the country's known deposits located in 25 coalfields, eight large coal-bearing areas, and more than 650 individual deposits. The oldest and largest region in the U.S.S.R. is the Donets Basin in the south, which contains more than a quarter of the total national coal reserves. The Kuznetsk coalfield in Siberia was the second largest, with about 20 percent, followed by the Kansk-Achinsk coal field. Significant coal reserves are located also in the Karaganda, Pechora, and other coal basins of the U.S.S.R.

New Capacities.—The annual capacity of coal mines and open pits was increased by 28.8 million tons of raw coal in 1970. The more important enterprises put into operation included the first stage of the No. 5–6 Irtysh open pit (with an annual capacity of 5 million tons of raw coal) in Pavlodar Oblast' in Kazakhstan, the Kharanorskiy open pit in Chita Oblast', the Morozovskiy open pit in Kirovgrad Oblast' in Ukraine, the Zapadno-Donbass No. 3 underground mine in Dnepropetrovsk Oblast', and the Samsonovskaya hydraulic underground mine in Voroshilovgrad Oblast' in the Ukraine. At many mines construction schedules were double the planned building period.[45]

Some 111 mines and open pits with a total annual capacity of 92.3 million tons of raw coal were built or renovated in the U.S.S.R. during the 1966–70 5-year plan period, and production capacities of preparation plants increased by 41.5 million tons. Capital investment on development of production capacity for the 1966–70 period was about 8 billion rubles.[46] The 1971–75 plan foresees commissioning of coal mines and open pits with a total annual capacity of 140 million tons of raw coal.[47]

Production Centers.—Production of raw coal at major coal basins in 1970, in million metric tons, follows:

Basin	Total coal	Coking coal
Donets	216.1	84.3
Kuznetsk	110.5	46.9
Karaganda	38.4	17.0
Pechora	21.5	12.7

The Donets, Kuznetsk, Karaganda, and Pechora coal basins produced over four-fifths of the total coal output in terms of calorific value and about 97 percent of the coking coal in the Soviet Union.

Mechanization and Productivity.—The expansion of the Soviet coal industry was largely due to growing inputs of labor and capital rather than to advancing technology. Manual labor was used extensively in roof support, conveyor transfer, and surface operations with the result that overall productivity was low and machines and equipment were underutilized.

Power supports were used in 581 (of a total 4,101) longwalls in 1970. Only about 250 longwall faces were equipped with walking hydraulic face supports. In many faces equipped with wide-web cutter-loaders and cutters, large amounts of coal were being extracted by blasting. The productivity of narrow-web combines was 2 to 3 times below established norms. About 70

[44] Economic Commission for Europe, Coal Committee. VAB/SYMP/COAL/A–10, May 20, 1969, p. 2.
[45] Shakhtnoye stroitel'stvo (Mine Development), Moscow. No. 4, April 1971, pp. 1–4.
[46] Ekonomicheskaya gazeta (Economic Gazette), Moscow. No. 26, June 1971, p. 4.
[47] Shakhtnoye stroitel'stvo (Mine Development), Moscow. No. 6, June 1971, p 1.

percent of the mining machinery and equipment is under repair or inoperative. The low degree of utilization of machinery resulted from defects in construction and a lack of sufficient repair shops and spare parts. The production of mining equipment has grown substantially, but the technical standards and the quality of machinery and equipment produced "do not always answer modern requirements."[48] Frequently plants preferred to manufacture old models rather than to undertake new technology.[49]

In 1970 average monthly (25.4 shifts) official productivity of the Soviet coal miners was 58.5 tons; 45.8 tons in underground mining and 289.1 tons in open pits. But these data are misleading because actual productivity was about two times less than officially reported. According to the magazine "Coal",[50] monthly productivity of the workers at one of the best Soviet open pits in the Kuznetsk Basin—Krasnobrodskiy open pit—was only 165.4 tons of raw coal in 1969.

Preparation.—Preparation of coal for the market was normally restricted to coking coals and fuel for export. The shortage of coal and beneficiation facilities forced Soviet planners to direct all efforts toward the improvement of quantity rather than quality.

During the year, 173 preparation plants employing some 60,000 workers processed 281.1 million tons of run-of-mine coal, or 45 percent of the total (including 149.9 million tons of coking coal), and produced 170.8 million tons of clean coal including 107.8 million tons of coking coal. The ash content of shipped coals has been rising and increased to 19.7 percent in 1970. During the 1966–70 period, many new preparation plants were put into operation in spite of numerous imperfections and insufficient equipment. Labor productivity and use of capacity were below planned levels and a large number of personnel was occupied in repair and auxilliary operations.

Consumption.—Diverse sources reported that in 1970, 220 million tons of run-of-mine coal were consumed in thermoelectric powerplants; 170 million tons of raw coal were used to produce coke; 24.5 million tons of prepared coal were exported; and the balance was ostensibly used for industrial and household heating. The most promising markets where coal consumption is expected to expand are in metallurgy, retail deliveries, and electric power stations in particular. By 1980, coal consumption by electric power plants is expected to increase to about twice the 1970 level. The share of coal in electric power generation is expected to fall from 55 percent in 1970 to about 52 percent in 1980.

Exports.—In 1969, 27.3 million tons of coal and coke were exported from the Soviet Union mainly from the Donets and Kuznetsk Basins. Nearly 36 percent, or 9.8 million tons of coal and about 1 million tons of coke, was shipped to non-Communist countries. The coal exported to the Western countries consisted of high-quality coking coals and anthracite, chiefly from the Donets Basin.

Among the major Western markets for Soviet coal, Japan ranks first, with 32 percent of the total exports to the West. Italy ranked second with more than 21 percent; followed by France, with 14 percent; and Austria, with 8 percent of the total Soviet coal exports to Western countries. Coal exports to Yugoslavia in 1969 amounted to 1.1 million tons.

Soviet export coals compare favorably with European and U.S. coals moving in international trade. Exports of coals from the Donets Basin, however, are comprised of bituminous (67 percent) and anthracite (33 percent), and have a reported value of about $18 per ton, f.o.b. mine.[51] The high priority placed on exports which must meet high international competitive price and quality standards make Soviet coal exports successful only at supported prices. Kuznetsk Basin coals, which are also exported, are likewise high-quality coals, but production costs are significantly lower than in the Donets Basin. Because a good share of the production is surface-mined, average f.o.b. mine cost of Kuznetsk coal was reported at about $8 per ton.[52] The lower production cost, however, is burdened by high rail transportation costs to the Far Eastern exit ports.

Soviet exports of high-quality coal and coke to Western countries are likely to continue in the future, although the volume exported is not expected to increase

[48] Pravda (Moscow). Mar. 19, 1968, p. 4.
[49] Izvestiya (Moscow). Mar. 19, 1968, p. 3.
[50] Ugol' (Coal), Moscow. No. 9, September 1970, p. 11.
[51] Pravda (Moscow). Febr. 21, 1971, p. 3.
[52] Work cited in footnote 51.

significantly. The potential markets for future coal and coke exports from the U.S.S.R. are mainly limited to Western Europe, and Japan. The controlling factor in future exports of coal and coke does not seem to be Soviet supply, but rather demand by and import policies of the free world countries. Although energy requirements of Western Europe and Japan will increase greatly, the relative share of coal, both indigenous and imported, is expected to continue to decline. Nonetheless, the market for imported coal in terms of tonnage is expected to rise somewhat and the need for diverse sources will provide room for slightly larger supplies from the Soviet Union. The market for Soviet anthracite, a space heating fuel, is not particularly attractive. European governments protect their own coal industries by subsidies, tariffs, and non-tariff barriers and have the option to purchase the best quality American coal at competitive prices. These factors will tend to limit shipments, although greater exports are desired by the U.S.S.R. The overall forecast for an annual Soviet shipment of coal and coke to West Europe would be 7 million tons in 1975 and about the same in 1980.

According to a 7-year long-term contract with Japan, the U.S.S.R. will export a total of 23 million tons of coal starting in 1969. An export level of 3.5 million tons annually for 1975, therefore, appears to be a reasonable expectation. Soviet officials have expressed interest in developing the coking coalfields of Southern Yakutia in a joint venture with the Japanese. A long-term annual supply of 10 million tons of coking coal from Yakutia is now under consideration by Japanese firms. Because of increased trade and industrial cooperation between Japan and the U.S.S.R. and a strong Japanese desire to diversify its sources of supply, Japan may import as much as 5 million tons of coking coal annually from the Soviet Union by 1980. Japan's future expanded needs for coking coal are likely to be divided among the United States, Canada, Australia, the Soviet Union, and mainland China.

According to signed agreements, the U.S.S.R. was required to deliver the following quanitites of coal during 1966–70 to the following destinations: East Germany, 31.5 million tons; Czechoslovakia, 19.0 million; Yugoslavia, 5.0 million; and Hungary, 4.6 million tons of coal. The steady flow of Soviet coal and coke to Communist countries is planned to grow from an estimated 17.5 million tons in 1970 to over 18 million in 1975, and to about 20 million tons in 1980. East Germany is the major importer of Soviet coal and coke in the CMEA group of countries. Soviet coal exports to Hungary are expected to be reduced after 1971.

Imports.—Soviet imports of coal and coke increased from 5.4 million tons in 1960 to 7.9 million tons in 1969. The principal foreign supplier of coal and coke to the U.S.S.R. is Poland. In 1975, some 8 million tons of coal and about 1 million tons of coke are expected to be imported by the Soviet Union, although much of the reported Polish exports of coal and coke to the U.S.S.R. is a paper transaction since the coal and coke moves on the Soviet account to other destinations.

In 1980 some 9 million tons of coal and around 1 million tons of coke are likely to be imported by the Soviet Union from Poland.

Soviet coal and coke statistics are presented in table 7.

Natural Gas.—In a single decade the U.S.S.R.'s natural gas industry has raised the output of more than 170 gas and gas condensate fields from 59 billion cubic meters in 1961 to 200 billion in 1970; however, output is below the original 5-year plan target of 225 to 240 billion cubic meters. Of this quantity, over 99 percent consisted of natural gas and oil associated gases and about 1 percent was gas from gasification of coal and oil shale. About five-sixths was produced in the European part of the country (eastern regions of the Ukraine, North Caucasus region, and Lower Volga region). In 1970 the Ukraine provided over 30 percent of the total Soviet gas output. In 1970, natural gas accounted for 20 percent of the Soviet fuel production. Although the production of natural gas increased substantially during the past decade, the industry has not been able to meet a single original annual production goal set for it since 1956. During the past 4 to 5 years, the rate of growth in gas extraction, despite the discovery of large gasfields in West Siberia, the Komi A.S.S.R., Orenburg Oblast'; and other regions, has

Table 7.—U.S.S.R.: Salient coal and coke statistics

(Million metric tons)

Item	Actual 1960	Actual 1965	Estimated 1970	Estimated 1975	Estimated 1980
Coal:					
Domestic output:					
Run-of-mine coal [1]	509.6	r 577.7	624.0	670.0	720.0
Clean coal [2]	306.0	331.0	357.0	383.0	412.0
Imports: [3]					
From other Communist countries	4.7	6.7	7.3	8.0	9.0
Exports:					
To other Communist countries	8.2	r 15.2	14.5	15.0	16.0
To non-Communist countries	4.1	r 7.2	9.0	9.5	11.0
Total	12.3	22.4	23.5	24.5	27.0
Apparent consumption:					
Run-of-mine coal [1]	502.0	r 562.0	607.8	653.5	702.0
Clean coal [2]	298.4	315.3	340.8	366.5	394.0
Coke:					
Domestic output	56.2	67.5	75.4	86.0	96.0
Imports: [3]					
From other Communist countries	.7	.7	.7	.8	.8
Exports:					
To other Communist countries	2.2	2.8	3.0	3.2	3.4
To non-Communist countries	.4	1.0	1.1	1.0	1.0
Total	2.6	3.8	4.1	4.2	4.4
Apparent consumption	54.3	64.4	72.6	82.6	92.4

r Revised.
[1] Run-of-mine coal as reported in Soviet sources.
[2] Clean coal; estimated in accordance with Western practice and experience.
[3] None from non-Communist countries.

Source: Production data for 1960 and 1965 taken from the National Economy of the U.S.S.R: (Moscow), 1960 and 1965; trade data form Foreign Trade of the U.S.S.R. (Moscow), 1960 and 1965.

declined somewhat, mainly because of a shortage of pipe and compressors.[53]

The utilization of associated gas increased from 63 percent in 1965 to 65 percent in 1970. Up to 1971, the utilization of gas condensate resources was unsatisfactory. At the existing low temperature separation facilities in the field, about 40 to 70 percent of the condensate produced along with the gas was recovered, and the remaining portion was placed into gas pipelines where much of it was lost.

The total length of gas pipelines rose from 42,000 kilometers in 1966 to over 67,000 kilometers at the end of 1970. In 1970 the average diameter of pipe was 690 millimeters. About 5.7 billion rubles were invested in the gas industry during 1966–70. More than 25,000 kilometers of transmission gas pipelines were built as well as 85 compressor stations. More than 1,500 development wells were completed. About 11,000 kilometers of crude and petroleum product pipelines were laid by the Ministry of the Gas Industry.

At present, Ukrainian gas is used in local markets in the central and northern regions, which also include the cities of Moscow and Leningrad, and is exported to Poland, Czechoslovakia, and Austria. The gas from the North Caucasus is used in the southern and central regions of the European part of the U.S.S.R. Uzbekistan gas supplies mainly the Urals and local consumers.

The potential for growth in Soviet natural gas production is excellent. All three main producing centers (Ukraine, mainly Shebelinka; North Caucasus, Krasnodarsk Kray and Stavropol' Kray; and Uzbek, mainly Gazli) have extensive reserves. Together, these and other centers are able to sustain an annual output of at least 300 billion cubic meters. The new fields in Western Siberia have a large natural gas reserve and can provide still another 100 billion cubic meters annually. Plans are for the Tyumen' gasfields (West Siberia) to supply the western and northern regions of the European part of the country's growing industrial needs and the export market. Although some Tyumen' gas

[53] Pravda (Moscow). May 23, 1969, p. 2.

may be exported directly, by 1980 most Soviet gas exports will come from the Ukraine, which is expected to have some "surplus" as Tyumen' gas comes into the northern markets.

The 1971–75 5-year plan foresees an annual output of 300 to 320 billion cubic meters by 1975. In 1971, natural gas production is planned to rise to 211 billion cubic meters, and the output of liquefied gases is expected to rise to 5 million tons. Extractions of condensate is slated to be about 6 million tons, or more than 2 million tons over the 1969 output. Gas production may fall slightly short of targets because of the shortage of pipes, compressors, and labor. Some estimates place natural gas production in 1975 and 1980 at 280 billion cubic meters and 370 billion cubic meters, respectively.

Exploration and Reserves.—The proved, probable, and possible reserves of natural gas in the U.S.S.R. were increased from 3,200 billion cubic meters in 1966 to 13,000 billion cubic meters in 1970. Deep drilling plans were fulfilled in 1970 only by 66 percent.

Gasfields.—The basic increments in gas extraction in the 1966–70 period were provided by the Ukraine (from 37.7 to 55.0 billion cubic meters) and Uzbek S.S.R. (from 15.9 billion to 31.4 billion cubic meters). During the past 5 years, 45 new gas and gas condensate fields and about 2,100 wells were placed into production. Among the largest fields (placed into production) were Vuktyl in the Komi A.S.S.R.; Achak, in Turkmen S.S.R.; Punga, in Tyuman' Oblast'; Krestishchena and Yefremovka in the Ukraine; and Mirnen in Stavropol' Kray. Total gas reserves of these deposits are estimated at about 1,000 billion cubic meters.[54]

Extraction of gas at major union republics in 1969 and plan targets for 1970 were in billion cubic meters, as follows:

	1969 (actual)		1970 (planned)	
	Non-associated natural gas	Associated natural gas	Non-associated natural gas	Associated natural gas
R.S.F.S.R.	65.7	15.3	68.3	16.5
Ukraine	53.1	2.3	56.8	2.1
Azerbaydzhan	2.4	2.6	2.2	2.3
Uzbek	30.7	.1	31.5	.1
Kirghiz	.3	--	.3	--
Tadzhik	.4	--	.5	--
Turkmen	6.3	1.2	11.6	1.4
Kazakhstan	.6	.1	1.9	.1
Belorussia	--	--	--	.2
Total U.S.S.R.	159.5	21.6	173.1	22.7

Source: Gazovaya promyshlennost' (Gas Industry), Moscow, No. 4, April 1970, pp. 52–54.

The planned extraction of major gas producing regions in 1971, in billion cubic meters, follows:

Ukraine	57.1
Uzbekistan	32.6
Kuban'	20.6
Stavropol'	15.4
Turkmenistan	15.1
Komi A.S.S.R.	10.0
Orenburg gasfield	3.0

Transportation.—The great distances of the principal consuming centers from the gasfields have made it inevitable that the bulk of natural gas must be transmitted by large pipelines. Over 80 percent of 1970 natural gas production was carried by trunk pipelines and about 20 percent was consumed at or near places of production.

During 1966–70 more than 25,000 kilometers of trunk gas pipelines were laid. The most important among them are: Central Asia—Center, "Brotherhood", Ostrogozhsk—Belousovo, Vuktyl—Ukhta, Ukhta—Torzhok, Messoyakha—Norilsk, Kuleshovka–Meleless–Ulyanovsk, Mokrous—Tolyatti, Kiev—Western regions of the Ukraine, Mayskoye—Ashkhabad—Bezmin, Bukhara gas region—Tashkent—Frunze—Alma-Ata, and others. The length of the transmission gaslines increased from 42,000 kilometers at the beginning of 1966 to over 67,000 kilometers by the end of 1970. In 1970 about 5,000 kilometers of transmission and branch gas pipelines were laid, and capital investment in the Ministry of the

[54] Gazovaya promyshlennost' (Gas Industry), Moscow. No. 3, March 1971, p. 5.

Gas Industry reached more than 1.5 billion rubles, while the volume of construction and installation work performed by subcontractors exceeded 1.8 billion rubles.

In 1971, 3,200 kilometers of transmission pipeline are to be put into operation, as well as 22 compressor stations and four underground storage installations. It is planned to invest 1.7 billion rubles by the Ministry of the Gas Industry and about 2 billion rubles by subcontractors.

A large-scale expansion of Soviet gas supplies to domestic and international markets is dependent mainly on the availability of large-diameter pipe. Plans call for the construction of 26,000 to 27,000 kilometers of additional main gaslines during 1971–75. The most significant domestic lines scheduled to be laid in 1971–75 are as follows: the "Northern Lights" gas pipeline from Nadym in Tyumen' Oblast' through Ukhta; Torzhok to Minsk. with branch lines to Leningrad and Arkhangel'sk (Archangel), and pipeline No. 3 from Central Asia to Moscow and the central regions. The Soviet planners hope to produce about 70 billion cubic meters of natural gas from Tyumen' by 1975 and some 150 billion cubic meters by 1980.

Planned exports of natural gas to neighboring countries are to be made by a network of gas pipeline transmissions connecting the U.S.S.R. with Czechoslovakia, Poland, Bulgaria, East Germany, Austria, Italy, West Germany, Finland, and probably several other West European countries and Japan.

According to an agreement, an international gas pipeline of 28 billion cubic meters annual capacity will be laid across Czechoslovakia. Soviet natural gas will be delivered through this line, beginning in 1973, to Austria, Italy, West Germany, Czechoslovakia, and East Germany. It is anticipated that the line will eventually be extended into France and Switzerland as well.

Underground Gas Storage.—On January 1, 1970, the total volume of underground storage facilities was about 10 billion cubic meters (5 billion cubic meters were under exploitation). Six underground gas depots (from a total of 13) were in operation near Moscow, Leningrad, Kiev, Tashkent, Riga, and Yere'van. Two underground gas storage facilities near the city of Komrat in Moldavia and near Kumertau in the Bashkir A.S.S.R. were under construction in 1970, scheduled for completion by the end of 1972. The first tests of the Chervonnyy Partizan underground gas storage facility in Chernigov Oblast' were completed in November. It will supply Kiev and other cities of the Ukraine.

Solid Gas.—According to Soviet sources, more than 30 promising deposits of solid gas have been discovered in the U.S.S.R. Solid gas appears as a hydrate, a combination of natural gas with water, which forms in permafrost areas at depths of up to 2,500 meters under high pressures and low temperatures. First supplies of gas recovered from hydrate deposits on the upper reaches of the Messoyakha River near Norilsk were already being piped to a powerplant and other projects.

Consumption.—About 60 percent of the natural gas extracted was utilized for industrial purposes, and some 25 percent was used for power generation. Natural gas became of considerable significance in metallurgy, whose share in the total Soviet gas consumption in 1970 rose to over 16 percent compared with 7.5 percent in 1959.

Reported Soviet consumption of natural gas in 1970 is presented, in billion cubic meters, in the following tabulation:

Communal (everyday consumers):	
Households	7.8
Other	18.4
Total	26.2
Industry (including industrial powerplants):	
Chemical	13.0
Metallurgical	32.6
Machine—building and metal working	18.9
Construction materials	19.6
Oil and gas	19.3
Light	2.5
Food	6.8
Woodworking	1.5
Other	3.2
Total	117.4
Electric powerplants	48.6
Construction	1.1
Transport	.9
Agriculture	.7
Other consumers	4.0
Grand total	198.9

Source: Gazovaya promyshlennost' (Gas Industry, Moscow). No. 3, March 1971, pp. 10–12.

Reported consumption of liquefied gases in the U.S.S.R. is presented, in thousand tons, in the following tabulation:

Year	For commercial uses	For communal—everyday uses
1966	2,142	1,041
1967	2,328	1,268
1968	2,462	1,533
1969	2,462	1,849
1970	2,590	2,061

Source: Stroitelstvo truboprovodov (Pipeline Construction), Moscow, No. 3. March 1971, p. 15.

Exports.—The role of Soviet gas in the international market has grown in recent years. In 1970, the U.S.S.R.'s exports of 3.3 billion cubic meters were distributed in nearly equal shares to Poland, Czechoslovakia, and Austria by the "Druzhba" pipeline (which has a planned annual capacity of 4 billion cubic meters) from the Dashava fields in West Ukraine. Construction of the 1,020-millimeter-diameter line over the 1,040-kilometer distance from Yefremovka (East Ukraine) to the Kiev-Western regions is to be completed in 1971. The line is to have an annual capacity of 10 billion cubic meters.

Among the Western countries, the first importer of Soviet natural gas was Austria, which contracted to import 32 billion cubic meters of gas at an annual rate of 1.5 billion cubic meters from 1971 through 1990. Deliveries of natural gas to Austria began in September 1968.

A 20-year agreement to supply 110 billion cubic meters of Soviet natural gas to Italy was signed in December 1969. Under the agreement, annual deliveries are scheduled to rise from 1.2 billion cubic meters in 1973 to 6 billion in 1975 and possibly to 10 billion cubic meters after 1980.

In February 1970 an agreement was signed with Ruhrgas, a West German company, for the delivery of 52 billion cubic meters of Soviet natural gas for a 20-year period beginning in 1973. During the first year, the delivery of gas to West Germany is to amount to 0.5 billion cubic meters and is to be increased thereafter to 3 billion cubic meters per year.

According to an agreement signed on April 20, 1971, annual deliveries of 0.5 million cubic meters of Soviet natural gas to Finland will begin in 1974 and will increase to 1.4 billion cubic meters by 1979.

Austria, Italy, West Germany, and Finland have provided the U.S.S.R. with credits for the purchase of large-diameter pipe and other equipment and materials mainly for gas production from these countries. It is very probable that deliveries of Soviet natural gas to Austria and West Germany will be increased during the late 1970's.

France, Belgium, and Denmark are currently negotiating with the U.S.S.R. for the supply of Soviet gas, while Sweden and Norway are as yet only potential markets for Soviet gas.

Discussion has been confirmed on plans to export Soviet natural gas to Japan. The U.S.S.R. may pipe some 2.5 billion cubic meters of gas annually from Sakhalin Island to Hokkaido in Japan via 1,500 kilometers of overland and undersea pipeline. Future deliveries of Soviet gas to Japan may be increased to 10 billion cubic meters per year from the deposits of the Yakut A.S.S.R. when new production is brought into play.

In the coming 10 years, Soviet gas deliveries to Poland and Czechoslovakia are to increase. Exports of gas to CMEA member countries will increase from 8 billion cubic meters in 1966–70 to 33 billion cubic meters in 1971–75. By 1975, exports to Czechoslovakia might reach 3.5 billion cubic meters; to Poland, 2 billion; and to Hungary, as much as 1 billion cubic meters of gas. By 1975, exports of gas to East Germany and Bulgaria can be expected to reach as much as 3.5 billion cubic meters, while deliveries to Yugoslavia may reach 0.5 to 1 billion cubic meters per year.

Total exports of natural gas from the U.S.S.R. to East European Communist countries might amount to as much as 10 billion cubic meters in 1975. Exports to non-Communist countries by 1975 may possibly fall short of 13 billion cubic meters planned. In 1980, total exports of gas from the Soviet Union might reach as much as 39 billion cubic meters, of which 24 billion cubic meters may go to non-Communist countries and 15 billion cubic meters to East European Communist countries.

Imports.—Soviet exports will be mainly offset, to some extent, by the imports of gas from Iran and Afghanistan. On the basis of a trade agreement between the Soviet Union and Afghanistan, gas is now being imported by the U.S.S.R. Gas imports, which began in October 1967, were as follows, in billion cubic meters: 1967, 0.2; 1968, 1.5; and 1969, 2.0 Plans are to increase Soviet imports of gas from Afghanistan from some 2.5 billion cubic meters in 1970 to 4 billion by 1980.

On October 28, 1970, the 1,300-kilometer Iran-U.S.S.R. gas pipeline was completed. Annual imports of gas are to begin with 6 billion cubic meters and are to increase to 10 billion cubic meters by 1975 and to 15 billion by 1980.

The Soviet press indicates planners are considering the importation of some 13 billion cubic meters of gas from Iran and Afghanistan in 1975 and 19 billion cubic meters in 1980.

Soviet natural gas statistics are presented in table 8.

Petroleum.—The U.S.S.R. continued to be the second largest petroleum-producing country in the world, surpassed only by the United States. Crude oil and gas condensate output in 1970 increased by 24.7 million tons to a total of 353 million tons.[55] More than 27 percent of the total was exported, either as crude (66.8 million tons) or as refinery products (29 million tons). In 1970, the return from these exports was 1,323 million rubles, 92 million rubles more than in 1969. The U.S.S.R. has had an excellent record in fulfilling crude petroleum production targets. The 1965 target, for example, was 230 to 240 million tons as compared with an actual output of 242.9 million tons; the targeted 1970 output of 345 to 355 million tons compared with an actual output of 353 million tons. These production goals were overfulfilled despite a slight underfulfillment of drilling plans. For 1970 and earlier years Soviet figures on the distribution of crude petroleum production by regions show the Volga-Urals region's contribution to be about two-thirds of the Soviet total, and the Tatar A.S.S.R. subregion's share about 29 percent of the national output.

During the past 5 years, new oil production regions came into existence in West Siberia, Western Kazakhstan, Orenburg Oblast', Checheno-Ingush A.S.S.R., and the Ukraine. Of the 24.7-million-ton increase in oil production made in 1970, about 20 million tons came from the above-named regions. In 1970, the Mangyshlak (Kazakhstan), Azerbaydzhan, Dagestan A.S.S.R., Checheno-Ingush A.S.S.R., and Stavropol Kray did not meet their planned targets.

There were over 630,000 workers and some 34,000 university graduate engineers, and 52,000 graduate technicians in the Soviet crude oil extracting industry in 1970.[56] The total number of workers engaged in drilling reached about one-fifth of all workers in the oil extracting industry. The number of engineers per drilling rig on the average rose from 3.3 in 1966 to 4.0 in 1968, and the number of technicians rose from 5.5 to 6.8, respectively.[57]

In 1971 the Ministry of the Oil Extracting Industry is to raise the output of crude oil and gas condensate to 371.7 million tons. Of the total planned increase in crude extraction of 22.7 million tons,

[55] Fifty metric tons per year is equal to 1 barrel per day.
[56] Neftyanoye khozyaystvo (Oil Economy), Moscow. No. 3, March 1971, pp. 8–9.
[57] Organizatsiya i upravleniye neftedobyvayushchey promyshlennosti (Organization and Administration of the Oil Extracting Industry), Moscow. No. 4, April 1970, pp. 7–11.

Table 8.—U.S.S.R.: Salient natural gas statistics

(Billion cubic meters)

	Actual [1]		Planned and estimated		
	1960	1965	1970	1975	1980
Production	47.2	129.4	200.0	280	370
Imports [2]	--	--	3.5	13	19
Total	47.2	129.4	203.5	293	389
Exports:					
To other Communist countries	.2	.4	2.2	10	15
To non-Communist countries	--	--	1.1	13	24
Total	.2	.4	3.3	23	39
Apparent consumption	47.0	129.0	200.2	270	350

[1] Production data taken from the National Economy of the U.S.S.R. (Moscow), 1960 and 1965; trade data from Foreign Trade of the U.S.S.R. (Moscow), 1960 and 1965.
[2] All from non-Communist countries.

about 75 percent is to be obtained in Western Siberia and Western Kazakhstan. In Tyumen Oblast' it is planned to raise the output of crude oil to 44.2 million tons, or an increase of 12.8 million tons.

Despite the high rates of growth in crude oil extraction in the new regions, the bulk of the crude oil production in 1971—more than 81 percent—is to be provided by the older regions, mainly the Urals-Volga. Here, at three regions alone —Tataria, Bashkiria, and Kuybyshev—the production of crude oil in 1971 is to exceed 175 million tons. In 1971 construction is to begin on four oil refineries in the eastern part of the U.S.S.R. and also on a number of large crude pipelines.

The 1975 Soviet crude oil situation can be forecast fairly accurately. According to the 5-year plan, the lower point of the crude oil output target would be 480 million tons for 1975. This is expected to be fulfilled as new fields are added and recoveries are improved. In 1975, the Volga-Urals region is expected to remain the major source of production, although its share of the total output in 1975 will decline from the current two-thirds to slightly more than one-half (53 percent). A large portion of the expected increase in production is to come from new oil-producing areas primarily in Western Siberia and Kazakhstan.

In 1970, Siberia produced more than 31 million tons of crude petroleum. By 1975, crude output in this area is to be raised to 100 to 120 million tons and in 1980 to 230 to 260 million tons. Construction in Tyumen Oblast' during 1966–69 has been valued at 4 billion rubles, and at 286.7 million rubles during the first 9 months of 1970. The growth in Siberian crude oil production, however, has not been matched by comparable development of oil refining capacity and pipeline construction.

The refining capacity for 1970 has been estimated at 295 million tons. The actual crude petroleum input amounted to 286 million tons, or about 96 percent of capacity according to traditional Soviet practice. The difference between production and crude petroleum refinery input approximates very closely the crude oil actually exported. The 5-year plan calls for a 50-percent increase in refining capacity, although the Soviet refinery construction program has been behind schedule for a long time. With a refining capacity estimated conservatively at 400 million tons per annum by 1975 and operations at 96 percent of capacity, the crude petroleum input is estimated at about 385 million tons. By deducting this amount from the expected output, the tonnage available for export would be about 100 million tons.

Crude oil output in 1980 has been estimated at 600 million tons, on the basis of earlier projections. The Volga-Urals region will continue to decline in relative significance, whereas Tyumen Oblast' in Western Siberia and Kazakhstan will make the most noteworthy gains. An estimate of the amount of crude oil to be refined in 1980 is uncertain; however, on the basis of the estimated or projected refining capacity at a growth rate slightly less than past years, a capacity of 500 million tons per year is derived, and assuming the same high utilization factor of 96 percent, the result amounts to 480 million tons of crude petroleum to be refined.

Exploration and Reserves.—According to Soviet sources, 248 crude oil and gas deposits were discovered in the U.S.S.R. in the 1966–70 period, of which 109 were put into production. However, the 5-year plan for increments to oil reserves, despite the significant number of new discoveries, was not met.[58] Some 15,600 wells were put into production.

In the past 5-year period, 15.2 million meters of exploratory wells and 30 million meters of development wells were drilled. During 1966–70, the average depth of wells increased as follows: in developmental drilling, by 85 meters or by 5.1 percent (average depth of 1,740 meters) and in exploratory drilling, by 327 meters or by 13.2 percent (average depth of 2,750 meters). Three methods in drilling of wells were used: Turbine, rotary, and by electrodrill. Almost three-quarters of all the drilling for oil and gas in the U.S.S.R. was done by the turbodrill. The volume of drilling increased from 8.6 million meters in 1965 to 9.5 million meters in 1970. The plan for drilling in 1970 (in the Ministry of the Oil Industry) was fulfilled by 94 percent. Out of 1,396 drilling brigades, about one-half did not meet their assignments. As a result, the shortfall in developmental drill-

[58] Neftyanaya geologiya i geofizika (Oil Geology and Geophysics), Moscow. No. 1, January 1970, pp. 3–7.

ing as well as in exploratory drilling reached 480,000 meters.[59] Because of the poor quality of the drill bits, the average penetration per bit in the drilling of wells reached 15 meters and in some intervals just 1 to 2 meters. The effectiveness of the drilling process reached just 10 to 12 percent and the remaining time was spent in changing bits and other supporting operations. As a result, the drilling speed was low—130 to 150 meters per rig per month.[60]

In 1969, in the testing of one exploratory well, on the average of 174 days were spent, as compared with the norm of 50 to 60 days.[61] The annual capital investment in drilling of wells reached about 1.3 billion rubles, or approximately 70 percent of all expenditures in the development of the oil extracting industry. The 1971–75 plan calls for drilling 50 to 55 million meters of wells. Developmental wells are to increase by 18,000 meters.

As of January 1, 1970, the proved, probable, and possible reserves of crude oil in the U.S.S.R. were estimated at 31 billion tons, which included 3.9 billion tons of proved reserves (Soviet category "A").[62]

Oilfields and Crude Oil Production.—In 1970, 449 oilfields were in production of which 168 were waterflooded. Primary and secondary recovery of crude oil in place was reported at 30 to 40 percent. The cumulative production of crude oil during the past 5 years (1966–70) was 1,543 millions tons, or 518 million more than during 1961–65. Water flooding has resulted in the additional extraction of more than 660 million tons of crude during 1966–70.

In 1970, the Urals-Volga area contributed about 60 percent of the national output. This area will continue to lead until the developing oilfields of Siberia come into their own. The Tatar A.S.S.R. produced 100.4 million tons of crude in 1970, and it is to hold the output of crude at 100 million tons per year in the future. The Bashkir A.S.S.R., which produced 35 million tons, did not meet the planned target of 40 million tons. Output in this republic has sharply declined because of the depletion of reserves at the Tuymazy and Shkapovo fields. During the past 5 years, oil production in Kuybyshev Oblast' has climbed to 35 million tons in 1970, and this region will continue to be one of the leading Soviet oil producers with 44 new oilfields slated to go on stream during 1971–75. Some 16.1 million tons of crude was produced in Perm Oblast' during 1970. Total output for the past 5 years amounted to 70.5 million tons, compared with 30.4 million tons during 1961–65. There are 79 oilfields and gasfields in the Oblast'. During the next 5 years, oil production in Perm Oblast' is slated to increase by 10.5, to 11 million tons annually as a result of putting several new fields on stream.

West Siberia, where 10 large oilfields have been put on stream since 1964, produced 31.4 million tons in 1970. Some 54 oilfields have been discovered in this area. It is planned to produce 44 million tons of crude in 1971 and to increase to 125 million tons by 1975 in West Siberia. Drilling is slated to advance to an average of 180,000 meters each year and to reach 2 million meters by 1975. Oil output in the Checkeno-Ingush A.S.S.R. rose from about 9 million tons in 1965 to over 20 million tons in 1970. In daily output of crude oil, this autonomous republic now ranks fifth in the U.S.S.R., after Tataria, Baskiria, Kuybyshev Oblast', and West Siberia.

In Azerbaydzhan, for the past few years the extraction of crude oil has been declining. The reduction in output is taking place at the onshore fields. Offshore crude production increased by 2 million tons during 1966–70. It was originally planned to raise crude oil extraction in this republic to 23.5 million tons by 1970, but actual output was 20.2 million tons, 1.3 million tons below the 1965 level. Some 64 percent of the crude oil produced in Azerbaydzhan came from offshore fields. The average annual capital investments in the petroleum industry of this republic rose to 200 million rubles during the past 5 years, as compared with 144 million rubles in the preceeding years. However, the desired results were not achieved. During the 1966–70 5-year period the volume of drilling declined by 1 million meters. Of 272

[59] Neftyanik (Oil Worker), Moscow. No. 4, April 1971, p. 2.

[60] Sotsialisticheskaya industriya (Socialist Industry), Moscow. May 11, 1971, p. 1; and July 31, 1971, p. 2.

[61] Bureniye (Drilling), Moscow. No. 1, January 1971, pp 3–6.

[62] Zhdanov, M. A. (ed.). Metodika i praktika podscheta zapasov nefti i gaza (Method and Practice of Oil and Gas Reserves Estimation). Moscow, 1967. p. 19. (Category "A" is the Soviet equivalent to U.S. proved reserves).

wells which were completed, 84, or 31 percent were not taken down to the desired horizon. Almost one-half of the calendar time in drilling was spent on the liquidation of accidents and in organizational idle (lost) time.[63] The new 5-year plan calls for a production of 19 million tons of crude oil and condensate in Azerbaydzhan by 1975.

Kazakhstan has become one of the Soviet Union's leading oil regions as a result of the discovery of new oilfields at Mangyshlak Peninsula and in the Emba area. Oil production in this republic has increased from 2 million tons in 1965 to 13.2 million tons in 1970, with output in the Mangyshlak Peninsula going up from 0.3 million tons to 10.4 million tons. Some 371.3 million rubles were invested at Mangyshlak in 1966–70. The extraction of crude oil in Kazakhstan in 1975 is to reach 30 million tons.

Turkmenistan produced 14.5 million tons of crude oil in 1970, or 50 percent more than in 1965. The level of output is to rise to about 16 million tons in 1971 and to 22 million tons by 1975. During the past 5 years, 311 exploratory wells and 404 developmental wells (totaling nearly 2 million meters) were completed in this republic. The Ukraine produced 13.9 million tons of crude oil in 1970, or 84 percent more than in 1965. A goal of 15 million tons of oil and condensate has been set for the republic in 1975. The Komi A.S.S.R. produced 5.6 million tons of crude oil in 1970. By 1975, output of crude in this autonomous republic is to rise by "several" times. Belorussia produced 4.2 million tons of crude from 80 producing wells in 1970. It is planned to produce 5.3 million tons of crude oil in 1971 and 10 million tons by 1975.

Refining and Petroleum Products Supply.—In 1970 crude oil primary processing was 44 percent, and oil refinery production was 40 percent higher than in 1965.[64] Nearly 80 refineries were in operation with a total estimated capacity of 295 million tons. The Bashkir A.S.S.R. continued to be the largest oil refining center in the Soviet Union. The 1971 plan envisages an increase of 5.8 percent over 1970 crude oil primary processing.[65]

In 1969, the U.S.S.R. exported 26.9 million tons of refined petroleum but imported 1.1 million tons. Although imports are expected to remain relatively unimportant, exports are expected to increase substantially. While the Soviets do not report output figures for petroleum products, good estimates can be derived, however, by applying to reported crude petroleum input a factor of 85 percent. Crude oil deliveries to the refineries contained as much as 2 to 3 percent water and 5,000 milligrams of chloride salts per liter, while the norms permit only 0.1 percent water and 50 milligrams of salt per liter. As a result, according to Soviet sources, refinery consumption and losses amount to 13.4 percent of throughput.[66] The total loss incurred by refining insufficiently desalinated crude oil is more than 200 million rubles per year.[67] Losses in storage and transportation of crude oil to refineries are estimated at 1.6 percent. Thus, Soviet output of refined products from crude oil in 1970 has been estimated at 244 million metric tons; to this should be added about 5 million tons of refined petroleum from natural gas (natural gas liquids). Based upon consumption figures by industry or other uses reported for 1969, a fairly accurate estimate of 221 million tons is made for 1970. Soviet exports of refined petroleum in 1970 have been estimated at 29 million tons.

The demand by the 5-year plan of a 50-percent increase in the refining of crude oil and the output of petroleum products is to be achieved by the construction of new refineries and by using enlarged technical sets and combined installations. Instead of the old installations for primary processing with a capacity of 1 million to 2 million tons per year, the Soviet Union is building and using installations with an output of 6 million tons. This activity has started already at Ufa, Angarsk, Kremenchug, Polotsk, Ryazan, and Kirovsk.

During the 1971–75 period, it is planned to carry out the stepped-up construction of the Achinsk and Lisichansk oil refineries; to complete the Mozyr refinery (about 2,000 workers were engaged in construction

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[36] Bakinskiy Rabochiy. Mar. 11, 1971, pp. 2–3.
[64] Neftepererabotka i neftekhimiya (Oil Industry and Petrochemistry), Moscow. No. 3, 1971, pp. 1–2.
[65] Khimiya i tekhnologiya topliv i masel (Chemistry and Technology of Fuels and Lubricants), Moscow. No. 1, January 1971, pp. 1–4.
[66] Promyshlennaya energetika (Industrial Power Engineering), Moscow. February 1968, p. 3.
[67] Sotsialisticheskaya industriya (Socialist Industry), Moscow. June 3, 1970, p. 1.

of this refinery in 1970) and the first section of the oil refineries in Kazakhstan, Lithuania, and Turkmen; to step up construction and the completion of new capacity at the Polotsk and Kremenchug refineries; to complete the expansion of the Komsomolsk-na-Amur refinery; and to begin construction of new refineries in the Soviet Far East, Arkhangelsk Oblast', and in the Ukraine. The ninth 5-year plan (1971–75) is to mark the beginning of a major renovation of the oil refining industry in Azerbaydzhan. At three refineries (named the 22d Party Congress, Karaev, and "Oil and Gas"), small out-dated units are to be replaced by modern ones. There were 422 workers for every 1 million tons of crude oil processed at the Baku oil refineries in 1970.[68]

The 1975 petroleum product supply picture is reasonably clear. The output of petroleum products from crude oil would be 328 million tons, based upon 85 percent of the estimated crude petroleum input, and that of refined petroleum from natural gas liquids would be about 8 million tons. A reasonably accurate consumption estimate of 305 million tons is based on the 5-year plan figures of industrial and other uses until 1975. Meanwhile, Soviet imports of petroleum products are expected to reach about 1 million tons. Thus, the net amount available for export in 1975 would be about 32 million tons.

Soviet output of refined petroleum by 1980 is estimated to reach 408 million tons (85 percent of the 480 million tons of crude oil refined). An additional 12 million tons will come from natural gas liquids. If imports of petroleum products are to be around 1 million tons, then consumption of some 385 million tons can be forecast for 1980. Thus, the supply balance shows that approximately 36 million tons of petroleum products could be available for export by the U.S.S.R. in 1980.

Transportation.—Some 60 percent of the total tonnage of crude oil and refinery products transported in 1970 was shipped by rail. The total length of crude oil and petroleum product trunk pipelines increased in 1970 by about 2,500 kilometers to 39,300 kilometers and the average distance of pipeline deliveries in 1970 was about 800 kilometers. Only 60 to 80 percent of total pipeline capacity was utilized.

Construction plans for 1971–80 include approximately 15,000 kilometers of crude oil pipeline with a total capacity of some 350 million tons per year. There is a plan for construction of a 6,500-kilometer Trans-Siberian pipeline from Ust'Balyk to Irkutsk and to the Soviet Far Eastern port of Nakhoda, which will be developed as an exit port for exports to Japan. The Soviet Union intends to build more than 5,000 kilometers of major pipelines in Western Siberia in the next decade.

The "Friendship Oil Pipeline," with a total length of 4,648 kilometers, crosses five countries. Through this pipeline, the Soviet Union supplies crude oil to refineries in the north at Plock in Poland and Schwedt in East Germany and to refineries in the south at Szazhalombatta in Hungary and Bratislava (Trnava) in Czechoslovakia. A second "Friendship Oil Pipeline" is under construction, scheduled for completion in 1975. The recently completed "Friendship Oil Pipeline" branch to Klaipeda in Lithuania was planned to supply oil for export to the Scandinavian countries.

It should be remembered that pipeline construction in the U.S.S.R. has lagged behind schedule, mainly because of the shortage of pipe. So far, only three-fourths of the Soviet pipe requirements came from indigenous suppliers and, during 1960–70, about two-fifths of its requirements for 40-inch pipe was purchased from West Germany, Italy, Sweden, and Japan. A severe shortage of pipe could retard planned oil exports to Japan and to Scandinavia in particular.

A key factor in the export of Soviet oil from the Baltic and Black Sea ports to West Europe is the supply of tankers. The Soviet Union attaches great importance to having its own tanker fleet. As of June 30, 1970, the tanker fleet (vessels in the 6,000-deadweight-ton class above) consisted of 187 vessels and 4.3 million deadweight tons. In 1970, some 74 million tons of oil were carried by tankers and included 42 million tons in non-Soviet ships. The 1971–75 plan calls for 50-percent increases in tanker tonnage and 65-percent in tanker fleet cargo turnover. By 1980, the tanker fleet tonnage may reach 9 million tons. These figures confirm Soviet intentions to roughly double oil exports to West Europe in the decade ahead.

[68] Vyshka. Apr. 30, 1971, p. 2.

Trade.—Since imports are not likely to be of any great consequence, the review of the Soviet oil supply and the export potential is based mainly upon published data on domestic output and consumption.

Soviet exports of crude oil and petroleum products totaled 90.8 million tons in 1969, a 5-percent increase over 1968, and comprised of over 70 percent crude oil and nearly 30 percent oil products. Over 40 percent of total exports of crude oil and 65 percent of the exports of products were shipped to non-Communist countries. The balance went to countries in the Communist bloc.

The free world market for Soviet oil is centered in West Europe and Japan, although most of the free world's petroleum supplies come from the Middle East, the Caribbean, and Africa, with the Soviet Union ranking fourth. Italy has been the largest importer of Soviet oil in Europe. The share of Soviet oil exports in the total supply of West Europe and Japan has grown slightly, from 5.5 percent in 1959 to perhaps 6.5 percent in 1970, but may decline in the decade ahead as petroleum requirements of West Europe and Japan are likely to increase at a faster rate than the availabilities of Soviet oil for export to these areas.

In the decade ahead, Soviet crude oil and refined products are expected to appear in free world markets in increasing volume. Whereas this trade will not have a major impact on free world demand and supply, it will be significant in specific areas and countries. If the present trends continue, West Europe and Japan can be expected to absorb most of these exports during the next decade. The Soviet oil trade will probably continue because of the economic gain and foreign exchange earnings it offers; because of the measure of security it offers as an alternate course of supply; and because prices are expected to remain relatively undisturbed.

While the largest share of Soviet oil exports were directed to non-Communist countries in the past, in the decade ahead principal buyers of crude oil will be the Communist countries.

Signed trade agreements and the latest Soviet forecasts anticipate a rise in petroleum exports from 90.8 million tons in 1969 to an estimated 96 million in 1970, 132 million in 1975, and 166 million tons in 1980.

Crude oil and petroleum product exports from the U.S.S.R. to Communist countries will probably rise from 47.6 million tons in 1969 to an estimated 51 million tons in 1970, 75 million tons in 1975, and 97 million tons in 1980. Actual and estimated exports of crude oil and products from the U.S.S.R. to CMEA nations are shown in table 9.

Table 9.—U.S.S.R.: Soviet exports of crude oil and products to CMEA nations in East Europe

(Million metric tons)

Year	Item	Czechoslovakia	Poland	Bulgaria	East Germany	Hungary	Total
1960 [1]	Crude oil	2.4	0.7	--	1.8	1.4	6.3
	Products	.3	1.4	0.8	.4	.1	3.6
	Total	2.7	2.1	.8	2.2	1.5	9.9
1965 [1]	Crude oil	6.0	3.2	2.1	4.9	2.0	18.2
	Products	.4	1.5	1.3	.5	.4	4.1
	Total	6.4	4.7	3.4	5.4	2.4	22.3
1970 [2]	Crude oil	9.5	6.6	5.0	9.0	3.8	33.9
	Products	1.0	2.0	2.0	.4	1.0	6.4
	Total	10.5	8.6	7.0	9.4	4.8	40.3
1975 [2]	Crude oil	15.5	11.0	10.0	14.0	6.5	57.0
	Products	1.0	2.4	2.1	.2	1.3	7.0
	Total	16.5	13.4	12.1	14.2	7.8	64.0
1980 [2]	Crude oil	18.0	15.0	14.0	17.0	10.0	74.0
	Products	1.1	2.6	2.2	.2	1.4	7.5
	Total	19.1	17.6	16.2	17.2	11.4	81.5

[1] Reported in Foreign Trade of the U.S.S.R. (Moscow), 1960 and 1965.
[2] Estimated.

Table 10.—U.S.S.R.: Salient petroleum statistics

(Million metric tons)

Item	Actual			Planned and estimated		
	1960	1965	1969	1970	1975	1980
Crude oil:						
Domestic output	[1] 147.9	[1] 242.9	[1] 328.3	353.0	480	600
Imports	[1] 1.2	--	--	--	5	10
Exports:						
To other Communist countries	[1] 8.8	[1] 22.9	[1] 38.1	41.0	64	85
To non-Communist countries	[1] 9.0	[1] 21.0	[1] 25.8	26.0	36	45
Total	[1] 17.8	[1] 43.9	[1] 63.9	67.0	100	130
Crude product conversion:						
Crude oil to refineries	[2] 130.0	[2] 199.5	[2] 264.4	286.0	385	480
Refinery capacity	[2] 153.0	[2] 225.0	[2] 280.0	295.0	400	500
Refined oil:						
Output from crude	[2] 119.0	[2] 173.0	[2] 224.0	244.0	328	408
Natural gas liquids	[1] 1.2	[1] 2.8	[1] 4.7	5.0	8	12
Imports	[1] 3.2	[1] 1.9	[1] 1.1	1.1	1	1
Exports:						
To other Communist countries	[1] 6.4	[1] 6.5	[1] 9.5	10.0	11	12
To non-Communist countries	[1] 9.0	[1] 14.5	[1] 17.4	19.0	21	24
Total	[1] 15.4	[1] 21.0	[1] 26.9	29.0	32	36
Apparent consumption	108.0	156.7	202.9	221.0	305	385

[1] Production data 1960, 1965, and 1969 taken from The National Economy of the U.S.S.R. (Moscow), 1960, 1965, and 1969; trade data from Foreign Trade of the U.S.S.R. (Moscow), 1960, 1965, and 1969.
[2] Estimated.

Deliveries of crude oil to CMEA-member countries by the U.S.S.R. are to increase from 138 million tons in 1966–70 to 243 million tons during 1971–75.

Oil exports (crude oil and products) from the U.S.S.R. to non-Communist countries are expected to grow from 43.2 million tons in 1969 to an estimated 45 million tons in 1970, 57 million in 1975, and 69 million tons in 1980. By 1980, the Soviet Union may have to import some 10 million tons of crude oil annually from non-Communist countries in Africa and the Middle East.

Soviet petroleum statistics are presented in table 10.

Other Fuels and Energy.—Among the Soviet resources of other fuels and energy of lesser significance in the energy economy in 1970 are hydroelectric power, nuclear energy, oil shale, peat, and fuel wood.

The technical potential of hydroelectric power in the U.S.S.R. was placed at 1,721 billion kilowatt hours per year. In the overall energy economy of the Soviet Union, however, water power is of relatively small significance. Hydroelectric power supplied 124 billion kilowatt-hours (kwhr) or 16.7 percent of all electric power generated in 1970.

At the beginning of 1971, the total capacity of Soviet electric power plants reached 165.6 million kilowatts (kw), of which 31 million kw represented hydroelectric capacity and about 1 million kw nuclear capacity. Most of the future development of electric power capacity will be centered on new thermal electric powerplants, most of which will be fueled by lignite. Under the 1971–75 5-year plan, 65 to 67 million kw of new electric power generating facilities are to be commissioned and are scheduled to produce 1,030 to 1,070 billion kwhr of electric power annually by 1975. The output of hydroelectric power may reach 170 billion kwhr by 1975 and 220 billion kwhr by 1980. In 1980, the capacity of hydroelectric powerplants may reach approximately 55 million kw.

Exports of electric power rose from 39 million kwhr in 1961 to 3.9 billion kwhr in 1969. The Soviet Union is the only important exporter of electricity among the CMEA countries. Smaller amounts of electric power are exported even to the free world, namely to Finland and Norway.

Under long-term contracts, the U.S.S.R. will export some 9 billion kwhr of electric power by 1975, including 4 billion kwhr to Hungary, about 2.9 billion to Bulgaria, 1.5 to Poland, and about 0.6 billion kwhr to Finland and Norway. By 1980, the total export of electric power might be about 12 billion kwhr, including some 1.0 billion kwhr to the non-Communist countries. Hungary is expected to remain the principal importer of Soviet electric power.

Nuclear Power.—There are no reliable data upon which to estimate the reserves of fissionable materials for the generation of nuclear energy in the Soviet Union. Uranium is the source of the nuclear energy now being generated in the U.S.S.R. Thorium may also be used for this purpose, but there are no plans for its use in nuclear plants in the immediate future. For the more distant future, electric power generation by controlled fusion of hydrogen has been mentioned.

Nuclear power may become significant in the long run, but prospects are not too promising in the decade ahead, although the Soviet planners intend to install between 6 million and 8 million kw of nuclear capacity by 1975. The total installed capacity of all four Soviet atomic powerplants was 930,000 kw or 0.56 percent of the capacity of all electric powerplant in the country on January 1, 1971. According to published data, the Novo-Voronezh plant generated over 6 billion kwhr in the period 1964–70 and the Beloyarsk atomic powerplant generated about 6 billion kwhr in 7 years. All existing Soviet atomic powerplants are using uranium-235 for fuel. According to Western sources, France will buy enriched uranium for a nuclear power reactor from the U.S.S.R.

Estimated levels of Soviet atomic generating capacity for 1975 and 1980 are 3,224 and 7,168 megawatts, respectively. The U.S.S.R. will probably increase the production of nuclear power from an estimated 3.5 billion kwhr in 1970 to 6 billion in 1975, and 15 billion kwhr in 1980. Nuclear power output is to represent about 0.6 percent of national electric power production and about 0.1 percent of total Soviet primary energy output by 1980.

Soviet atomic energy statistics are presented, in megawatts, in the following tabulation:

Nuclear plant and unit	Began operation	Capacity (megawatts)		
		Actual, Jan. 1, 1971	Estimated, Dec. 31	
			1975	1980
Obninsk	1954	5	--	--
Beloyarsk No. 1	1964	100	--	--
Beloyarsk No. 2	1967	200	--	--
Beloyarsk No. 3	--	--	600	--
Beloyarsk No. 4	--	--	--	600
Novo-Vornezh No. 1	1964	210	--	--
Novo-Vornezh No. 2	1970	365	--	--
Novo-Vornezh No. 3	--	--	440	--
Novo-Vornezh No. 4	--	--	--	440
Melekess	1965	50	--	--
Shevchenko [1]	--	--	350	--
Bilibino No. 1	--	--	12	--
Bilibino No. 2	--	--	12	--
Bilibino No. 3	--	--	--	12
Bilibino No. 4	--	--	--	12
Kola Peninsula No. 1	--	--	440	--
Kola Peninsula No. 2	--	--	--	440
Armenia No. 1	--	--	440	--
Armenia No. 2	--	--	--	440
Leningrad No. 1	--	--	--	1,000
Kursk	--	--	--	1,000
New capacity	--	930	2,294	3,944
Total capacity	--	930	3,224	7,168

[1] The first dual-purpose nuclear power plant using a sodium-cooled fast reactor with a designed capacity of 150,000 kilowatts and desalination capacity of 120,000 cubic meters per day of fresh water.

Source: Pravda (Moscow) Oct. 13, 1970, p. 3; Stroitel'naya gazeta (Construction Gazette, Moscow) Jan. 29, 1971, p. 1; and Moscower pravda (Moscow), Oct. 9, 1970, p. 3.

Other Fuels.—Peat (fuel), oil shale, and fuel wood together accounted for 7.7 percent of the total Soviet fuel production in 1960, but, by 1969, their aggregate share had fallen to 4.5 percent. There was, in fact, an absolute increase in the production of these commodities, a trend which is expected to continue into the future.

Minable oil shale reserves, confined to deposits in Estonia, the Leningrad Oblast', and the Volga region, amounted to over 5 billion tons of standard fuel equivalent. The largest oil shale reserves are in Estonia. The production of oil shale increased from 14.1 million tons in 1960 to over 23 million tons in 1970. The output of oil shale may possibly reach 27 million tons in 1975 and around 30 million tons in 1980. Little of the oil shale is used for the distillation of oil in the Soviet Union. Most of it is used directly for making gas, electric power, and petrochemicals.

Soviet gross reserves of peat had been

expanded between 1955 and 1970 from about 20 billion to 25 billion tons of standard fuel equivalent. Only about 11 percent of today's minable reserves, however, are located in the central European part of the U.S.S.R., Belorussia, the Baltic States, and the Ukraine regions which produce over 80 percent of the national output. In 1970, 57.3 million tons of fuel peat was produced in the U.S.S.R. Analysis of past trends and Soviet potential facilities indicate that extraction of fuel peat may reach 60 million tons in 1975 and about 70 million tons in 1980.

The Mineral Industry of the United Arab Republic

By Roman V. Sondermayer [1]

During 1970 the mineral output of the United Arab Republic (U.A.R.) remained of modest importance to the nation's economy. The most significant mineral industry developments were in the petroleum sector, with the focal points being exploration in the Western Desert and development of the El Morgan offshore oilfield in the Gulf of Suez. Output of crude petroleum production increased a substantial 33 percent.

In addition to activities in the petroleum sector, the iron and steel, fertilizer, and cement industries were developed modestly according to the needs of a war economy.

Ratification of an agreement by the Supreme Soviet in Moscow for construction of Egypt's first aluminum smelter may indicate the beginning of an aluminum industry. Exploration for all nonferrous metals was intensive; however, results were not made public at the yearend.

PRODUCTION

Statistics on mineral commodity production are shown in the following table:

[1] Petroleum engineer, Division of Fossil Fuels.

Table 1.—United Arab Republic: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Copper	5,191	NA	NA
Iron and steel:			
Iron ore and concentrate thousand tons	447	460	e 500
Pig iron do	e 200	423	e 450
Crude steel do	190	e 490	e 500
Manganese ore and concentrate do	4	4	NA
Titanium, ilmenite concentrate, gross weight	--------	204	--------
NONMETALS			
Asbestos (including vermiculite)	2,602	--------	--------
Barite	373	e 400	e 400
Cement, hydraulic thousand tons	r 3,147	3,613	3,686
Clays:			
Fire do	700	928	e 900
Kaolin	r 108,900	78,000	e 80,000
Refractory	77,790	NA	NA
Diatomite	1,221	900	e 1,000
Feldspar, crude	1,718	3,000	e 3,000
Fertilizer materials:			
Crude, phosphate rock thousand tons	1,441	660	e 700
Manufactured:			
Nitrogenous, gross weight do	711	e 700	e 700
Phosphatic, gross weight do	369	e 370	e 370
Gypsum and anhydrite, crude do	571	470	e 500
Pigments, natural mineral, iron oxide	r 385	e 400	e 400
Pumice	8,000	200	e 200
Salt, marine thousand tons	622	385	e 500
Stone, sand and gravel, n.e.s.:			
Basalt thousand cubic meters	336	3,420	NA
Dolomite thousand tons	78	e 70	NA
Granite thousand cubic meters	27	e 30	NA
Gravel do	1,200	1,500	NA
Limestone and other calcareous do	4,000	4,300	NA
Quartz	20,602	13,000	NA
Sand including glass sand thousand cubic meters	2,628	r 2,825	NA
Sandstone do	67	75	NA
Sulfur, elemental, byproduct	3,200	500	e 650
Talc, soapstone, steatite, and pyrophyllite	e r 4,500	4,300	e 4,500
MINERAL FUELS AND RELATED MATERIALS			
Coal thousand tons	--------	4	--------
Coke:			
Oven and beehive do	312	r 312	e 320
Low temperature and gashouse do	30	35	e 30
Total do	342	347	e 350
Gas:			
Manufactured, all types do	28	e 30	e 30
Natural million cubic feet	1,978	2,507	e 3,000
Petroleum:			
Crude thousand 42-gallon barrels	62,206	89,598	119,477
Refinery products:			
Gasoline do	6,523	3,868	NA
Jet fuel do	} 4,878	24	NA
Kerosine do		3,294	NA
Distillate fuel oil do	7,242	3,633	NA
Residual fuel oil do	20,282	9,850	NA
Other do	1,375	404	NA
Refinery fuel and losses do	NA	1,264	NA
Total do	NA	22,337	NA

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

TRADE

The U.A.R. balance of total commodity trade showed a surplus in 1969. However, trade in minerals showed a deficit of $84.9 million.[2]

The relationships between total commodity trade and mineral trade were as follows:

	Value (million dollars)		
	Mineral commodities	Total trade	Mineral commodities share of total (percent)
Exports:			
1968	46.3	776.2	5.96
1969	54.0	930.2	5.80
Imports:			
1968	151.9	813.6	18.67
1969	138.9	796.2	17.45

Principal commodities traded by the U.A.R. in 1969 and their valuation follows:

	Value (thousand dollars)	
	1968	1969
Exports:		
Crude oil	9,412	21,370
Partly refined oil	8,641	--------
Refinery products	4,401	6,012
Other fuels and related products	151	342
Iron and steel	1,587	6,826
Other metals	27	220
Cement	14,598	11,943
Phosphate rock	5,712	4,812
Other nonmetals	1,795	2,482
Total	46,324	54,007
Imports:		
Iron and steel	41,436	39,148
Other metals	19,998	17,492
Fertilizers	20,147	14,538
Sulfur	4,518	3,309
Other nonmetals	10,508	12,528
Crude and partly refined oil	25,426	19,337
Refinery products	16,909	17,049
Coal, coke and briquets	9,546	10,954
Other fuels	3,477	4,580
Total	151,965	138,935

[2] Where necessary, values have been converted from United Arab Republic pounds (E£) to U.S. dollars at the rate of E£s 1.00=US$2.80.

Table 2.—United Arab Republic: Exports [1] of mineral commodities [2]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, semimanufactures	--------	1
Copper including alloys, semimanufactures	--------	87
Iron and steel:		
Roasted pyrite	--------	992
Pig iron, sponge, iron and steel powder	--------	4,545
Primary forms	6,447	41,919
Semimanufactures	r 6,068	16,163
Lead including alloys, semimanufactures	59	27
Other:		
Nonferrous ores and concentrates, n.e.s.	--------	1
Ash and residues bearing nonferrous metals, n.e.s.	--------	246
NONMETALS		
Abrasives, natural, grinding stones	4	15
Cement	876,294	819,791
Clays and products:		
Clays, crude n.e.s.	--------	543
Products:		
Refractory (including nonclay bricks)	1	1
Nonrefractory	3,142	4,004
Diamond:		
Gem carats	1,623	503
Industrial do	--------	19,178
Diatomite	--------	25
Fertilizer materials:		
Crude, phosphatic	450,705	409,523
Manufactured, phosphatic, Thomas slag	29,700	39,102
Gypsum and plasters	r 832	45
Lime	751	1,945
Salt	48,730	41,080
Stone, sand and gravel:		
Dimension:		
Crude and partly worked:		
Granite, porphyry, sandstone, etc	--------	758
Worked:		
Building or monumental	8	5
Gravel and crushed rock	--------	401
Sulfur, sulfuric acid-oleum	--------	50
Talc, steatite	--------	2,530
Other n.e.s.:		
Crude:		
Meerschaum, amber and jet	--------	1
Other	--------	4
Slag and ash n.e.s.	2	43
Building materials of asbestos, cement or of fibre-cement	1,320	4,965
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	3,138	328
Coke and semicoke	5,822	19,843
Peat including briquets and litter	--------	50
Gas, hydrocarbon natural	110	190
Petroleum:		
Crude thousand 42-gallon barrels	r 5,234	10,912
Partly refined do	2,581	--------
Refinery products:		
Gasoline do	3,166	--------
Kerosine and jet fuel do	305	273
Distillate fuel oil do	r 1,372	54
Residual fuel oil do	--------	649
Other do	--------	1,204
Total do	r 4,843	2,180

r Revised.
1 Includes reexports.
2 From the Central Agency for Public Mobilisation and Statistics. Monthly Bulletin of Foreign Trade. September 1969 and July 1970, 140 pp.

Table 3.—United Arab Republic: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	23	267
Metal:		
Scrap	r 8,134	4,578
Unwrought and semimanufactures	r 331	1,262
Arsenic trioxide, pentoxide, and acid	14	105
Chromium oxides and hydroxides	15	5
Cobalt oxides and hydroxides	2	42
Copper:		
Matte	1,185	1,309
Copper sulfates (including alums) and persulfates	14,120	19,082
Metal including alloys, all forms	330	393
Gold troy ounces	r 8,122	685
Iron and steel:		
Roasted pyrite	1,664	59,883
Metal:		
Scrap	r 35,205	32,310
Sponge iron, powder, and shot	159	155
Spiegeleisen	85,797	52,776
Ferromanganese	10,020	6,279
Steel, primary	24,434	8,713
Semimanufactures	r 139,988	136,028
Lead:		
Oxides	423	549
Metal including alloys, all forms	4,719	8,134
Manganese:		
Ores and concentrates	91	--------
Oxides	784	1,346
Mercury 76-pound flasks	116	58
Molybdenum including alloys, all forms	1	3
Nickel:		
Matte, speiss, and similar materials	--------	19
Metal including alloys, semimanufactures	593	9
Platinum-group and silver:		
Waste and sweeping troy ounces	--------	482
Metals including alloys:		
Platinum do	7	64
Silver, unwrought and semimanufactures thousand troy ounces	3	93
Rare-earth, compounds of thorium, uranium and of rare-earth metals	9	4
Uranium and thorium and their alloys	30	95
Tin:		
Oxide long tons	9	6
Metal including alloys, all forms do	468	289
Titanium oxides	339	584
Tungsten	3	1
Zinc:		
Oxides	186	292
Metal including alloys, all forms	r 4,766	2,740
Other:		
Ore and concentrate n.e.s	456	7,367
Ash and residues containing nonferrous metals	21	NA
Other inorganic bases and metallic oxides	59	61
Metal including alloys, all forms:		
Metalloids	15	--------
Pyrophoric alloys (including ferrocerium)	--------	1
Base metals including alloys, all forms n.e.s	(2)	41
NONMETALS		
Abrasives, natural, n.e.s	84	45
Asbestos	3,959	2,717
Boron materials, oxide and acid	35	23
Cement	r 1,192	2,889
Chalk	(2)	5
Clays and products (including all refractory brick):		
Crude n.e.s	6,168	5,178
Products:		
Refractory (including nonclay bricks)	8,888	11,806
Nonrefractory	99	6
Diamond not set or strung carats	--------	90
Diatomite	r 2,029	3,466
Feldspar and fluorspar	1,223	417
Fertilizer materials:		
Crude:		
Nitrogenous	72	30
Potassic	1,988	7,385
Manufactured:		
Nitrogenous	r 409,047	287,176
Other including mixed	(2)	20
Ammonia	25	28

See footnotes at end of table.

Table 3.—United Arab Republic: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Graphite, natural	41	157
Gypsum and plasters	284	335
Magnesite	915	916
Mica including worked	1	56
Pigments, mineral, natural, crude	737	769
Pyrite unroasted	64,658	26,978
Salt	14	15
Sodium and potassium compounds n.e.s:		
Caustic soda	37,674	47,253
Caustic potash, peroxides of potassium or sodium	76	192
Stone, sand and gravel:		
Dimension	624	57
Dolomite	203	38
Gravel and crushed rock	47	53
Quartz and quartzite	13	211
Sand (excluding metal bearing)	95	452
Sulfur:		
Elemental	r 60,652	41,219
Sulfur dioxide	(2)	39,424
Sulfuric acid	9,783	10,239
Talc, steatite, natural	1	26
Other n.e.s:		
Crude n.e.s	218	406
Oxides, hydroxides and peroxides of barium and strontium	1	2
Other halogens	4	5
Building materials of asphalt, asbestos-cement or of fibre-cement	283	29
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	395	5,375
Carbon black	1,979	NA
Coal and briquets:		
Anthracite and bituminous coal	505,205	491,660
Briquets of anthracite and bituminous coal	11	-------
Lignite and lignite briquets	-------	8
Coke and semicoke	-------	72,378
Gas, natural	39,334	68,051
Hydrogen and rare gases	20	37
Peat including briquets and litter	830	1,811
Petroleum:		
Crude ... thousand 42-gallon barrels	r 9,406	6,868
Partly refined ... do	71	14
Refinery products:		
Gasoline ... do	87	17
Kerosine and jet fuel ... do	2,086	2,169
Distillate fuel oil ... do	4,135	2,963
Residual fuel oil ... do	-------	4,933
Lubricants ... do	481	351
Other ... do	270	1,096
Total ... do	7,059	11,529
Mineral tar and other coal, petroleum, or gas derived crude chemicals	309	932

r Revised. NA Not available.

[1] From the Central Agency for Public Mobilisation and Statistics. Monthly Bulletin of Foreign Trade. September 1969 and July 1970, 140 pp.

[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—In 1970 the council of the Supreme Soviet in Moscow ratified the 1969 agreement between the Governments of the U.A.R. and the U.S.S.R. for financing the construction of a 100,000-ton-per-year aluminum smelter at a not yet determined location in Egypt. The plant is to be completed by 1974. Power from Aswan Dam electric plants and imported alumina will be used for the electrolytic prodction of aluminum metal. Approximately 60 percent of the annual output will be exported. Reportedly, the plant will cost an equivalent of about $96 million.

Iron and Steel.—Expansion of the Helwan steel plant continued in 1970. Details on accomplishments were not made public. Reportedly, two blast furnaces are being added, raising the total pig iron capacity to 1.5 million tons per year. The construction is supposed to be completed in two stages. The first furnace is scheduled to be completed in 1973 and the second in 1975.

Exploration of the iron ore deposits found in 1969 at Bahariya Oasis, about 200 miles southwest of Cairo, continued. Detailed surveys confirmed about 200 million tons of medium-grade iron-ore reserves. The Egyptian Mining Organization plans to develop the properties and construct a railroad between Bahariya and the steel complex at Helwan.

Other Metals.—About 40,000 square kilometers were covered by geological teams exploring for nonferrous metals, however results were not made public.

NONMETALS

Cement.—Detailed plans for constructing the four new cement plants approved in 1969 were completed during 1970 by the Ministry of Industry. The Alexandria plant will be built first and will have a capacity of 1 million tons of cement per year. Most of the cement from the Alexandria plant will be exported. The Assuit plant will have an annual capacity of 550,000 tons, and its output will be used to satisfy the requirements of southern Egypt. The two remaining plants, each of which is scheduled to have a capacity of 500,000 tons, are planned for Helwan (near Cairo) and for a Red Sea coastal location between Safaga and El Quseir.

Fertilizer Materials.—Exploration of phosphate rock deposits in New Valley near Abu Tartour continued during 1970. In general, the result confirmed the existence of sizable deposits; however, estimates of recoverable reserves have been reduced from 300 million tons to 200 million tons.

Romanian specialists continued developing four phosphate mines and a beneficiation complex at Hamrawayn near Al Quayer on the Red Sea coast. The mines will produce approximately 1.2 million tons per year of phosphate rock. The beneficiation plant will yield about 600,000 tons of concentrates annually. A railway line will connect mines at Hamrawayn with the Safaga sea port.

A new phosphate mine was under development at Aby Shumayila in the Western Desert. Production of 50,000 tons of phosphate rock is planned for 1972. Reportedly, reserves amounted to 7 million tons of rock, but the P_2O_5 content of ore was not reported.

Plans call for construction of a new fertilizer plant which will utilize natural gas from Abu Madi field. The plant will produce 800,000 tons of nitrogenous fertilizer per year. Although government officials had not determined the location for the plant, a site near Alexandria appears to be the most probable. The 200,000-ton-per-year granulated super phosphate plant of Société Financière et Industrielle de Kafr-el-Zayat was completed in early 1970, and was producing at capacity at yearend.

Sulfur.—Construction continued on a plant at Ras Gharib to extract sulfur from natural gas. The capacity of the plant was not disclosed.

Construction of two sulfuric acid plants was underway at yearend 1970. The plant being built at Abu Zabal will have a capacity of 100,000 tons per year and will operate on imported pyrite. The second plant was under construction at Assuit and will have a capacity of 80,000 tons per year. Completion dates, which were not fixed for either plant, will depend on financing.

Other Nonmetals.—Egypt also produced barite, diatomaceous earth, gypsum, kaolin, lime, natron, sand and gravel, stone, and talc during 1970. In general, quantities were small and reports on nonmetalics were incomplete, lacking important data on new reserves and capacities of existing mines and related facilities. Reportedly gypsum was found in the Alamein area, and about 1 million tons of quartz stone was discovered in the Higlia area of the Eastern Desert. Furthermore, limestone exploration was concentrated in areas of upper Egypt, along the Nile Valley, and southwest of Suez. Because Egypt's white sand workings are located in Sinai Peninsula, now occupied by Israeli forces, exploration for new white sand deposits has been extensive. Black sand exploration has been concentrated in the Nile Delta.

MINERAL FUELS

Petroleum was the principal source of energy used in Egypt, accounting for about 72 percent of the total fuel consumption. Imports of refinery products were essential since the refineries near Suez were destroyed by Israeli forces in 1968. The U.A.R.'s coal deposits in the Sinai Peninsula remained under the control of Israel and imports covered the modest domestic demand.

Petroleum.—Exploration for oil and gas was concentrated mostly in the Western Desert; however, the bulk of the country's oil production came from the Gulf of Suez area. With production over 300,000 barrels per day in 1970, El Morgan offshore field was by far the country's largest.

During 1970 the country's policy favoring the participation of foreign interests in exploration and production continued. In general, financial terms are negotiable. Exploration expenses are generally provided by the foreign company until a commercial discovery is made. Subsequent development and production costs and profits are shared equally between the Government company, Egyptian General Petroleum Corp. (EGPC), and the foreign company, in a joint venture.

During 1970 the Government finalized oil exploration agreements with three foreign companies. The first, Amoco U.A.R. Oil Co. (AMOCO) obtained an additional area in January 1970. With relinquishments and new acquisitions, Amoco holds 56,340 square kilometers (as of July 1, 1970) of exploration acreage, all in the Western Desert.

During 1970 Japan's North Sumatra Oil Development Corp. (NOSODECO) formally signed an exploration contract with the Egyptian Government. The contract, which covers a 38-square-mile block offshore in the Gulf of Suez, is an Indonesian-style contract in which production is shared with EGPC. The acreage, which is considered highly promising, is situated close to Ras Gharib, Karim and El Morgan oilfields. The contract provides for a 3-year exploration phase and a 15-year development and production period with a further 5-year period at NOSODECO's option. NOSODECO undertakes to spend a minimum of $3 million on exploration during the first 3 years, and to start drilling an offshore exploration well within 12 months of the effective date. Forty percent of crude oil production will be set aside for recovery of NOSODECO exploration and development expenses. The remaining 60 percent of production will be shared between EGPC and NOSODECO as follows: When production is less than 50,000 barrels per day, EGPC will receive 68.5 percent and the rest will go to NOSODECO; when production exceeds 50,000 barrels per day, EGPC will receive 75 percent. NOSODECO will pay a bonus of $500,000 when production reaches 50,000 barrels per day for a period of 90 consecutive days. EGPC will pay the royalties equal to 15 percent of production, and also the income taxes of NOSODECO. Egyptian Petroleum Development Co. (EPEDCO) was organized as the operating subsidiary of the NOSODECO-EGPC joint venture. Later in the year, the United States' independent Southeast Asia Oil Co. obtained large blocks of exploration acreage in Egypt. The acreage consisted of six widely scattered blocks with a total area of slightly over 12,000 square miles.

Occidental Petroleum Co. and Frontier Petroleum Co. discussed and negotiated joint ventures with EGPC. However, at yearend no official action was reported on these negotiations. Areas discussed included acreages in the Eastern and Western Deserts, as well as some offshore sites in the Red Sea.

The concession holdings for each company are shown in table 4.

Table 4.—Principal concession holdings in the United Arab Republic, July 1, 1970

(Square kilometers)

Company	Red Sea Area	Nile Delta	Western Desert	Total
Amoco UAR Oil Co. (AMOCO)	--------	--------	56,340	56,340
Compagnie Orientale des Petroles d'Egypt (COPE)	435	--------	--------	[1] 435
Egyptian Petroleum Development Co. (EPEDCO)	100	--------	--------	100
Egyptian General Petroleum Corp. (EGPC)	--------	--------	48,500	[2] 48,500
General Petroleum Co. (GPC)	390	--------	--------	390
Gulf of Suez Oil Co. (GUPCO)	5,895	--------	--------	5,895
Philips Petroleum Co. (Philips)	--------	--------	13,940	13,940
Western Desert Operating Co. (WEPCO)	--------	--------	34,700	34,700
International Egyptian Oil Co. (IEOC)	1,650	20,200	--------	21,850

[1] All in occupied Sinai.
[2] Government held acreage for future leasing.

During 1970, drilling activities continued at the same level as in 1969. Seven rigs were drilling exploratory wells and five were engaged in development and production. Approximately 600,000 feet were drilled of which about 47 percent were "wild cat" drillings. No significant discoveries resulted. However, some of the results in the general area of the Quattar Depression in the Western Desert were promising. Most of the production drilling was concentrated in offshore El Morgan oilfield, and onshore Umm-Al-Yusr, Uyun, and Amr. Daily average production for the first 5 months of 1970, was as follows:

Company and field	Production (barrels per day)
General Petroleum Co. (GPC):	
Bakr	10,440
Ras Gharib	8,420
Umm-Al-Yusr	3,400
Karim	1,840
Amr	890
Uyun	160
Western Desert Operating Co. (WEPCO):	
El Alamein	37,770
Gulf of Suez Oil Co. (GUPCO):	
El Morgan	243,450

Compared with the same pediod in 1969, average production increased by 81,000 barrels per day.

Egypt's largest field was the offshore El Morgan field; however, because its location is south of the now closed Suez Canal, the marketing of El Morgan oil is especially difficult. During 1970 through Petroleo Brasiliero S.A. (PETROBRAS), Brazil, signed an agreement to purchase oil at $1.10 per barrel, f.o.b. Ras Shukeir. This price is considerably lower than similar crudes with a Mediterranean Sea outlet. Two PETROBRAS tankers will move the oil to Brazil. Egypt will supply 10 million barrels per year for 3 years, or about 27,400 barrels per day. The oil, 32° API gravity with 1.16-percent-sulfur content will be used in PETROBRAS's Duque de Caixias refinery.

Egyptian plans for the Suez-Mediterranean (Sumed) crude oil transit pipeline were completed at yearend 1970. The pipeline will connect a new petroleum port at Sohna, 25 miles south of Suez, with another new oil port in the general area of Alexandria. Capacity of the 42-inch pipeline will reach 1.2 million barrels per day. One pump station will be located at Sohna and another near Cairo. Storage capacity at each terminal of the line will be 6.3 million barrels. Estimates of the cost of the pipeline range from $200 million, including an equivalent of $30 million in local currency supplied by the Egyptian Government.[3]

Egyptian Authorities together with foreign companies were planning to develop three sources of natural gas to be used to create an internal supply primarily for generation of electric power and production of fertilizers. Involved in the planning are flared gas at El Morgan field, development of Abu Madi field in Nile Delta, and development of Abu Qir off Egypt's Mediterranean coast. Costs for developing the gasfields, Abu Madi and Abu Qir, were reported at $23 million. WEPCO would drill six wells in the offshore field of Abu Qir, about 15 miles northeast of Alexandria. Also, a pipeline to carry the gas to Alexandria was made part of the project.

During the first half of 1970 the Czechoslovakian export firm Technoexport completed the delivery of equipment for a petroleum refinery to be constructed near Alexandria by the Alexandria Petroleum Co. The plant was designed to process either imported or Egyptian crude oil. Reportedly, the input capacity for imported oil will be 1 million tons, and for domestic crude oil, 1.6 million tons. Fundamentally, the plant is a straight-run refinery with facilities for desalting crude oil and for producing liquified petroleum gases. The refinery equipment was manufactured by the Kralovo Pole Engineering Works in Czechoslovakia.

[3] Petroleum Intelligence Weekly. V. 9, No. 51, Dec. 21, 1970, p. 5.

The Mineral Industry of the United Kingdom

By Horace T. Reno [1]

According to the National Institute of Economic and Social Research, stagnation characterized the economy of the United Kingdom in 1970. Compared with 1969, output increased 1.5 percent, exports increased 3 percent, and imports increased 5 to 6 percent. There was a balance of payments surplus of $1,390 million.[2] Nevertheless employment trended downward during the year.

Crude steel output was a record 28 million tons, but the ferrous metals production index indicated a decline from past years. Unusually severe winter weather for the third year in succession and perennial labor trouble left their mark on the domestic metal and mineral industries in 1970. Consumer demand for heating coal contributed to an overall shortage, and more than 1 million working days were lost by labor strikes. The nation's coal mines were the most severely affected by strikes with a loss of 2,870 working days per 1,000 employees.

Consolidation and reorganization of the steel industry to achieve higher efficiency and the benefits of large-scale operations continued as planned. The nonferrous and nonmetallic industries operated about as usual; however, there was a shortage of rock salt to keep the roads free of ice. Planned mechanization and consolidation of the coal industry continued. There was a shortage of coal for all purposes, and the Government lifted its ban on coal imports.

A major oil discovery was made in the United Kingdom sector of the North Sea which gave promise of providing a British-owned supply base for the United Kingdom's refining industry. North Sea natural gas continued to have great impact on storage, distribution, and consumption of gas throughout the United Kingdom; however, activity in the gasfields was somewhat less than in the last 6 years.

PRODUCTION

Production indices for mining and quarrying and manufacturing branches of the mineral industry were as follows (1963 = 100):

	1969	1970
Mining and quarrying	80.2	78.1
Manufacturing:		
Ferrous metals	116.2	115.7
Nonferrous metals	109.3	109.5
Nonmetallic mineral processing	127.8	124.7
Chemicals	149.2	158.5
Coal and petroleum products	139.3	151.1
All industry	122.9	124.0

Source: Central Statistical Office (London). Monthly Digest of Statistics. No. 303, March 1971, pp. 44–45.

Detailed production data are given in table 1.

[1] Physical scientist, Division of Ferrous Metals.
[2] Where necessary, values have been converted from United Kingdom pounds (UK£) to U.S. dollars at the rate of UK£1 = US$2.40.

Table 1.—United Kingdom: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
METALS			
Aluminum:			
Alumina [e]	90	90	90
Metal:			
Primary	38	34	40
Secondary	[r] 200	227	214
Cadmium including secondary ... metric tons	[r] 205	245	318
Copper, refined:			
Primary (from imported blister) ... do	49,707	49,316	49,437
Secondary ... do	[r] 148,003	148,927	156,807
Iron and steel:			
Iron ore	[r] 13,936	12,298	12,018
Pig iron and blast furnace ferroalloys	[r] 16,696	16,653	17,672
Steel, crude	[r] 26,277	26,846	28,316
Steel semimanufactures: ... thousand tons			
Sections	5,111	5,596	5,656
Plates, sheets and strip ... do	11,123	11,814	12,238
Pipe and tube stock ... do	832	895	891
Railway track material ... do	276	274	303
Other rolled [1] ... do	937	903	881
Castings and forgings ... do	417	435	423
Wire rods ... do	1,981	2,092	2,211
Total ... do	20,677	22,009	22,603
Lead:			
Mine output, metal content ... metric tons	[r] 3,248	[e] 3,000	[e] 3,000
Metal:			
Bullion from imported ores and concentrates ... do	31,890	39,056	43,768
Refined [2] ... do	235,600	260,500	287,000
Magnesium including secondary ... do	3,600	[p] 2,900	[e] 2,700
Nickel, refined including ferronickel ... do	[r] 41,700	29,700	36,700
Tin:			
Mine output, metal content ... long tons	[r] 1,798	1,622	1,695
Metal:			
Primary ... do	24,933	25,982	21,687
Secondary ... do	2,829	2,321	2,466
Zinc, smelter ... metric tons	142,882	150,993	146,597
NONMETALS			
Barite and witherite	[r] 30	18	[e] 18
Calcite	[r] 28	[e] 27	26
Cement	17,873	17,421	17,053
Chalk	[r] 19,011	18,295	16,123
Clays:			
China	[r] 2,826	3,055	3,183
Fire	1,969	1,703	1,731
Potter's and ball	[r] 742	830	837
Other including shale	39,823	37,400	[e] 35,580
Diatomite ... metric tons	14,937	12,983	[e] 13,000
Feldspar (china stone) ... do	30,872	33,102	[e] 33,500
Fertilizers manufactured: [3]			
Nitrogenous (N content)	[r] 800	841	710
Phosphatic (P_2O_5 content)	441	444	445
Other, gross weight	[r] 2,941	2,835	2,702
Fluorspar [4] ... metric tons	196,098	190,298	[e] 215,000
Gypsum and anhydrite	4,789	4,596	4,276
Salt:			
Rock	1,105	1,539	1,757
Brine	[r] 1,519	1,605	1,733
Other [5]	5,131	5,582	5,698
Stone, sand and gravel:			
Chert and flint	55	15	19
Igneous rock and perlite	[r] 34,074	35,806	36,686
Limestone including marble	[r] 81,188	83,935	87,826
Sandstone including ganister	[r] 13,465	16,636	16,649
Slate	78	70	65
Sand and gravel:			
Sand for glassmaking	1,529	1,589	1,201
Other silica sand	2,009	2,352	2,214
Molding sand	1,383	1,665	1,321
Building and concrete sand ... thousand cubic meters	32,897	32,581	32,409
Gravel ... do	39,540	38,312	38,806
Strontium minerals ... metric tons	7,888	11,721	[e] 8,000
Sulfur, elemental recovered	47	43	37
Talc, soapstone, and pyrophyllite ... metric tons	[r] 11,527	10,261	[e] 10,000

See footnotes at end of table.

Table 1.—United Kingdom: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	184	198	211
Coal:			
Anthracite	3,942	3,631	3,684
Bituminous	r 162,762	149,340	140,879
Coke:			
Metallurgical	r 16,508	16,841	16,590
Gashouse	r 4,668	3,034	1,902
Coke breeze, all types	2,651	2,278	2,010
Fuel briquets, all grades	1,040	1,158	1,204
Gas:			
Manufactured [6] million therms [7]	3,809	3,513	2,390
Natural [8] million cubic feet	71,351	[9] 178,673	391,958
Petroleum:			
Crude thousand 42-gallon barrels	r 591	562	607
Refinery products:			
Gasoline, aviation do	533	334	434
Gasoline, motor do	81,035	86,962	96,483
Jet fuel do	21,471	25,414	27,817
Kerosine do	18,746	19,793	20,769
Distillate fuel oil do	127,905	145,309	167,965
Residual fuel oil do	228,271	254,965	285,565
Lubricants do	7,204	8,411	9,264
Other do	84,611	86,589	87,231
Refinery fuel and losses do	40,682	44,059	46,744
Total do	610,458	671,836	741,772

e Estimate. p Preliminary. r Revised.
[1] Includes wheels, types and axles, and semis for sale.
[2] Includes lead refined from imported bullion and secondary lead.
[3] Year ending May 31 of that stated.
[4] Includes fluorspar recovered from old mine dumps.
[5] Salt in brine other than for saltmaking.
[6] Gas made at gasworks plus purchased coke-oven and refinery gas.
[7] 1 therm = 100,000 British thermal units.
[8] Gross production and marketed production not reported separately, but regarded as virtually equal.
[9] Gross production of which 99.7 percent was sold to consumers.

TRADE

Trade in mineral commodities in 1969 accounted for approximately 16 percent of the value of all exports and 28 percent of the value of all imports by the United Kingdom. The value of trade increased about $300 million in exports and $450 million in imports. The trade deficit attributable to mineral commodities was approximately $3.0 billion.

The United Kingdom became a significant coal importer for the first time.

Approximate values of the major mineral commodities traded in 1970 were as follows:

	Million dollars	
	Export	Import
Petroleum, crude	19	1,649
Diamond	605	755
Iron and steel	809	[1] 695
Copper	303	681
Gold bullion	648	1,030
Petroleum products	400	512
Silver and platinum group metals [1]	180	111
Aluminum	63	[1] 319
Nickel	133	[1] 253
Lead and zinc	64	[1] 186
Tin	58	[1] 97

[1] Including ores and concentrates.

Source: Overseas Trade Accounts of the United Kingdom (December 1970).

Table 2.—United Kingdom: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	17,123	10,152
Metal including alloys:		
Unwrought	21,317	22,242
Semimanufactures	40,041	40,882
Bismuth	308	357
Chromium	1,070	1,282
Cobalt oxide and hydroxide	93	71
Copper including alloys:		
Unwrought	r 102,529	103,585
Semimanufactures	r 74,761	84,969
Gold unworked or partly worked: thousand troy ounces		
Bullion, refined	54,773	10,676
Other including leaf do	203	546
Iron and steel: thousand tons		
Scrap	r 917	561
Pig iron, ferroalloys, and similar materials do	r 115	112
Steel, primary forms do	459	292
Semimanufactures:		
Bars, rods, angles, shapes, sections: do		
Wire rod	258	206
Other bars and rods do	366	440
Angles, shapes, sections do	421	448
Universals, plates and sheets:		
Universals and heavy plates uncoated do	392	387
Medium plates and sheets uncoated do	73	57
Light plates and sheets uncoated do	977	664
Tinned plates and sheets uncoated do	369	361
Other coated plates and sheets do	227	244
Hoop and strip do	103	112
Rails and accessories do	r 151	153
Wire do	124	129
Tubes, pipes and fittings do	491	535
Castings and forgings, rough do	18	23
Lead:		
Oxides	5,081	6,214
Metal including alloys:		
Unwrought	r 102,757	142,822
Semimanufactures	r 1,927	2,594
Magnesium including alloys, all forms	r 923	1,067
Nickel including alloys:		
Unwrought	r 34,020	23,491
Semimanufactures	r 11,761	12,136
Silver and platinum group including alloys: thousand troy ounces		
Platinum group	1,233	1,311
Silver do	26,607	44,056
Tin:		
Oxides long tons	355	404
Metals including alloys:		
Unwrought do	r 12,873	16,419
Semimanufactures do	610	584
Zinc:		
Oxide and peroxide	r 4,639	5,634
Metal including alloys:		
Unwrought	r 22,753	16,412
Semimanufactures	r 4,600	6,866
Other:		
Nonferrous base metal ores and concentrates (excluding radioactive ores and concentrates)	8,012	12,084
Nonferrous base metal scrap, ores, concentrates and waste of precious metals, and uranium and thorium ores	33,561	45,092
NONMETALS		
Abrasives, natural n.e.s.:		
Crude	8,952	5,472
Grinding and polishing wheels and stones	5,869	7,651
Asbestos, crude and waste	r 4,459	4,787
Cement thousand tons	273	347
Clays and products (including all refractory brick):		
Crude including china and others do	2,298	2,603
Products:		
Refractory (including nonclay bricks) do	r 170	185
Nonrefractory do	72	82
Fertilizer material manufactured, nitrogenous do	345	301
Lime	36,127	40,590
Mineral pigments, natural	5,997	5,430
Salt thousand tons	483	519
Stone, sand and gravel do	1,106	2,685
Strontium minerals, celestite	5,917	7,667
Other n.e.s.:		
Crude including metallurgical wastes not containing recoverable metals thousand tons	579	724

See footnote at end of table.

Table 2.—United Kingdom: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	7,836	5,561
Carbon black	r 33,326	33,996
Coal including briquets, all grades ... thousand tons	r 2,762	3,545
Coke ... do	853	1,021
Gas, natural and manufactured ... do	36	55
Petroleum:		
Crude and refined ... do	334	443
Refinery products:		
Gasoline (including natural) ... do	1,341	1,043
Kerosine ... do	r 939	1,013
Distillate fuel oil ... do	r 4,728	5,079
Residual fuel oil ... do	r 6,623	5,999
Lubricants ... do	r 563	589
Mineral jelly and wax	r 3,892	4,745
Other including bitumen and other residues ... thousand tons	r 217	206

r Revised.

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

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate .... thousand tons	442	478
Metal including alloys:		
Scrap .... do	13	14
Unwrought .... do	362	358
Semimanufactures .... do	39	47
Bismuth including alloys:		
Metal	326	335
Alloys	160	241
Cadmium including alloys, all forms	1,268	1,388
Chromite .... thousand tons	r 159	199
Cobalt:		
Oxide and hydroxide	955	611
Metal including alloys, all forms	1,560	1,465
Copper:		
Ore and concentrate	r 1,426	NA
Metal including alloys:		
Scrap	8,058	8,280
Unwrought, unrefined and refined blister .... thousand tons	r 471	473
Semimanufactures	r 11,805	11,155
Gold:		
Metal unworked and partly worked, fine basis:		
Refined .... thousand troy ounces	44,637	12,875
Unrefined .... do	819	767
Iron and steel:		
Ore and concentrate, except roasted pyrite .... thousand tons	r 17,524	18,261
Roasted pyrite .... do	362	201
Scrap .... do	3	294
Pig iron including cast iron, powder and shot .... do	241	190
Ferroalloys:		
Ferromanganese .... do	67	96
Other .... do	213	234
Steel, primary forms .... do	591	1,125
Semimanufactures:		
Bars, rods, angles, shapes, and sections:		
Wire rod .... do	155	58
Other bars and rods .... do	376	272
Angles, shapes, and sections .... do	36	36
Universals, plates and sheets:		
Heavy and medium plates and sheets, uncoated .... do	177	135
Light plates and sheets, uncoated .... do	r 425	335
Other coated plates and sheets .... do	r 72	42
Hoop and strip .... do	63	41
Wire .... do	8	10
Tubes, pipes and fittings .... do	258	169
Castings and forgings, rough .... do	2	3
Lead:		
Ore and concentrate .... do	60	71
Metal including alloys:		
Scrap	1,914	1,450
Unwrought .... thousand tons	r 214	229
Semimanufactures	1,022	889
Magnesium including alloys:		
Scrap	481	212
Unwrought	6,186	5,682
Manganese ore and concentrate .... thousand tons	r 481	438
Mercury .... 76-pound flasks	18,237	22,184
Molybdenum ore and concentrate	8,401	12,918
Nickel:		
Matte, speiss and similar materials	r 59,194	47,142
Metal including alloys:		
Scrap	r 4,321	5,444
Unwrought	r 31,092	23,089
Semimanufactures	r 1,450	1,964
Platinum group including alloys, all forms .... thousand troy ounces	158	168
Selenium, elemental	159	224
Silicon, elemental	14,597	16,690
Silver bullion, fine basis:		
Refined .... thousand troy ounces	72,706	104,234
Unrefined .... do	53,171	19,650
Titanium ore and concentrate:		
Ilmenite .... thousand tons	254	260
Other .... do	21	45
Tin:		
Ore and concentrate .... long tons	r 67,568	74,805
Metal including alloys:		
Scrap .... do	1,035	1,141
Unwrought and semimanufactures .... do	r 9,479	7,117
Tungsten ore and concentrate	r 6,273	8,422

See footnotes at end of table.

Table 3.—United Kingdom: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS—Continued		
Zinc:		
Ore and concentrate ... thousand tons	336	334
Metal including alloys:		
Scrap	3,505	1,217
Unwrought ... thousand tons	173	165
Semimanufactures	r 1,648	1,235
Zirconium ore and concentrate	r 50,134	48,184
Other:		
Ores and concentrate ... thousand tons	r 18	19
Ash and residues containing nonferrous metals ... do	63	88
Base metals including tungsten, molybdenum and tantalum ... do	r 23	28
NONMETALS		
Abrasives, natural excluding diatomite ... thousand tons	80	65
Asbestos, crude ... do	179	180
Barite and witherite ... do	33	56
Borax ... do	13	13
Cement ... do	330	183
Clays and products (including all refractory brick):		
Crude n.e.s.[1] ... do	101	136
Products:		
Refractory (including nonclay bricks) ... do	59	69
Nonrefractory ... do	21	13
Diatomite and other infusorial earths ... do	43	40
Feldspar and fluorspar ... do	[2] 134	139
Fertilizer materials:		
Crude:		
Nitrogenous ... do	380	283
Phosphatic ... do	r 1,873	1,693
Potassic ... do	37	37
Other ... do	27	27
Manufactured:		
Nitrogenous ... do	380	283
Phosphatic ... do	75	52
Potassic ... do	810	748
Other including mixed ... do	315	296
Graphite, natural	r 10,408	10,454
Gypsum and plasters ... thousand tons	191	168
Magnesite ... do	76	124
Mica, crude including splittings and waste ... do	13	12
Pigments, mineral, crude, natural	r 6,196	5,845
Pyrite (gross weight) ... thousand tons	220	221
Salt ... do	33	54
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked ... do	31	31
Worked ... do	28	24
Dolomite ... do	r 23	27
Gravel and crushed rock ... do	r 245	224
Quartz and quartzite ... do	10	8
Sand excluding metal bearing ... do	212	223
Sulfur, elemental ... do	r 781	744
Talc, steatite, soapstone, and pyrophyllite ... do	51	52
Other n.e.s.:		
Crude ... do	r 353	396
Slag, dross, and similar waste, not metal bearing	r 12,699	3,745
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural ... thousand tons	66	50
Carbon black ... do	15	12
Coal and coke including briquets ... do	71	91
Gas, natural and manufactured ... do	r 1,093	1,131
Petroleum:		
Crude and partly refined ... do	r 82,581	94,569
Refinery products:		
Gasoline (including natural) ... do	r 4,712	4,204
Kerosine and jet fuel ... do	r 5,818	6,178
Distillate fuel oil ... do	r 3,575	2,994
Residual fuel oil ... do	r 7,184	6,228
Lubricants ... do	r 638	531
Mineral jelly and wax ... do	189	186
Petroleum coke ... do	r 74	91
Other ... do	68	56

r Revised. NA Not available.
[1] Includes andalusite, kyanite, etc.
[2] Includes nepheline syenite.

COMMODITY REVIEW

METALS

Aluminum.—Primary aluminum production in 1970 was 18 percent more than in 1969, but secondary production was 6 percent less. Smelting plant capacity was unchanged. However, the construction of three new aluminum smelters planned for completion in 1971 proceeded as scheduled.

Preliminary data indicate that aluminum consumption increased about 3 percent compared with that of 1969. Labor strikes at the British Aluminium Co. Ltd. (BACO) plant at Falkish and the Alcoa (Great Britain) Ltd. plant at Swansea probably accounted for most of the difference between supply and consumption.

Exports of semifinished aluminum shapes totaled 41,638 metric tons, 2 percent more than in 1969. Imports of unwrought aluminum and aluminum alloys, which account for most of the United Kingdom supply, were up 5 percent, with imports of semifinished aluminum goods unchanged.

Aluminum prices were raised an average of 3 percent in the second quarter of the year, and 5 percent in the fourth quarter. The leading aluminum firms of the United Kingdom changed from the imperial to the metric measuring system in July and immediately began charging premium prices for imperial-dimension aluminum to encourage the change. Continental suppliers, however, continued to offer imperial-dimension aluminum in the United Kingdom at the lower prices. In view of the overall difference between domestically produced and imported aluminum goods, the Aluminum Federation asked the Government to impose antidumping duties on low-priced imports.

Anglesey Aluminium Ltd., BACO, and Alcan Aluminium, Ltd., were constructing aluminum smelters, to be completed in 1971, with planned initial annual capacity of 260,000 metric tons. The Anglesey plant in Wales on Holy Island near Holyhead was nearest to being completed at yearend. Carbon-baking electrode furnaces were operating, and 10 training cells began operation in November. Baking furnaces at the BACO plant in Sutland at Ivergordon were lit, and it was anticipated that the furnaces at the Alcan smelter at Lynemouth in the north of England would be lit in the first quarter of 1971.

In view of the anticipated activity in the United Kingdom primary aluminum industry, a subcommittee of the London Metal Exchange studied the feasibility of opening an aluminum market. At yearend, the committee apparently had not yet reported its findings.

Copper.—All copper produced in the United Kingdom is smelted and refined from imported blister and matte or from secondary materials. Imported copper comes principally from Chile, the Republic of South Africa, and Zambia. Production from imported blister in 1970 was unchanged from that of 1969. However, production from scrap was 157,000 metric tons, compared with 149,000 tons in 1969. Refined copper imports, principally from Zambia, Canada, and Chile (in that order), totaled 409,920 metric tons. Consumption of copper in all forms was changed little from that of 1969, but total exports of semifinished copper and copper alloys were 17 percent more than in 1969.

According to the Rio Tinto Zinc Corp. Ltd. (RTZ) annual report, after preliminary drilling for copper at Coed-y-Brenin, permission was sought to carry out more extensive scout drilling in the area.

Iron Ore.—The United Kingdom's iron ore mines produced slightly less ore in 1970 than they produced in 1969, in spite of a 7-percent increase in consumption measured by the quantity of ore consumed. Domestic ores provided 37 percent of the total ore consumed, foreign ores 63 percent. In terms of contained iron, however, the domestic mines provided only 22 percent of the total.

Canada, Norway, Liberia, Mauritania, Venezuela, Sweden, and the U.S.S.R., in that order, were the principal suppliers. It is noteworthy that Sweden, in the past second in rank, this year ranked sixth. The use of new deep-water iron ore unloading facilities completed last year, as well as diversifying supply sources, was responsible for the changed pattern.

This changing pattern in the United Kingdom iron ore supply sources was reflected in smelting operations. Approximately 20 million tons of ore was sintered in 1970, continuing the downward trend in the use of sintered ore in the steel industry. Downward trends in the coke rate and use of gas also continued, but the use of liquid fuel in the industry remained remarkably stable. The pig iron-to-scrap ratio in 1970 was 1.04 to 1.0, continuing a 5-year trend of increasing use of scrap to make steel.

Lead and Zinc.—Lead and zinc concentrates were produced principally as a byproduct of fluorspar mining in Derbyshire. The production of 4,100 metric tons was little more than that produced in 1969, despite exploration and development of some of the old mines in the district and in North Wales. Imported bullion and secondary materials were the principal basis for the lead industry, and imported concentrate was the principal raw material for the zinc industry. Practically all the lead bullion and most of the zinc concentrate originated in Australian mines. The Irish Republic supplied zinc concentrate to the United Kingdom, as it has since 1968.

The trend in consumption of both refined lead and lead alloys continued downward, but consumption of zinc although less than that of 1969 was more than that of 1968. At yearend, however, there was some indication of slackening activity in the domestic zinc industry.

Steel.—The change of government in June did not noticeably affect the operations and planning of the nationalized sector of the iron and steel industry. British Steel Corp. (BSC), reorganized on March 29, 1970, into six product divisions: special steels; general steels; tubes; strip mills; constructional engineering; and chemicals. According to corporation officials the new organization would enable it to rationalize selling and production where similar products are involved, to employ its present plants, and to plan future development to the greater benefit of the corporation as a whole. Each division is headed by a managing director; the division management is essentially autonomous within its own field.

The special steels division's predominate activity is the making and rolling of stainless alloy and high-grade carbon steels. The manufacturing plant it controls is widespread, ranging from South Wales, North Wales, and the Midlands to Cumberland and west Scotland. The nucleus of the division is in the Sheffield area in which the divisional headquarters is situated.

The general steels division is the largest of the six and the largest producer of crude steel. This division operated 37 plants and employed about 86,000 workers in 1970. Its principal products are billets, plates, structural shapes, rods, bars, and wire. Its operations are widespread throughout the United Kingdom with major concentrations at Scunthorpe on Teeside and in Scotland.

The tubes division is responsible for producing about 70 percent of all the steel tubing and steel pipe manufactured in Great Britain, and a large part of the spun iron and concrete pipes. The division operates throughout the United Kingdom with works at Calder, Clydesdale, Addiewell, Hartlepool, Stockton, Staveley, Stanton, Wednesbury, Bromford, Huntingdon, Newport, Llawern, and Corby in Northamptonshire. Its headquarters are at Corby, where it operates the largest integrated iron and steel tube works in Europe.

The strip mills division is charged with the operation of all the wide-strip mills in the United Kingdom and all the corporation's interest in narrow, mild-steel strip. The division employs 70,000 people and operates at 31 sites throughout the country from Scotland to southwest Wales. Its headquarters are at Cardiff.

The constructional engineering division brings together all the construction interests of the BSC. It offers a wide range of products and services to the construction industry and has a building and contracting group that operates throughout the world. The core of this division is 18 steel fabricating works with total fabricating capacity of 200,000 tons per year. The division employs 10,000 people whose numbers include structural engineers and designers with a wide variety of skills and experience.

The chemicals division is charged with all the corporation's chemical operations. Its main objective is to optimize the return on coke-oven byproducts and coal chemicals and the inorganic chemicals used directly in the steel industry. The division was formed from the United Coke and Chemicals Co., Ltd., with its integrated coke ovens, and tar and benzole refineries; Dorman Long Chemicals with established tar and benzole refineries and associated chemical plants; and Bristol and West Tar Distillers Ltd., as the core of the new division.

The general steels division of the BSC announced plans to install a pipeline in the Scunthorpe area from the estuary to the River Humber to dispose of effluent from the Redbourne, Normandy Park, and Appleby-Frodingham works. The Anchor expansion in this area, probably the most ambitious of BSC plans to modernize and utilize the economies of large-scale steel-making operations, was well underway by yearend. Existing effluent disposal systems at the three works did not comply with statutory regulations of the locality, even without the new facilities.

The low level of domestic steel prices continued to plague both private and public sectors of the industry. The BSC was granted a 10-percent price increase on January 27 and a 5-percent increase on October 16, the third and fourth increases in 18 months. However, some observers claimed that, as in the past, the increases were too little and too late. The fact was that the corporation did not make a reasonable return on capital already invested, and capital expenditures during the year were at an unprecedentedly high rate.

Tin.—Tin mines in the United Kingdom produced slightly more tin concentrate in 1970 than in 1969. Although imports of tin ore and concentrate were up slightly from those of 1969, imports of unwrought and semimanufactured tin and tin alloys decreased more than 80 percent compared with 1969 figures, and 90 percent compared with 1968 data. Smelter production was down 17 percent, but tin consumption was only 6 percent less than in 1969. The imbalance between supply and consumption caused an abnormally high inventory, in spite of exports increasing almost 60 percent compared with those of 1969 and more than doubling compared with those of 1967 and 1968.

The South Crofty Ltd. mine at Poole, near Redruth in Cornwall, is the older and larger of Britain's two active tin mines. In 1970 it was in about the middle of a $2.4 million development program designed to double its production of ore to 200,000 tons per year, which will increase its output of concentrate to over 2,000 tons per year.

Geevor Tin Mines Ltd. successfully dewatered its Levant mine to the 190-fathom level. The company reported development openings of 5,036 linear feet at its Levant mine and of 4,240 feet at its Sims mine.

Williams Harvey and Co., Ltd., which completed a new primary tin smelting plant at Kirby, Lancashire, last year, experienced mechanical and technical problems which seriously impeded production at the new plant. The company sold the Cornish Tin Smelting Co., Ltd., which had been recovering tin concentrates from old mine dumps in Cornwall.

The plant expansion plans of Capper Pass and Son, an RTZ subsidiary, at its tin smelter at North Ferriby, Yorkshire, were on schedule, and its existing smelting and refining plant at Capper Pass operated at capacity.

NONMETALS

Barite.—The Closehouse mine, near Middleton-in-Teesdale in the northern Pennines, was the only mine in the United Kingdom in 1970 producing barite as its principal product. Byproduct barite was produced at the Muirshiel mine of RTZ near Lochwinnoch, Renfrewshire, by Laporte Industries, Ltd., as a flotation concentrate at its Cavendish mill, and by C. E. Giulini, Ltd., at its new mill at Hopton.[3] Production of 16,250 metric tons was reported for 1969. Barite imports in 1970 were 16 percent above the 1969 level.

Clays.—*Fuller's Earth.*—Geologists of the Institute of Geological Sciences found important deposits of fuller's earth at shallow depths during routine mapping in the Swindon-Abingdon district of Berkshire.[4]

Fluorspar.—Deepwood Mining Co. outlined a sizable deposit of fluorspar 6 miles northwest of Bakewell, Derbyshire. The company reported that the deposit is high grade, containing more than 50 percent CaF_2 plus barite and lead, and that it would be amenable to open pit mining.[5]

Gypsum and Anhydrite.—Mine production of gypsum and anhydrite in 1970 was 7 percent less than the record established in 1969. United States Gypsum Co. sold its interest in BPB Industries, Ltd. which dominates the United Kingdom gypsum industry. The two companies, however, planned to maintain a close working relationship and exchange know-how and research information.[6] Bellrock Gypsum, Ltd., the only other large producer of gypsum, was taken over by the BPB subsidiary, British Gypsum, Ltd.

[3] Industrial Minerals. The World's Barite Industry. No. 32, May 1970, pp. 15–23.
[4] Industrial Minerals. Fuller's Earth Found in Berkshire. No. 28, January 1970, p. 37.
[5] Industrial Minerals. Fluorspar Find in Derbyshire. No. 28, January 1970, p. 37.
[6] Industrial Minerals. US Gypsum Disposes of Its BPB Interest. No. 36, September 1970, p. 35.

Potash.—The sinking of two 18-foot-diameter circular shafts by Cleveland Potash, Ltd., at Boulby near Straithes, North Yorkshire, proceeded on schedule. Preliminary figures indicate that the United Kingdom imported slightly more potash in 1970 than in 1969. As in the past, East Germany was the principal supplier with 34 percent of the total, followed by France with 12 percent, and West Germany with 11 percent.

Salt.—Imperial Chemical Industries Ltd. salt mine at Winsford in Cheshire was the only producer in Great Britain in 1970. Production was 1.8 million tons. Three hard winters in succession resulted in an insufficient supply of rock salt to keep roads open in icy weather.

Silica Sand.—The British Industrial Sand, Ltd. (BIS) and Buckland Sand and Silica Co., Ltd., are the only independent companies in Great Britain that regularly produce silica sands for colorless glass. Production was estimated at 1,585,000 metric tons in 1969 and 1,524,000 tons in 1970.

MINERAL FUELS

Coal.—The coal industry of the United Kingdom was marked by a year-long labor shortage, unauthorized strikes in most of its mines, and a demand for coal far exceeding the supply.

Coal production at the mines was down about 6 percent from output in 1969. Ten collieries were closed during the year, but open-pit mining increased in spite of opposition from environmentalists. Opposition to open-pit coal mining in several districts was largely dissipated when it was demonstrated that open-pit mining in areas despoiled by waste from underground workings again made the land useful for agriculture.

Coal output per manshift was 1-½ percent higher than in 1969. There were 87 deaths in coal mine accidents during the year in comparison with 95 in 1969, but the rate of deaths per 100,000 manshifts increased from 0.13 to 0.14. Overall, the safety record in the United Kingdom coal mines has been improving. The National Coal Board, in its report for the fiscal year ending March 1970, reported 82 deaths compared with 115 deaths in the year ending March 1969 and 130 deaths in the year ending March 1968. Serious injuries reported in these periods were 672, 788, and 975, and total accidents per 100,000 manshifts were 172.9, 182.5, and 191.2, respectively.

In spite of the severe shortage of coal in domestic markets, coal exports from the United Kingdom in 1970 were 13 percent more than in 1969. However, the Government lifted its ban on coal imports on December 5, so that 227,219 tons of coal, coke, and briquets valued at $47,824,000 were imported during the year.

The National Coal Board was unusually active in promoting district heating, which combined with waste disposal offers many advantages to communities seeking to resolve their air pollution and waste disposal problems at the same time. In addition to its own work, the Board sponsored the first international district heating convention in London in April 1970. Researchers on coal mine mechanization reported the development of an automatic vertical steering system for power loaders. The system uses nucleonic sensing to guide the machines below a preselected roof. They also developed heavy-duty, armored, flexible face conveyors. The National Coal Board formally opened the most modern mine in Europe, the Reddings Drift near Barnsbly in Yorkshire, which operates on a retreat mining system in two entryways. In 1970 it achieved productivity of 17.5 tons per manshift. The average of all United Kingdom coal mines was about 2.2 tons per manshift.

Mechanization of United Kingdom coal mines and liquidation of high-cost, inefficient mines were the prime objectives of the National Coal Board when it was established 10 years ago. In 1970 the Board was well on its way toward achieving both objectives. However, success was not without drawbacks in either instance. The liquidated mines would have helped overcome the coal shortage, and mechanization at the mining faces threw many operations out of balance because hoisting and transportation capacity was not adequate to handle the increased coal output of the mechanized working places.

Natural Gas.—Natural gas from the North Sea continued to change the pattern of the United Kingdom's energy supply. Production from the North Sea gasfield more than doubled for the second year, 392 billion cubic feet in 1970 compared with 178.7 billion cubic feet in 1968. An unusually cold winter and a shortage of coal facilitated the change from coal to gas as a source of heat and power. According to the Gas Council, natural gas made up for three-fifths of a consumer shortage of a half million tons of coal during the winter.

The following tabulations show the sources of gas available in the United Kingdom for fiscal years ending in 1969 and 1970:

	Million therms	
	1968–69	1969–70
Gas (manufactured):		
Coal gas	665	427
Oil gas	2,134	1,747
Water gas and other gases	143	46
Gas (purchased):		
Refinery gas	285	227
Liquefied petroleum gas	346	272
Coke oven gas	358	330
Other (including natural gas used in gas manufacture)	1,074	1,958
Subtotal	5,005	5,007
Natural gas direct to consumers	160	737
Total gas available	5,165	5,744

Source: The Gas Council Annual Report and Accounts 1969–70.

The House of Commons was informed in April that the reserves of natural gas recoverable from the North Sea had been estimated at 29 trillion cubic feet (29×10^{12}). The Gas Council continued studies to determine the most economical storage facilities for natural gas, and during the year added 493 miles of pipeline to the national transmission system, bringing the total system length to 1,565 miles.

There was some indication that the impact of North Sea gasfields on the United Kingdom economy was beginning to moderate. Most license holders to explore for oil and gas in the United Kingdom sector of the North Sea obtained the bulk of their concessions in September 1964, and under the terms of the law, were to surrender at least half their territory at the end of the initial 6-year period. The Ministry of Technology revealed that approximately three-fourths of the originally licensed area had been returned. Apparently most interest in the North Sea sector centered on the possibility of finding oil in certain areas close to the Norwegian sector. The retained areas were where natural gas had already been proved or where there are favorable prospects for doing so.[7]

Petroleum.—Historically, Great Britain's petroleum industry has been noted as an important processor of crude oil and a consumer of refinery products. This year may have marked the beginning of expansion of the industry into crude oil production. BP Petroleum Development Limited announced a major oil discovery in the British sector of the North Sea, 110 miles northeast of Aberdeen. The well was reported to test 4,700 barrels per day of sweet oil acceptable in domestic markets.

The existing industry continued to grow. Domestic consumption in 1970 totaled 95 million tons, an increase of 6.7 percent compared with the level of 1969, and petroleum product exports totaled 17 million tons valued at $400 million compared with exports of 14 million tons valued at $350 million in 1969. The following tabulation shows consumption of petroleum refinery products in the United Kingdom for 1969 and 1970:

[7] Petroleum Press Service. Massive Surrender of United Kingdom Licenses. V. 37, No. 11, November 1970, p. 418.

Product	Metric tons	
	1969	1970
Refinery gases	465,544	323,265
Propane	421,791	432,274
Butane	786,719	740,745
Naphtha/L.D.F	11,250,780	9,489,800
Aviation spirit	100,869	74,596
Aviation turbine fuel, wide cut	281,952	152,629
Aviation turbine fuel, other	2,968,121	3,253,767
Motor spirit (including industrial benzole)	13,443,841	14,234,757
Industrial spirits (including industrial benzole)	100,870	48,173
White spirit	144,196	136,294
Burning oil	2,243,903	2,480,742
Vaporizing oil	64,525	53,671
Derv fuel	4,868,100	5,034,599
Gas and/or diesel oil	10,514,569	12,109,047
Fuel oil, light	3,451,437	3,163,047
Fuel oil, medium	5,520,585	6,856,096
Fuel oil, heavy	24,956,580	28,565,710
Lubricating oils and greases	1,227,524	1,175,245
Paraffin wax and scale	59,185	57,035
Bitumen	1,840,816	2,068,629
Chemical feedstock (other than naphtha)	411,467	388,443
Refinery consumption, fuel oil	5,653,532	6,028,398
Total deliveries into inland consumption	90,776,906	96,866,962
Bunkers, gas and/or diesel oil	780,196	799,141
Bunkers, fuel oil	4,805,222	4,717,108
Total bunkers	5,585,418	5,516,249
Methane	813,588	652,682

Source: Institute of Petroleum (London). Consumption and Refinery Production 1969 and 1970. May 1971, p. 3. (Figures converted from long tons, using factor of long ton X 1.01605.)

The Mineral Industry of Venezuela

By Gordon W. Koelling [1]

The value of Venezuela's crude minerals output increased more than 1 percent during 1970, primarily as a result of higher petroleum (including natural gas) and iron ore production. Approximately 94 percent of the value of crude minerals output was accounted for by the petroleum industry which also was responsible for more than 90 percent of the country's total export receipts and probably provided over 65 percent of the Government's ordinary revenues. About 5 percent of the value of Venezuela's crude minerals output was accounted for by iron ore.

Venezuela, which experienced only a small increase in crude oil production, declined from first to third place among the world's petroleum exporting countries following Saudi Arabia and Iran and fell to fifth place among the world's crude oil producing nations. This drop in relative world importance reflected some of the Venezuelan petroleum industry's basic problems. Crude oil reserves declined for the fifth consecutive year and production costs remained high in comparison with those in other major petroleum exporting countries. Increasingly severe antipollution regulations limiting the allowable sulfur content of fuels used in the Eastern United States continued to exert some restriction on shipments of Venezuelan residual fuel oil to its principal market despite the operation of sizable desulfurization facilities at the country's two largest refineries.

In December 1970, a Law for Partial Reform of the Income Tax Law was enacted by the Venezuelan Congress and signed by the President. The principal features of this amending legislation follow:

1. The previous Schedule B income tax contained in Article 58 of the Income Tax Law, under which income tax rates on petroleum and iron ore companies rose on a graduated scale from 20 percent to 52 percent, was replaced by a uniform rate of 60 percent.
2. The above tax increase was made applicable to fiscal years ending after December 30, 1970. This, in effect, applied the 60 percent rate to the 1970 income of most of the companies involved.
3. For income tax purposes, the Venezuelan Government was given the right to fix unilaterally, for periods of up to 3 years, the prices of petroleum and iron ore exported (the arbitrarily determined prices are called Tax Reference Values). Under the original terms of the Tax Law, the Government negotiated Tax Reference Values with the companies for 5-year periods.

At yearend, the Government announced its intention to seek Congressional approval of a law reserving future development of the natural gas industry for the State. This would, among other things, nullify proposals advanced by U.S. firms for joint ventures involving the construction of facilities for the liquefaction of natural gas.

PRODUCTION

Output of almost all minerals produced in Venezuela increased during 1970. The most important gains were registered by petroleum and natural gas, iron ore, coal, aluminum, industrial diamond, cement, and salt. Only phosphate rock registered a major decline in production.

[1] Geographer, Division of Fossil Fuels.

Table 1.—Venezuela: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1968	1969	1970 p
METALS			
Aluminum	10,000	13,804	23,000
Gold ... troy ounces	20,600	19,385	21,862
Iron and steel:			
Iron ore and concentrate ... thousand tons	16,190	19,716	22,200
Pig iron ... do	r 614	520	510
Crude steel ... do	861	821	923
NONMETALS			
Cement, hydraulic ... do	2,438	2,080	2,650
Diamond:			
Gem ... carats	59,655	117,614	129,250
Industrial ... do	54,345	76,169	370,350
Total ... do	114,000	193,783	499,600
Fertilizer materials:			
Crude, phosphate rock, marketable	r 59,359	62,000	30,983
Manufactured, nitrogenous, gross weight [2]	151,092	151,882	206,940
Gypsum e	99,000	82,000	100,000
Salt, all types	126,000	171,000	265,396
Stone, limestone ... thousand tons	3,170	2,700	NA
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	7,350	7,258	7,348
Coal, bituminous	30,825	32,484	39,978
Gas, natural:			
Gross production ... million cubic feet	1,634,602	r 1,673,013	1,710,200
Marketed ... do	301,197	r 314,092	348,630
Natural gas liquids:			
Condensate ... thousand 42-gallon barrels	1,987	1,999	1,899
Natural gasoline ... do	3,183	3,048	3,882
Liquefied petroleum gas ... do	7,397	8,773	11,141
Total ... do	12,567	13,820	16,922
Petroleum:			
Crude ... do	1,319,340	1,311,832	1,353,420
Refinery products: [3]			
Aviation gasoline ... do	297	278	185
Motor gasoline ... do	23,676	22,807	26,317
Naphtha ... do	33,353	37,195	38,856
Jet fuel ... do	24,791	23,773	26,803
Kerosine ... do	4,740	5,613	4,301
Distillate fuel oil ... do	67,006	55,250	55,149
Residual fuel oil ... do	258,839	257,702	297,531
Liquefied petroleum gas ... do	3,120	2,809	3,945
Lubricants ... do	4,199	3,583	3,852
Asphalt and bitumen ... do	5,476	4,816	5,136
Refinery gas [4] ... do	5,564	5,673	6,211
Other ... do	2,376	2,568	2,578
Total ... do	433,437	422,067	470,864

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

[1] In addition to the commodities listed, lime, sand, gravel, and clays are also produced, but information is inadequate to make estimates of output levels.

[2] Sales.

[3] Includes refinery fuels.

[4] Liquid equivalent.

TRADE

Exports of mineral commodities continued to dominate Venezuela's overall foreign trade during 1968 and 1969, the latest years for which complete trade information is available. 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 latter area consisted of crude and unfinished oils destined for processing at two large refineries owned by the parent companies of Creole Petroleum Corp. and Cía. Shell de Venezuela, Ltd., Venezuela's first- and second-ranking crude oil producers. 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 1968–70 were as follows:

Destination	Exports (thousand 42-gallon barrels)		
	1968	1969	1970
Western Hemisphere:			
Canada	155,357	161,631	174,799
Puerto Rico	63,618	75,418	74,997
Trinidad and Tobago	76,666	69,929	51,768
United States	505,091	512,673	575,294
Other	150,976	172,949	174,989
Total	951,708	992,600	1,051,847
Eastern Hemisphere:			
Western Europe:			
European Economic Community (EEC)	77,196	82,480	73,859
Spain	28,004	23,936	18,820
United Kingdom	81,243	69,253	65,571
Other	31,540	33,947	31,260
Subtotal	217,983	209,616	189,510
Other	43,823	35,275	24,583
Total	261,806	244,891	214,093
Grand total	1,213,514	1,237,491	1,265,940

Source: Ministerio de Minas e Hidrocarburos, Memoria y Cuenta, Año 1968, 1969, 1970. Caracas, Venezuela, March 1969, March 1970, and March 1971.

Table 2.—Venezuela: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum including alloys, all forms	r 6,933	217	Mainly to United States.
Copper including alloys, all forms	570	670	Belgium-Luxembourg 279; Spain 224.
Iron and steel:			
Ore and concentrate thousand tons	15,053	18,992	Mainly to United States.
Metal:			
Pig iron, ferroalloys, and similar materials	60,950	---------	
Steel, primary	197,034	202,405	Argentina 119,642; Mexico 44,999; Colombia 36,466.
Semimanufactures	11,932	29,255	Mexico 11,162; Colombia 6,187; Dominican Republic 3,446.
NONMETALS			
Cement	113,149	212,601	Surinam 45,970; Argentina 31,973; Brazil 31,523; Virgin Islands 30,388.
Clays and products (including all refractory brick):			
Crude	---------	60	All to Colombia.
Products	251	304	Mainly to Puerto Rico.
Gypsum and plasters	9,770	13,975	Mainly to Trinidad and Tobago.
Precious and semiprecious stone, except diamond kilograms	36	56	United States 31; Netherlands 19.
Salt	62,710	146,294	United States 93,194; Japan 48,947.
Stone, sand and gravel:			
Dimension, crude and partly worked	529	659	Curaçao and Aruba 442; Trinidad and Tobago 216.
Sand and gravel	(1)	---------	
MINERAL FUELS AND RELATED MATERIALS			
Asphalt	2,869	2,324	Mainly to United States.
Carbon black	164	373	Mainly to Colombia.
Coal and coke including briquets	83	8	All to Colombia.
Gas hydrocarbons, natural gas liquids:			
Natural gasoline thousand 42-gallon barrels	2,911	1,859	Mainly to United States.
Liquefied petroleum gases do	6,014	5,912	Brazil 3,085; Argentina 799.
Petroleum:			
Crude and partly refined do	898,499	903,728	Curaçao and Aruba 263,537; United States 136,105; Canada 109,105; Trinidad and Tobago 68,893; United Kingdom 50,792.
Refinery products:			
Gasoline do	28,810	26,898	Puerto Rico 13,246; United States 4,643; United Kingdom 3,876.
Kerosine do	278	96	United Kingdom 67; Curaçao and Aruba 28.
Jet fuel do	22,804	21,684	United States 11,492; Canada 3,043; Malaysia 2,255; Japan 1,396.
Distillate fuel oil do	40,265	32,466	Canada 14,120; United States 4,806; Japan 2,461; Sweden 2,148; United Kingdom 1,398.
Residual fuel oil do	233,749	252,335	United States 189,954; Canada 15,043; Curaçao and Aruba 12,821; Panama Canal Zone 7,320; Argentina 4,313.
Lubricants do	2,928	2,915	United Kingdom 1,336; Argentina 459; Brazil 119.
Other do	2,630	2,490	Argentina 696; United Kingdom 473; Brazil 441; France 220.

r Revised.
1 Less than ½ unit.

Source: Dirección General de Estadística y Censos Nacionales, Ministerio de Fomento, Boletin de Comercia Exterior, 1968 and 1969, Venezuela. Memoria y Cuenta, Año 1968 y 1969, Caracas, Venezuela, March 1968 and 1969.

Table 3.—Venezuela: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Oxide (alumina) and hydroxide	25,898	33,971	Mainly from United States.
Metal:			
Unwrought	311	21	Do.
Semimanufactures	8,556	6,120	United States 2,000; Italy 974; Canada 618; West Germany 321.
Antimony including alloys, all forms	74	64	West Germany 38; Denmark 21.
Arsenic trioxide, and pentoxide	20	34	Sweden 15; West Germany 13.
Chromite	4,934	4,756	All from United States.
Copper:			
Copper sulfate	64	99	West Germany 30; France 25; Belgium-Luxembourg 15.
Metal:			
Unwrought	430	213	Mainly from United States.
Semimanufactures	7,444	6,626	United States 2,577; Chile 2,019.
Gold worked or partly worked troy ounces	9,356	4,180	West Germany 2,379; Italy 997.
Iron and steel:			
Scrap	31,094	47,854	Mainly from United States.
Pig iron, ferroalloys, and similar materials	8,472	7,673	India 4,011; Norway 1,684; United States 671.
Steel, primary ingots	6,714	6,549	West Germany 1,703; United States 1,505; Japan 834; Belgium-Luxembourg 645.
Semimanufactures:			
Bars, rods, sections	55,439	39,665	Belgium-Luxembourg 16,645; United States 5,752; West Germany 5,645; Japan 4,843.
Universals, plates, and sheets:			
Medium plates and sheets, uncoated	226,420	251,325	Mainly from Japan.
Other coated plates and sheets	71,104	79,672	Japan 29,065; France 28,432; Canada 10,852.
Other	17,176	20,270	Japan 10,144; United States 5,358.
Hoop and strip	4,997	5,228	West Germany 1,774; Japan 1,501; Belgium-Luxembourg 624.
Rails and accessories	r 2,479	2,094	Mainly from United States.
Wire	23,907	31,390	Belgium-Luxembourg 14,200; Japan 7,666; West Germany 4,138.
Tubes, pipes, and fittings	66,262	93,268	United States 39,303; Japan 32,899.
Other	1,357	1,102	Mainly from United States.
Lead including alloys, all forms	5,087	2,721	Mexico 1,115; United States 518; United Kingdom 373.
Mercury 76-pound flasks	85	50	West Germany 23; United States 19.
Nickel including alloys, all forms	246	55	Switzerland 21; United States 15; Canada 9.
Platinum-group including alloys, all forms, platinum troy ounces	52,020	4,726	United States 2,508; West Germany 2,218.
Silver including alloys, all forms do	193,612	162,393	United States 86,807; West Germany 47,165.
Tin including alloys, all forms long tons	223	147	United States 42; United Kingdom 34; West Germany 28.
Titanium oxide	4,629	4,406	United Kingdom 1,793; Norway 975; Finland 706.
Zinc including alloys:			
Unwrought	6,865	6,265	United States 2,641; Mexico 1,822; Zambia 880; West Germany 429.
Semimanufactures	934	692	Canada 442; Mexico 142.
Other:			
Ore and concentrate	171	151	Mainly from United States.
Ash and residue containing nonferrous metals	883	51	Mainly from Colombia.
Metals including alloys, all forms	876	224	Mainly from United States.
NONMETALS			
Abrasives, natural n.e.s	355	429	Mainly from West Germany.
Asbestos	5,664	4,673	Mainly from Canada.
Barite	14,929	12,610	Mainly from United States.
Boron materials, crude natural borates	1,270	1,089	West Germany 368; Spain 238; United States 193.
Cement	1,569	1,012	West Germany 500; France 259; United States 207.
Clays and products (including all refractory brick), crude n.e.s.:			
Bentonite	8,414	6,843	Mainly from United States.
Kaolin (china)	9,799	9,104	United States 5,638; United Kingdom 3,201.
Other	16,132	16,563	United States 11,052; Guyana 4,350.

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Cryolite and chiolite	411	552	Mainly from Italy.
Diamond, industrial thousand carats	2,115	155	Mainly from United States.
Diatomite and other infusorial earths	2,871	3,382	Do.
Feldspar	9,801	1,841	Do.
Fertilizer materials crude and manufactured:			
Nitrogenous	16,078	18,823	United States 10,195; West Germany 5,503.
Phosphatic	2	2	All from United States.
Potassic	24,076	19,247	Mainly from United States.
Mixed	353	13	United States 7; West Germany 6.
Fluorspar	202	57	Mainly from other African countries.
Graphite, natural	189	153	Mainly from United States.
Gypsum and plasters	214	269	West Germany 153; United States 70.
Magnesite	r 3,459	3,688	Mainly from Japan.
Mica, all forms	359	202	Mainly from United States.
Salt	55	30	Do.
Sodium and potassium compounds	63,763	62,962	Do.
Stone, sand and gravel:			
Dimension stone	2,690	5,019	Mainly from Italy.
Crushed rock	42,563	54,322	Mainly from United States.
Sand and gravel	7,351	1,858	Do.
Sulfur [1]	42,961	11,598	Do.
Talc, steatite	5,804	4,421	United States 1,790; Italy 1,640.
Vermiculite	524	386	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	624	89	United States 61; West Germany 28.
Carbon black	721	1,193	Mainly from United States.
Coal, all grades including briquets	18,202	27,174	Do.
Coke and semicoke	360,288	276,679	United States 119,938; West Germany 116,849.
Natural gas liquids:			
Natural gasoline 42-gallon barrels	----------	535	All from United States.
Natural gas liquids do	106	95	France 35; United Kingdom 35.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	62	47	United States 23; United Kingdom 17.
Kerosine do	1	(2)	All from United States.
Lubricants do	43	39	Mainly from United States.
Mineral jelly and wax do	11	12	Do.
Other do	41	104	Do.

r Revised.
[1] Mostly unrefined.
[2] Less than ½ unit.

Source: Dirección General de Estadística y Censos Nacionales, Ministerio de Fomento, Boletin de Comercio Exterior, 1968 and 1969, Venezuela.

COMMODITY REVIEW

METALS

Aluminum.—The output of Venezuela's only aluminum reduction plant, located at Matanzas just outside of Puerto Ordaz, slightly exceeded its recently expanded design capacity of 22,500 tons per year during 1970 despite a workers strike in May. This plant 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.

Gold.—During the latter part of 1970, the Ministerio de Minas e Hidrocarburos signed a contract with Compañía National de Minería (MINERVEN) for a study to determine the feasibility of resuming gold mining operations in the El Callao area of the State of Bolívar. MINERVEN is a locally owned firm which has close ties with a United Kingdom mining enterprise.

The El Callao area was 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. Interest was recently revived in the area following an exploratory program resulting in the discovery of an additional 2 million tons of gold ore which raised the total proved ore reserves at El Callao to 3 million tons. These reserves have an average gold content of 0.32 troy ounce per ton.

Iron and Steel.—Venezuela's iron ore production increased 13 percent to a record high during 1970. 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 19 million tons, and Iron Mines Co. of Venezuela, a subsidiary of Bethlehem Steel Corp., which produced 3 million tons. The remaining 200,000 tons of 1970 output was produced in conjunction with evaluation activities at the San Isidro deposits near Ciudad Piar.

Most of the country's 1970 iron ore production was exported with approximately two-thirds of these shipments going 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 Orinoco Mining.

Construction was nearing completion at yearend on Orinoco Mining's one-million-ton-per-year iron-ore briquetting plant. This plant, located at Puerto Ordaz, will use a natural gas reduction process to upgrade ore to 86.5 percent iron content. Production was expected to begin at this plant during the latter part of 1971.

At yearend 1970, the Ministerio de Minas e Hidrocarburos was in the process of evaluating a study dealing with the feasibility of developing the San Isidro iron-ore deposit. This study was prepared by a consortium consisting of Wells Overseas, Ltd., of Canada, Schneider-Creusot of France, and Philipp Brothers, a division of Engelhard Minerals & Chemicals Corp. of Newark, N.J. The Ministerio has indicated that upon completion of the report evaluation, it will call for State-private company joint venture bids for exploitation of the San Isidro deposit.

Venezuela's output of pig iron, which declined slightly during 1970, was produced exclusively by SIDOR. This company also accounted for 85 percent of the country's total production of crude steel which increased 12 percent during the year. The remaining 15 percent of crude steel output was accounted for by Siderúrgica Venezolana, S.A. (SIVENSA), a private company.

During 1970, SIDOR began operation of a new 30,000-ton-per-year cast iron pipe unit at its Ciudad Guayana steel mill. A new oxygen plant and two soaking pits were under construction and work was initiated on a program to modify the Siemens-Martin open-hearth furnaces in order to increase their combined capacity from the current 900,000 tons to 1,250,000 tons annually. A contract was awarded to a Belgian-German consortium for the construction of a flat products plant at the mill and an agreement for the installation of an electrolytic tinning line was signed with Wean Industries, Inc., of Pittsburgh, Pa.

Nickel.—During the second half of 1970, four offers were submitted to the Ministerio de Minas e Hidrocarburos for the exploitation of nickel deposits at Loma de Hierro in the States of Aragua and Miranda. Among the companies submitting offers were two U.S.-owned firms; National Bulk Carriers, Inc., and Occidental Minerals Corporation de Venezuela, a subsidiary of Occidental Petroleum Corp. Offers were also submitted by Société Le Nickel of France and a consortium of Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V., a Netherlands firm, and Gränges AB, a Swedish company. 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 1.5 to 1.6 percent.

NONMETALS

Asbestos.—Talks were held in 1970 between the Ministerio de Minas e Hidrocarburos and companies specializing in the exploitation of asbestos concerning the feasibility of mining the asbestos deposits at Tinaquillo in the State of Cojedes. The reserves of fibre-bearing rock in these deposits were calculated at 1.5 million tons by the Ministerio.

Cement.—Consolidada de Cementos, C.A., completed a 400,000-ton-per-year cement plant at San Sebastian in the State of Aragua during 1970. The principal equipment for this plant was supplied by Klockner-Humboldt-Deutz, A.G., of West Germany and the electrical equipment was supplied by Siemens, A.G., of the same country.

Fertilizer Materials.—A new 600-ton-per-year ammonia plant at the Morón petrochemical complex of the Instituto Venezolano de Petroquímica (I.V.P.) probably was completed by yearend 1970. This plant raises the ammonia output potential of the Morón complex to 200,000 tons annually. Initial site work was also in progress at Morón on a planned 750-ton-per-year urea plant.

I.V.P. began moving forward more rapidly on the construction of the petrochemicals complex at El Tablazo near Lake Maracaibo as a result of the $200 million [2] in borrowing authority it received during 1970. Construction was in progress on the ammonia plant of Venezolana de Nitrógen (NITROVEN), a joint-venture firm owned 50 percent by I.V.P., 40 percent by International Development and Investment, a U.S. and European consortium, and 10 percent 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 when completed and is scheduled to begin partial operations during 1971. It was being built, under contract, by a Venezuelan subsidiary of C. & I. Girdler, S.A., a Belgian firm.

Final bids were received by the Government during 1970 on a project involving the expansion of the Riecito phosphate mine in the State of Falcón. Plans call for an increase in this mine's annual production capacity from the present 60,000 tons per year to 600,000 tons per year.

MINERAL FUELS

Coal.—Coal output increased 23 percent during 1970 but remained 5 percent below the production peak of approximately 42,000 tons recorded in 1963. All output in 1970 was from the State of Táchira, and the principal producing company was Minas de Carbon de Lobatera, C.A., which received a loan of $270,000 at midyear from Corporación Venezolana de Fomento to improve its coal mining equipment.

Early in 1970, engineers representing a United Kingdom firm visited the State of Zulia to investigate the commercial possibilities of coal deposits in the Perijá district about 40 miles northwest of Maracaibo. No specific business proposals were made during this visit. The Perijá coal deposits reportedly consist of low volatile coal suitable for coking.

The Ministerio de Minas, which took over the administration of the Naricual coal mines from C.V.G. at the beginning of the year, arranged for a group of United Kingdom firms to underwrite a study aimed at determining the feasibility of reopening these mines which were closed in 1963. This study was also to consider the possibility of combining the operation of the Naricual mines with that of a coking plant which could be constructed to supply SIDOR's iron and steel mill at Ciudad Guayana.

Petroleum and Natural Gas.—Crude oil production rose 3 percent to an alltime high of 3,708,000 barrels per day during 1970. This increase was accounted for by the growing output of heavy crudes

[2] Where necessary, values have been converted from Bolivares (Bs) to U.S. dollars at the rate of Bs 4.485 = U.S. $1.00.

Table 4.—Venezuela: Salient statistics of the petroleum and natural gas industry

		1968	1969	1970 p
Crude oil:				
Production	thousand 42-gallon barrels	1,319,340	1,311,832	1,353,420
Processed at refineries	do	434,032	421,783	471,709
Exports [1]	do	898,499	903,728	888,637
Natural gas:				
Production	million cubic feet	1,634,602	r 1,673,013	1,710,200
Sales	do	125,331	r 130,736	136,528
Producers' fuel	do	148,462	r 151,078	180,989
Shrinkage due to extraction of natural gas liquids	do	27,404	r 32,278	31,113
Field injection	do	738,179	r 752,845	710,220
Flared or otherwise lost	do	595,226	r 606,076	651,350
Natural gas liquids:				
Production	thousand 42-gallon barrels	12,567	13,820	16,922
Exports	do	8,925	7,771	9,276
Refinery products:				
Refinery output [2]	do	433,437	422,067	470,864
Consumption	do	50,508	r 51,354	54,939
International bunkers	do	20,380	r 18,859	18,877
Exports	do	334,360	341,209	377,769

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, Venezuela. Memoria y Cuenta, Año 1968, 1969, 1970. Caracas, Venezuela, March 1969, March 1970, and March 1971.

(under 22.1° API gravity), which accounted for 27 percent of total production. Some of the gain in heavy oil production resulted from the reactivation of old fields along the northeastern edge of the Orinoco heavy oil belt (formerly referred to as the Orinoco tar belt). Output of medium (22.1° to 30° API) and light (over 30° API) crudes, which accounted for 39 and 34 percent, respectively, of the total, declined slightly. Companies owned by U.S. firms produced approximately 72 percent of the total with Creole Petroleum Corp., a subsidiary of Standard Oil Co. (New Jersey), alone accounting for 43 percent.

Natural gas output increased almost 5 percent to 4,685 million cubic feet per day in 1970. More than 98 percent of the natural gas produced was from oilfields. The output of natural gas liquids rose 22 percent to 46,000 barrels per day in conjunction with a large increase in the capacity of Venezuela's natural gas processing facilities.

Proved reserves of crude oil declined for the fifth consecutive year, dropping 851 million barrels to a reported total of 14,039 million barrels at yearend 1970. Natural gas reserves, as of the same date, totaled 25,394 billion cubic feet, 1,683 billion cubic feet less than at yearend 1969. Almost 93 percent to total proved gas reserves at the end of 1970 was accounted for by dissolved and associated gas; only 7 percent was nonassociated.

Geologic and geophysical exploration and exploratory, development, and injection drilling activities were as follows:

	1968	1969	1970
Geologic and geophysical exploration:			
Geologic surveying ---- party months	3.5	3.5	6.7
Gravimetric surveying ---- do	.5	.7	.4
Magnetic surveying ---- do	.5	.7	.4
Seismic surveying ---- do	9.2	12.9	11.7
Structural drilling ---- do	5.0	11.3	11.9
Total ---- do	18.7	29.1	31.1
Drilling:			
Wells drilled:			
Exploratory:			
Oil ---- number	74	69	64
Dry ---- do	26	33	38
Subtotal ---- do	100	102	102
Development:			
Oil ---- do	324	375	513
Dry ---- do	14	12	5
Subtotal ---- do	338	387	518
Injection ---- do	9	11	12
Total ---- do	447	500	632
Footage drilled ---- thousand feet	3,487	3,188	3,063

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1968, 1969, 1970, Caracas, Venezuela, March 1969, March 1970, and March 1971.

A detailed seismic survey of the 11,700-square-mile Orinoco heavy oil belt completed by the Government oil company, Corporación Venezolano del Petróleo (C.V.P.), during 1970 indicated the presence of quantities greater than previously estimated of crude oil light enough for production by normal means. In addition, two exploratory wells drilled in the area produced 12° API crude on test and indicated possible accumulations of lighter oils at several intervals. Total crude oil in place within the heavy oil belt has been estimated at over 700 billion barrels, most of which is too heavy for recovery by normal production techniques.

An offshore geophysical survey covering the Continental Shelf between the Orinoco delta and the Venezuela-Trinidad median line was also completed during the year. This survey was performed under contract to C.V.P. by Geophysical Service, Inc., a U.S. company.

At midyear, the Venezuelan Congress approved the contract bases (minimum conditions) established by C.V.P. for service contracts covering approximately 250,000 hectares assigned to C.V.P. in the southern part of Lake Maracaibo. Initial bids covering some or all of the five blocks into which this area was divided for contract purposes were received from 11 companies or consortia involving a total of 16 firms. However, following the submission of final tenders to C.V.P. in October 1970, the list of bidders remaining in contention was narrowed to four companies. After further evaluation of the remaining bids, C.V.P. announced in mid-November that three blocks would be awarded to Occidental Petroleum Corp. and one each would be granted to Mobil Oil Co. de Venezuela and Cía. Shell de Venezuela, Ltd. Final service contract texts were in an advanced stage of negotiations between the winning bidders and C.V.P. at yearend.

The capacity of natural gas injection facilities was increased by only 45 million cubic feet daily to a total of 3,665 million cubic feet per day in 1970. Gas injection during the year was at an average rate of 2,220 cubic feet daily. Water injection capacity was raised 444,000 barrels per day to a total of 1,924,000 barrels daily by yearend 1970, and the average injection rate during the year was 1,509,000 barrels per day.

Refinery output, which averaged 1,290,000 barrels per day in 1970, was up 12 percent from the previous year. This sizable increase occurred in conjunction with a 40,000-barrel-per-day rise in the country's refinery capacity and the completion of repairs to the 159,000-barrel-per-day Venezuelan Gulf Refining Co. plant at Puerto La Cruz which had been severely damaged by an explosion and fire during 1969. Venezuela's refineries processed approximately 35 percent of the country's crude oil output in 1970 as compared with 32 percent during the previous year.

Desulfurization facilities reported to be the largest of their type in the world were placed on-stream at the Amuay refinery of Creole Petroleum Corp. during the latter part of 1970. These facilities are of the hydrogen process type and depend on natural gas from the Lake Maracaibo area oilfields to provide feedstock for the necessary hydrogen production. The process used at Amuay involves middle distillate and vacuum gas oil desulfurization. In this technique, the middle distillate from the atmospheric distillation units and gas oil from the vacuum units are reduced to a sulfur content of about 0.2 percent. This desulfurized product is then blended with high-sulfur vacuum bottoms and topped crudes to produce heavy fuels of desired sulfur contents. Using this method, the Amuay desulfurization facilities are capable of producing about 160,000 barrels per day of residual fuel oil with a sulfur content of 1.0 percent, or 100,000 barrels per day with 1.0 percent sulfur content and 50,000 barrels per day with a 0.3 percent sulfur content.

Among the principal units added to the Amuay refinery in connection with the desulfurization program were two 92,500-barrel-per-day vacuum distillation units, two 71,500-barrel-per-day vacuum gas oil hydrodesulfurizers, a 56,000-barrel-per-day middle distillate desulfurizer, a naphtha fractionation and treating unit, a 68-million-cubic-foot-per-day hydrogen plant, and a 300-ton-per-day sulfur recovery unit. In addition, a new electric powerplant and additional steam generation facilities were constructed. Four 530,000-barrel tanks were added for storing feedstocks for the desulfurizers during crude unit turnarounds. A new 8-billion-barrel earthen reservoir was constructed for storing heavy, high-sulfur fuel oil during periods of slack demand. This facility, along with two older earthen reservoirs, provides the Amuay refinery with a total heavy fuel storage capacity of almost 30 million barrels.

During the latter part of 1970, Creole Petroleum Corp. received the necessary Government approval for the construction of a fifth atmospheric distillation unit at Amuay. The addition of this unit will increase the refinery's throughput capacity by about 40 percent to 640,000 barrels per day. Work on the project was scheduled to begin during the first quarter of 1971 and completion was expected before the end of 1973. Construction of an additional vacuum distillation unit was also planned.

The total length of crude oil and natural gas pipelines in service increased 108 and 248 kilometers, respectively, during 1970, but the length of refined product lines remained the same. Data on the length of pipelines in operation at yearend 1970 were as follows:

Type of line	Total length (kilometers)
Crude oil:	
Trunk	3,359
Secondary	2,676
Subtotal	6,035
Refined products	512
Natural gas	2,784
Total	9,331

Source: Ministerio de Minas e Hidrocarburos. Memoria y Cuenta, Año 1970. Caracas, Venezuela, March 1971.

The 226-kilometer natural gas line from Anaco to Puerto Ordaz was the longest pipeline completed during the year. This C.V.P. line will be used primarily to supply gas to the Orinoco Mining Co.'s iron-ore processing plant under construction at Puerto Ordaz.

In May 1970, the Philadelphia Gas Works of Philadelphia, Pa., proposed a joint venture with C.V.P. involving the construction of a 500,000-million-cubic-foot-per-day gas liquefaction plant at Puerto La Cruz in eastern Venezuela. A similar proposal was made to C.V.P. by Creole Petroleum Corp. during August of the same year for the erection of a 450,000-million-cubic-foot-per-day natural gas liquefaction plant in the Lake Maracaibo area. Both proposals envisioned the exportation of the liquefied natural gas (LNG) output of these facilities to the east coast of the United States by 1975. However, these proposals were shelved by the Venezuelan Government because it felt that they failed to offer C.V.P. adequate equity participation and operational control.

At yearend, the Government announced its intention to seek Congressional approval of a law which would guarantee C.V.P. a 100-percent equity in all natural gas liquefaction facilities to be located in the country. The Government's plans involve construction of two liquefaction plants and the acquisition of seven LNG tankers. Natural gas presently flared by private concessionaires would be used as a feedstock for the liquefaction plants.

Several petrochemical projects in addition to those summarized previously under "Fertilizer Materials" were in the planning stage during 1970. I.V.P. was in the process of obtaining bids for the construction of a chloro-soda plant at El Tablazo which would be capable of producing 35,000 tons of chlorine and 39,200 tons of caustic soda per year. Details were being negotiated for the construction of a joint I.V.P.-B. F. Goodrich Co. plant for the annual production of 50,000 tons of vinyl chloride monomer and 30,000 tons of polyvinyl chloride. Also under consideration for construction at the El Tablazo petrochemicals complex was a project for the production of 40,000 tons of isoprene and poly-isoprene and 38,000 tons of methanol annually. I.V.P. would have a two-thirds equity in this project and Ashland Chemical Co. would hold a one-third interest.

The status of a 50,000-ton-per-year, low density polyethylene plant was uncertain at yearend 1970. This plant was to be built at El Tablazo by Unicar Petroquímica, C. A., a joint company owned 60 percent by Union Carbide Corp. and 40 percent by I.V.P. However, Union Carbide Corp. withdrew its support of the project during the year.

Table 5.—Venezula: Distribution of landholdings, crude oil production, and refining capacity, by companies, 1970

Company	Principal ownership or affiliation	Nationality of ownership	Concessions [1] and assignations [2] as of Dec. 31, 1970 (hectares)	Crude oil production (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1970 (thousand 42-gallon barrels daily)
PRIVATE					
Caracas Petroleum, S.A	Ultramar Co., Ltd	British	29,883	1,853	----------
Chevron Oil Co. de Venezuela, S.A	Standard Oil Co. of California	United States	87,020	20,867	62
Cía. Shell de Venezuela, Ltd	Royal Dutch/Shell Group	British/Dutch	301,428	353,416	404
Cía. Española de Petróleos, S.A	Cía. Española de Petróleos, S.A	Spanish	10,546	----------	----------
Continental Oil Co. of Venezuela	Continental Oil Co	United States	797	2,840	----------
Coro Petroleum Co	Texaco, Inc	do	70,865	3,645	----------
Creole Petroleum Corp	Standard Oil Co. (New Jersey)	do	651,833	576,740	554
International Petroleum (Venezuela), Ltd	do	do	6,133	----------	----------
King Mill Oil Co., C.A	King Mill Oil Co	do	4,970	----------	----------
Mene Grande Oil Co., C.A	Gulf Oil Corp	do	600,227	155,635	----------
Mito Juan Concesionaria de Hidrocarburos, C.A	Venezuelan investors	Venezuelan	27,296	1,384	----------
Mobil Oil Co. de Venezuela	Mobil Oil Corp	United States	144,054	42,031	106
Pan American Venezuelan Oil Co	Standard Oil Co. (Indiana)	do	5,500	4,316	----------
Phillips Petroleum Co	Phillips Petroleum Co	do	39,447	15,684	4
Signal Oil and Gas of Venezuela	Signal Companies, Inc	do	7,000	3,751	----------
Sinclair Venezuelan Oil Co	Atlantic Richfield Co	do	39,082	15,796	43
Sociedad Anónima Petrolera (Petmer) Las Mercedes	Texaco, Inc., and Ultramar Co., Ltd	United States/British	63,026	991	----------
Talón Petroleum Co., C.A	Kirby Petroleum Co	United States	60,167	973	----------
Texaco Maracaibo, Inc	Texaco, Inc	do	3,147	27,260	----------
Texas Petroleum Co	do	do	124,328	21,845	10
Venezuelan American Independent Oil Producers Association, Inc	Atlantic Richfield Co., Sun Oil Co., Texaco, Inc	do	841	(3)	----------
Venezuelan Atlantic Refining Co	Atlantic Richfield Co	do	21,151	----------	----------
Venezuelan Gulf Refining Co	Gulf Oil Corp	do	----------	----------	159
Venezuelan Sun Oil Co	Sun Oil Co	do	20,000	86,414	----------
Total private companies			2,318,741	1,335,441	1,342
Venezuelan Government: Corporación Venezolano de Petróleo (C.V.P.)			715,057	17,979	22
Grand total			3,033,798	1,353,420	1,364

[1] To private companies.
[2] To the Government.
[3] Less than ½ unit.

Source: Ministerio de Minas e Hidrocarburos, Venezuela. Memoria y Cuenta, Año 1970, Caracas, Venezuela, March 1971.

The Mineral Industry of Yugoslavia

By Roman V. Sondermayer [1]

In 1970 Yugoslavia continued to be one of Europe's leading nonferrous metal producers inspite of a leveling off in its mineral output. Bauxite, antimony, copper, lead and zinc ores and metals as well as barite, cement, feldspar, magnesite, and pyrite were among the more important minerals produced in the country. Although modest by world standards, crude oil output ranked fourth among European oil producers. Domestic mineral fuel output however, was insufficient to meet the country's demand, and substantial imports of high rank coals and liquid fuels were necessary. Iron and steel output continued to be inadequate and necessitated substantial imports of iron and steel products. Shortages of electric power adversely influenced mineral production.

The mineral industry employed about 6 percent of the total labor force in 1970 and contributed about 15 percent to the gross national product (GNP) of Yugoslavia. Although a significant exporter of minerals, Yugoslavia had a negative trade balance in mineral commodities during 1969, the last year for which complete trade data were available. A similar trade deficit may have existed in 1970 since no significant changes in mineral trade were expected.

Economic conditions forced the consolidation of some operations and the closing of certain small mines.

Major activities in the mineral industry of Yugoslavia included construction of an alumina and aluminum plant near Titograd in Crna Gora (Montenegro); construction of an alumina plant in Mostar in Hercegovina and an aluminum plant in Šibenik in Dalmacia; offshore drilling on the Adriatic Sea of Island Dugi Otok; start-up of the steel plant near Split in Dalmacia; and construction of cement plants at Kakanj in Bosnia and Zagreb in Croatia.

PRODUCTION

Because of the country's economic problems, the policy of limiting investments in the mining industry continued during 1970. Consequently, producers directed their efforts toward better utilization of existing facilities rather than the construction of new ones. Most new investments were directed toward mineral processing rather than mining, reflecting the Government's desire to shift Yugoslavia from the position of an ore exporter to that of a metal dealer. Closing of unprofitable mines and conversion to opencast mining whenever possible was common in 1970. Mechanization and automation of both mining and processing proceeded at a more rapid pace than in 1969.

Productivity per man-shift of Yugoslav miners remained lower than the average productivity of miners in Western Europe.

Modern and efficient methods prevailed in petroleum exploration, production, and refining. All three primary methods of oil production (flowing, pumping, and gas lifting) were used; secondary recovery methods (repressuring and waterflooding) were employed at older fields. Chemical and hydraulic methods for stimulating gas and oil production were widely used during 1970.

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[1] Petroleum engineer, Division of Fossil Fuels.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
METALS			
Aluminum:			
Bauxite, gross wieght ... thousand tons	2,072	2,128	2,099
Alumina, gross weight	118,082	121,568	125,129
Ingot including secondary	48,080	48,248	47,738
Antimony:			
Mine output, metal content	2,657	2,067	e 2,000
Metal (regulus)	1,755	2,037	1,967
Bismuth, smelter [2]	86	102	75
Cadmium, smelter [2]	r 157	170	e 170
Chromium, chromite, gross weight	45,261	39,434	40,565
Copper:			
Mine output, metal content	70,487	81,676	90,808
Blister:			
Primary	r 72,890	92,619	105,901
Secondary	r 10,391	3,304	1,902
Refined (electrolytic):			
Primary	59,421	78,326	86,837
Secondary	10,633	3,677	2,450
Gold [3] ... troy ounces	70,314	84,074	97,384
Iron and steel:			
Iron ore and concentrate ... thousand tons	2,720	2,721	3,694
Pig iron ... do	1,201	1,198	1,275
Ferroalloys, all types ... do	r 83	90	102
Crude steel ... do	1,997	2,220	2,228
Semimanufactures ... do	1,510	1,570	1,774
Lead:			
Mine output, metal content	111,768	118,045	126,693
Metal:			
Smelter, crude, including secondary	108,715	123,512	112,232
Refined including secondary	r 105,982	106,956	97,399
Manganese ore and concentrate, gross weight	14,136	12,331	14,785
Mercury ... 76-pound flasks	14,794	14,330	15,461
Selenium, elemental ... kilograms	9,637	8,866	16,000
Silver, refined including secondary [2] ... thousand troy ounces	r 3,023	3,818	3,417
Zinc:			
Mine output, metal content	95,474	96,728	101,145
Smelter including secondary	78,978	81,059	65,028
NONMETALS			
Asbestos	10,393	11,461	12,104
Barite	70,436	81,511	79,729
Cement, hydraulic ... thousand tons	3,765	3,964	4,399
Clays, fire:			
Crude	178,192	259,529	292,070
Burned	38,410	71,671	88,370
Feldspar, crude	44,038	44,982	49,504
Fertilizer materials manufactured:			
Nitrogenous:			
Gross weight ... thousand tons	661	917	1,332
Nitrogen content ... do	132	183	266
Phosphatic:			
Gross weight ... do	1,072	872	1,294
Phosphorus pentoxide content ... do	177	143	214
Gypsum:			
Crude	196,630	231,829	250,619
Calcined	52,213	63,069	66,010
Lime:			
Quicklime ... thousand tons	983	1,030	1,078
Hydrated ... do	323	366	430
Magnesite:			
Crude	400,316	477,417	511,854
Sintered	156,301	193,160	210,309
Caustic, calcined	17,074	14,410	10,135
Mica, all grades ... kilograms	143,501	135,565	227,468
Pyrite:			
Gross weight	273,663	272,422	355,000
Sulfur content e	114,938	114,417	149,000
Quartz, quartzite and glass sand ... thousand tons	r 660	812	983
Salt:			
Marine	10,574	17,696	23,510
Evaporated	127,000	127,887	101,668
Other	41,426	66,417	84,625
Total	179,000	212,000	209,803

See footnotes at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
NONMETALS—Continued			
Stone, sand and gravel, n.e.s.:			
Dimension:			
Crude:			
Ornamental ... thousand cubic meters	28	36	39
Other ... do	17	19	8
Partly worked facing stone ... thousand square meters	370	427	485
Cobblestones, curbstones, and other ... thousand cubic meters	71	64	51
Crushed and broken ... do	4,986	5,564	6,067
Milled marble and other ... do	1,092	1,410	1,862
Sand and gravel ... do	6,644	7,163	7,713
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	8,936	15,531	13,469
Coal:			
Bituminous ... thousand tons	835	682	643
Brown ... do	9,508	9,442	8,989
Lignite ... do	16,389	16,373	18,790
Total ... do	26,732	26,497	28,422
Coke:			
Metallurgical ... do	1,173	1,165	1,226
Breeze ... do	61	61	83
Gaswork ... do	2	-------	-------
Total ... do	1,236	1,226	1,309
Fuel briquets, all grades	33,635	36,450	21,312
Gas:			
Manufactured (city gas only) ... million cubic feet	2,641	3,044	e 3,100
Natural, gross production ... do	20,615	25,784	34,502
Natural gas liquids ... thousand 42-gallon barrels	797	806	NA
Petroleum:			
Crude oil:			
As reported ... thousand tons	2,494	2,699	2,854
Converted e ... thousand 42-gallon barrels	18,473	19,991	21,140
Refinery products:			
Gasoline ... do	7,948	8,526	10,481
Jet fuel ... do	830	1,069	e 1,195
Kerosine ... do	122	97	e 108
Distillate fuel oil ... do	10,295	12,846	15,606
Residual fuel oil ... do	12,301	13,100	16,710
Lubricants ... do	726	630	719
Asphalt and bitumen including natural ... do	1,487	1,902	2,168
Liquefied petroleum gas ... do	794	903	NA
Other (white spirit and paraffin) ... do	157	[4] 163	175
Total ... do	34,660	39,236	NA

e Estimate. p Preliminary. r Revised. NA Not available.
[1] In addition to the commodities listed, germanium, clays (bentonite and kaolin), diatomite, and additional petroleum products (most notably petroleum coke), are also produced, but information available is inadequate to make reliable estimates of production levels.
[2] All as a byproduct of lead and zinc production.
[3] Mainly as a byproduct of copper production.
[4] White spirit only.

TRADE

The latest year for which mineral trade data were available is 1969. Nonferrous metals constituted the largest export commodity group, and iron and steel together with liquid fuels accounted for the major portion of the country's mineral imports. West Germany remained the principal importer, and the U.S.S.R. remained the principal supplier.

Table 2.—Yugoslavia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite, thousand tons	r 1,847	1,983	U.S.S.R. 804; West Germany 596; Italy 271.
Oxide and hydroxide	r 29,886	23,703	Austria 16,240; Hungary 4,874; West Germany 2,554.
Metal including alloys, all forms	r 46,953	56,746	Italy 13,316, United States 12,400; West Germany 8,704.
Antimony, regulus	r 1,287	1,266	Greece 460; U.S.S.R. 398; Italy 270.
Arsenic, trioxide	26	597	Mainly to India.
Bismuth including alloys, all forms	45	55	Netherlands 30; West Germany 14; United Kingdom 5.
Cadmium including alloys, all forms	72	130	United Kingdom 45; Netherlands 25; Italy 23.
Chromium, chromite, concentrates	r 9,500	3,203	Mainly to Czechoslovakia.
Copper including alloys:			
Scrap	r 227	519	All to Italy.
Unwrought	9,358	17,51[illegible]	United Kingdom 13,034; France 4,152; United States 333.
Semimanufactures	r 34,820	45,733	United Kingdom 11,840; United States 10,812; Italy 6,361.
Iron and steel:			
Ore and concentrate except roasted pyrite	97,345	153,747	Mainly to Romania.
Roasted pyrite	2,369	1,192	All to Austria.
Metal:			
Scrap	r 28,321	14,632	Italy 8,900; West Germany 5,029.
Pig iron, ferroalloys, and similar materials	r 51,647	46,921	Italy 11,693; United States 9,017; West Germany 6,190.
Steel, primary forms	r 38,794	36,105	Bulgaria 18,686; Italy 8,515.
Semimanufactures:			
Bars, rods, angles, shapes, sections	r 128,066	94,613	U.S.S.R. 41,049; Italy 11,087; Romania 10,477.
Universals, plates, and sheets	r 14,894	49,167	Italy 14,691; East Germany 9,503.
Hoop and strip	9,542	8,806	Italy 3,441; Greece 2,274.
Rails and accessories	9,932	23,570	Romania 9,860; Brazil 7,656; Italy 4,492.
Wire (excluding wire rods)	7,947	2,358	Greece 1,003; Italy 702.
Tubes, pipes, and fittings	64,659	69,476	East Germany 21,377; Italy 11,854; West Germany 8,135.
Castings and forgings, rough	r 7,166	9,090	Hungary 3,523; West Germany 1,943; Poland 1,151.
Total	r 242,206	257,080	
Lead including alloys:			
Ore and concentrates	5,802	25,812	France 10,291; West Germany 7,730; United States 2,992.
Oxides	668	1,327	Czechoslovakia 790; West Germany 210.
Unwrought	55,147	67,261	United States 24,228; Austria 9,854; Greece 4,987.
Semimanufactures	619	1,797	Mainly to Italy.
Magnesium including alloys, all forms	5	25	West Germany 15; Italy 10.
Manganese:			
Ore and concentrates	42	194	All to Switzerland.
Metal	25	75	All to Italy.
Mercury, 76-pound flasks	14,172	14,775	United States 5,546; United Kingdom 3,301.
Nickel including alloys, all forms	181	354	Italy 111; West Germany 103; Netherlands 88.
Platinum-group, palladium, troy ounces	23,309	15,947	Switzerland 4,823; Greece 3,215, West Germany 3,215; Israel 3,215.
Selenium, elemental, kilograms	17,743	13,190	Mainly to West Germany.
Silicon	50	23	All to Australia.
Silver including alloys, thousand troy ounces	2,320	3,283	Mainly to West Germany.
Tin including alloys, all forms, long tons	387	265	Czechoslovakia 118; Italy 104.
Vanadium oxides	------	75	West Germany 39; Netherlands 21; Hungary 11.
Zinc:			
Ore and concentrates	r 22,939	31,007	Mainly to Bulgaria.
Oxide	1,004	1,543	Hungary 987; Romania 526.
Metal including alloys:			
Blue powder	r 20	------	
Unwrought	30,622	31,033	Italy 12,761; United Kingdom 7,517; Greece 5,242.
Semimanufactures	r 13,605	19,351	West Germany 6,087; Denmark 2,851; France 1,985.
Other:			
Ore and concentrate	------	37	All to Japan.
Ash and residue containing nonferrous metals	3,349	7,851	Italy 3,768; West Germany 3,129; Austria 786.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS			
Abrasives, natural, grinding and polishing wheels and stones	1,256	1,612	Poland 1,128; Italy 212; West Germany 158.
Asbestos	1,570	2,449	Mainly to the United States.
Barite and witherite	r 52,094	52,926	U.S.S.R. 23,880; Hungary 17,541; Austria 4,399.
Boron materials, all forms	------	2,212	All to Switzerland.
Cement:			
Portland	110,856	131,903	Italy 39,336; Libya 34,470; Malta 30,051.
Other	r 33,885	36,585	West Germany 10,630; Saudi Arabia 9,960; Guinea 7,050.
Chalk	------	7	All to East Germany.
Clays and products (including all refractory brick):			
Crude:			
Bentonite	23,746	22,335	Czechoslovakia 8,172; East Germany 3,820; Sweden 2,489.
Fire	8,854	26,741	Italy 10,901; Hungary 9,793; Czechoslovakia 4,073.
Kaolin (china)	188	59	Mainly to Italy.
Other	r 96	160	Austria 93; West Germany 64.
Products:			
Refractory	44,150	62,975	East Germany 21,944; Romania 13,525; Italy 5,401.
Nonrefractory	r 3,359	5,397	Hungary 3,977; West Germany 296.
Diatomite	1,420	1,236	Mainly to Greece.
Feldspar	15,481	18,083	East Germany 7,257; Hungary 4,545; Czechoslovakia 2,555.
Fertilizer materials manufactured:			
Nitrogenous	787	26	United Arab Republic 16; Greece 10.
Phosphatic	346,067	110,913	Bulgaria 90,770; Poland 14,990; U.S.S.R. 5,150.
Potassic	------	3	All to Guinea.
Other including mixed	692	837	Mainly to Italy.
Ammonia	------	1,034	Mainly to Hungary.
Gypsum and plasters	48	1,839	Do.
Lime	1,781	688	Mainly to Italy.
Magnesite:			
Raw	r 327	898	Do.
Calcined	13,939	9,559	Poland 3,516; Netherlands 2,360; West Germany 2,000.
Sintered	93,553	73,521	United Kingdom 21,220; United States 13,969; Italy 12,345.
Pigments, mineral:			
Natural, crude	1	13	All to Czechoslovakia.
Iron oxides, processed	------	10	All to Italy.
Pyrites (gross weight)	106,726	109,327	Greece 42,537; West Germany 32,372.
Salt and brines	------	10	All to Switzerland.
Sodium and potassium compounds, n.e.s	9,551	13,651	Italy 11,682; West Germany 1,209.
Stone, sand and gravel:			
Dimension, crude, partly worked, and worked	r 49,801	48,676	Italy 28,663; Austria 7,923; West Germany 4,950.
Gravel and crushed rock	r 42,914	53,427	Libya 26,801; Italy 26,509.
Quartz and quartzite	7,157	10,132	Mainly to West Germany.
Sand excluding metal bearing	6,397	6,430	All to Italy.
Sulfur:			
Elemental, all forms	4,949	1,080	Mainly to U.S.S.R.
Sulfur dioxide	------	273	All to West Germany.
Sulfuric acid	56,505	41,427	Turkey 14,897; Italy 12,497; Israel 10,756.
Talc, steatite, soapstone, and pyrophyllite	101	657	Tunisia 500; Albania 157.
Slag, dross, and similar waste, not bearing:			
From iron and steel manufacture	271	5,530	Italy 4,342; Austria 1,188.
Slag and ash, n.e.s	2,721	3,320	Italy 3,065; Austria 255.
Building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals, n.e.s	47,787	61,987	Hungary 35,874; Libya 5,854; Cyprus 4,831.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	20	81	All to East Germany.
Carbon black and gas carbon:			
Carbon black	1,114	6,413	Czechoslovakia 3,027; Poland 1,375; Hungary 945.
Gas carbon	1,403	783	Mainly to Switzerland.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coal:			
Bituminous coal	1,506	1,280	All to Greece.
Dust	65,425	66,014	Mainly to Italy.
Brown coal	9,323	12,134	Austria 10,948; Italy 1,160.
Lignite	21,895	37,987	Mainly to Italy.
Coke and semicoke	------	112,846	Bulgaria 45,255; Romania 40,120; Hungary 27,429.
Gas, liquefied, all kinds	r 10,025	7,229	Austria 3,987; Italy 3,233.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	2,164	1,756	Mainly to Austria.
Refinery products:			
Gasoline (including natural) do	1,091	829	Austria 522; Italy 240.
Kerosine and jet fuel do	142	192	United Kingdom 47; East Germany 35.
Distillate fuel oil do	547	470	Austria 212; Switzerland 115.
Residual fuel oil do	278	161	All to Austria.
Lubricants do	110	1	Mainly to Albania.
Other do	20	31	Romania 12; Italy 10; Hungary 7.
Total do	2,188	1,684	
Mineral tar and other coal, petroleum, or gas derived crude chemicals	5,385	4,425	Netherlands 2,092; Greece 945; West Germany 887.

r Revised.

Table 3.—Yugoslavia: Imports of mineral commodities

(Metric tons unless otherwise sepcified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	9,961	225,250	Australia 195,906; Guinea 19,477; India 9,500.
Alumina	1,046	6,040	France 3,300; Greece 2,000.
Oxide and hydroxide	262	1,087	France 1,050.
Metal including alloys:			
Unwrought	r 21,650	39,991	U.S.S.R. 26,224; Hungary 4,224; Switzerland 3,445.
Semimanufactures	r 4,348	9,105	West Germany 3,510; Austria 2,935; Italy 1,012.
Scrap	------	22	All from Austria.
Antimony including alloys, all forms	------	1,348	Netherlands 748; West Germany 300; Turkey 300.
Arsenic including alloys, all forms	499	779	U.S.S.R. 766.
Bismuth including alloys, all forms	7	13	Switzerland 7.
Chromium:			
Chromite	75,488	66,478	Albania 62,884.
Oxide and hydroxide	r 453	543	West Germany 212; U.S.S.R. 126; Hungary 110.
Metal including alloys, all forms	1	13	United Kingdom 11.
Cobalt:			
Oxide and hydroxide	11	20	West Germany 11; Belgium 5; United Kingdom 4.
Metal including alloys, all forms	45	55	Belgium 52; West Germany 3.
Columbium and tantalum including alloys, all forms	45	4,588	Italy 4,482.
Copper:			
Ore and concentrate	4,917	4,216	United Kingdom 4,215.
Copper sulfate	------	985	All from Hungary.
Metal including alloys:			
Scrap	1,067	1,917	United Kingdom 677; United States 593; Austria 544.
Unwrought:			
Blister and other unrefined unalloyed	6,002	10,818	All from the United Kingdom.
Refined and alloys	r 15,933	21,585	United Kingdom 19,163; Austria 1,100.
Semimanufactures	r 6,808	8,105	United States 2,041; West Germany 1,746; Austria 1,604.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and steel:			
Ore and concentrate	200,807	263,590	India 212,906; U.S.S.R. 22,736; Sweden 21,498.
Metal:			
Scrap	87,756	78,170	United States 29,350; Lebanon 17,016; U.S.S.R. 13,673.
Pig iron including cast iron	146,093	215,483	U.S.S.R. 114,994; Czechoslovakia 63,963; West Germany 18,209.
Sponge iron, powder, and shot	r 898	1,486	Sweden 728; Italy 245; West Germany 192; Spain 185.
Ferroalloys:			
Ferromanganese	2,529	169	West Germany 110; Switzerland 40; Hungary 19.
Other	r 1,919	3,303	West Germany 1,291; United Kingdom 853; Austria 331.
Steel, primary forms:			
Ingots	9,660	103	All from Romania.
Blooms, billets, slabs	99,970	142,928	Poland 66,778; U.S.S.R. 46,639; Czechoslovakia 26,487.
Coils for rerolling	------	9,451	Poland 7,943; Czechoslovakia 1,508.
Steel semimanufactures:			
Bars, rods, angles, shapes, and sections	r 91,114	95,387	Bulgaria 16,539; West Germany 15,778; Hungary 13,986; Italy 11,335.
Universals, plates, and sheets	r 397,190	489,727	West Germany 110,000; U.S.S.R. 68,427; Greece 60,133; Italy 58,738.
Hoop and strip	r 60,530	87,407	Czechoslovakia 50,627; Romania 16,114; West Germany 8,575.
Rails and accessories	2,572	3,580	Austria 1,706; West Germany 1,407.
Wire	15,813	16,794	West Germany 12,096; Austria 1,587; Italy 1,579.
Tubes, pipes, and fittings	r 38,224	39,852	Hungary 9,122; West Germany 8,522; West Germany 7,007.
Castings and forgings, rough	r 1,305	873	Czechoslovakia 169; Poland 152; Italy 148; West Germany 136.
Total	r 606,748	733,620	
Lead:			
Ore and concentrate	12,260	2,833	All from Italy.
Oxides	533	620	West Germany 580; Switzerland 40.
Metal including alloys:			
Scrap	152	467	Belgium 196; Kenya 157; Lebanon 74; Saudi Arabia 40.
Unwrought	r 8,546	4,617	Switzerland 1,249; Zambia 1,219; Italy 1,155.
Semimanufactures	325	249	Italy 234; West Germany 15.
Magnesium including alloys, all forms	419	615	U.S.S.R. 313; Italy 73; United States 73.
Manganese:			
Ore and concentrate	35,562	53,783	U.S.S.R. 27,450; Netherlands 15,863; Brazil 9,960.
Oxides	394	279	Netherlands 130; Japan 105.
Metal including alloys, unwrought	r 65	153	West Germany 44; Switzerland 40; United Kingdom 29.
Mercury .... 76-pound flasks	722	1,585	United States 976; United Kingdom 458; Netherlands 150.
Molybdenum including alloys, all forms .... kilograms	3,365	9,834	Austria 6,867; Netherlands 2,698.
Nickel:			
Matte, speiss, and similar materials	15	59	United Kingdom 21; West Germany 19; Netherlands 19.
Metal including alloys:			
Scrap	70	167	Italy 75; Netherlands 58.
Unwrought and semimanufactures	r 1,534	1,414	U.S.S.R. 368; West Germany 352; Netherlands 275; United Kingdom 186.
Platinum-group and silver including alloys:			
Platinum-group .... troy ounces	r 52,877	17,095	U.S.S.R. 15,753; West Germany 1,016.
Silver .... do	887,038	2,255,532	West Germany 1,537,125; Austria 385,648; United Kingdom 161,010.
Rare-earth including alloys, all forms	209	143	Italy 65; United Kingdom 45.
Selenium, elemental .... kilograms	1,905	1,860	All from West Germany.
Tantalum including alloys, all forms .... do	45	4,588	Italy 4,482.
Tellurium, elemental .... do	104	200	All from West Germany.
Tin:			
Oxides .... long tons	21	16	Do.
Metal including alloys:			
Unwrought .... do	r 1,385	1,039	Malaysia 560; Indonesia 200; Switzerland 115.
Semimanufactures .... do	60	39	West Germany 33; Hungary 2.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Titanium:			
Ore and concentrate	1,005	1,771	United Kingdom 1,103; Australia 548.
Oxides	4,594	5,120	West Germany 3,978; United Kingdom 759.
Metal including alloys, all forms kilograms	682	4,341	United Kingdom 3,901; West Germany 346.
Tungsten including alloys, all forms kilograms	6,575	15,869	Netherlands 9,339; France 2,116; United Kingdom 1,212.
Uranium and thorium including alloys, all forms kilograms	1	70	France 69; United Kingdom 1.
Zinc:			
Ore and concentrate	r 42,107	50,681	West Germany 36,797; Czechoslovakia 9,409.
Oxide	47	59	West Germany 58.
Metal including alloys:			
Scrap and blue powder	r 27	1	All from West Germany.
Unwrought	r 7,465	11,714	Zambia 10,004; Bulgaria 1,446.
Semimanufactures	r 190	211	Italy 164; West Germany 33.
Other:			
Ores and concentrates	315	410	United Kingdom 230; Australia 101.
Ash and residues containing nonferrous metals	104	31	All from Hungary.
Oxides, hydroxides, and peroxides of metals, n.e.s	147	286	West Germany 103; U.S.S.R. 55; Norway 35; Czechoslovakia 30.
Metals including alloys, all forms	429	131	United Kingdom 43; West Germany 31; Italy 26.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	391	557	Denmark 207; Italy 154; West Germany 130.
Dust and powder of precious and semi-precious stones kilograms	r 10	13	U.S.S.R. 6; West Germany 3; Netherlands 3.
Grinding and polishing wheels and stones	833	1,322	Austria 870; West Germany 294.
Asbestos	17,125	26,462	U.S.S.R. 13,971; Canada 6,425; Botswana 3,287.
Barite and witherite	708	1,278	Italy 925; West Germany 313; Czechoslovakia 40.
Boron materials:			
Crude natural borates	303	521	United States 500; Turkey 20.
Oxide and acid	3,459	107	U.S.S.R. 52; West Germany 37.
Bromine kilograms	2,270	1,691	Israel 1,491; Poland 200.
Cement:			
Portland	682,653	975,193	Romania 300,326; Czechoslovakia 181,519; United Arab Republic 179,386; Hungary 130,546.
Other	21,017	100,068	Greece 53,182; Austria 20,605; United Kingdom 19,164.
Chalk	265	451	East Germany 255; Italy 97; France 40.
Clays and products:			
Crude n.e.s.:			
Bentonite	114	33	Austria 18; Hungary 15.
Fire	36,540	34,753	Czechoslovakia 25,576; Poland 6,971; East Germany 2,071.
Fuller's earth, dinas, chamotte	1,155	1,813	West Germany 542; Austria 529; Italy 397; Czechoslovakia 251.
Kaolin	29,702	36,163	Czechoslovakia 18,998; East Germany 7,870; Greece 4,968.
Other	3,458	3,192	Italy 2,414; West Germany 364; Austria 140.
Products:			
Refractory (including nonclay bricks)	r 15,746	19,083	West Germany 7,082; East Germany 4,473; Austria 2,584.
Nonrefractory	30,822	96,201	Italy 64,745; Hungary 8,079; Czechoslovakia 5,333.
Diamond, all grades carats	60,000	72,725	Switzerland 55,775; Austria 8,500; West Germany 4,000.
Diatomite and other infusorial earths	r 854	1,210	Austria 725; Italy 239; West Germany 201.
Feldspar and cryolite kilograms	------	17,020	Italy 15,000; West Germany 2,000.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Phosphatic	796,975	727,359	Tunisia 255,564; Jordan 253,104; Morocco 117,796.
Potassic	12,521	7,722	East Germany 6,792; U.S.S.R. 930.
Manufactured:			
Nitrogenous	r407,668	329,882	U.S.S.R. 86,881; Hungary 83,787; Italy 36,091; Poland 31,927.
Phosphatic:			
Thomas slag	19,100	26,500	United Arab Republic 15,200; Belgium 11,300.
Other	5,000	29,053	United States 18,553; Tunisia 10,500.
Potassic	r191,268	201,861	East Germany 106,661; U.S.S.R. 91,379; West Germany 2,840.
Other including mixed	197,865	3,400	All from Italy.
Ammonia	4,086	46,235	Italy 18,090; Greece 17,538; Ghana 5,617.
Fluorspar	r 4,080	5,639	East Germany 3,851; West Germany 1,028; Bulgaria 447.
Graphite, natural	892	999	Austria 746; West Germany 153; Czechoslovakia 83.
Gypsum and plasters	13,018	16,134	Italy 16,114; East Germany 20.
Iodine kilograms	3,667	9,751	West Germany 3,600; Poland 3,151; France 3,000.
Lime	10	27	Austria 15; France 12.
Magnesite	97	427	Austria 327; Netherlands 94; West Germany 6.
Mica:			
Crude including splittings and waste	70	86	United Kingdom 43; West Germany 26; Norway 10; Austria 7.
Worked including agglomerated splittings	31	77	Switzerland 18; Czechoslovakia 15; West Germany 10; Italy 10; Austria 10.
Pigments, mineral:			
Natural, crude	6	35	All from Hungary.
Iron oxides, processed	1,232	1,878	West Germany 1,082; Poland 318; Spain 210; East Germany 115.
Precious and semiprecious stones except diamond kilograms	r 419	1,073	United Kingdom 750; West Germany 141; Czechoslovakia 61.
Pyrite (gross weight)	22	52,915	U.S.S.R. 50,870; Spain 2,002; West Germany 43.
Salt	r137,665	171,043	Romania 108,532; Tunisia 33,400; Turkey 21,261.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	r 14,853	15,912	West Germany 13,339; Italy 2,361.
Caustic potash, sodic and potassic peroxides	1,342	2,123	East Germany 1,499; Czechoslovakia 195; Italy 190.
Stone, sand and gravel:			
Dolomite, chiefly refractory grade	r 3,746	5,579	Italy 5,349; Austria 215.
Gravel and crushed rock	64,164	74,522	Hungary 71,270; Italy 630; U.S.S.R. 189.
Limestone, except dimension	r 14,896	24,190	All from Hungary.
Quartz and quartzite	r 2,132	6,034	Hungary 3,500; West Germany 1,928.
Sand, excluding metal bearing	r 66,810	82,717	Italy 55,859; Hungary 16,577; Netherlands 4,682.
Dimension:			
Crude and partly worked	3,891	4,943	Austria 4,531; Italy 154; Switzerland 88.
Worked	581	492	Italy 480.
Sulfur:			
Elemental, all forms	r 20,651	22,732	Poland 16,131; Italy 5,006; West Germany 733.
Sulfuric acid	29	140	Albania 113; Austria 12; East Germany 10.
Talc, steatite, soapstone, and pyrophyllite	701	1,539	India 515; Italy 456; United Arab Republic 225.
Other nonmetals, n.e.s.:			
Crude	177	99	Italy 70; West Germany 24; Austria 5.
Slag, dross, and similar waste, not metal bearing	20,042	63,055	Italy 62,200.
Oxides and hydroxides of magnesium, strontium, and barium	137	199	West Germany 163; Switzerland 15.
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s	2,673	9,058	Czechoslovakia 7,173; Italy 923; Bulgaria 435.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	14,194	3,264	Romania 1,486; Albania 1,300; United States 260.
Carbon black and gas carbon	3,184	1,669	West Germany 889; Italy 293; Bulgaria 253.
Coal and briquets:			
Anthracite and bituminous coal	1,742,231	1,830,349	U.S.S.R. 1,097,300; Czechoslovakia 543,908; United States 149,908.
Briquets of anthracite and bituminous coal	r 13,049	------	
Coke and semicoke	110,193	120,928	Italy 33,800; Poland 23,281; Czechoslovakia 19,147; United Kingdom 18,820.
Gas, hydrocarbon	555	348	Mainly from Hungary.
Hydrogen, helium, and rare gases kilograms	5,645	7,874	Italy 4,121; United Kingdom 1,150; United States 831.
Peat including briquets and litter	44	462	Mainly from Poland.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	19,874	23,867	Iraq 9,288; U.S.S.R. 8,735; Iran 4,110.
Refinery products:			
Gasoline (including natural) do	290	202	United Kingdom 88; Italy 68; Romania 30.
Kerosine and jet fuel do	204	39	Romania 26; Italy 13.
Distillate fuel oil do	2,208	1,956	U.S.S.R. 1,022; Romania 934.
Residual fuel oil do	3,566	2,524	U.S.S.R. 1,528; Romania 540; Poland 276.
Lubricants do	270	364	Hungary 90; Romania 84; Italy 50.
Mineral jelly and wax do	29	40	Romania 12; East Germany 9; Poland 8.
Other do	629	486	Albania 134; Italy 95; United State 95.
Total do	7,196	5,611	
Mineral tar and coal, petroleum, or gas derived crude chemicals	48,147	43,144	Italy 14,489; U.S.S.R. 14,206; Bulgaria 3,077.

r Revised.

COMMODITY REVIEW

METALS

Aluminum.—Aluminum industry development accounted for the largest part of Yugoslav investments in the mineral industry during 1970. Focal points remained the construction of new alumina and aluminum-producing facilities located in Titograd, Crna Gora, (Montenegro); Šibenik Dalmacia; Mostar, Hercegovina; and aluminum rolling installations at Sevojno in Serbia. Policy goals are to shift the country from principally an exporter of bauxite to a producer and exporter of aluminum metal and semimanufactured products.

Production and export of bauxite brought most of the revenue to the industry. Domestic output of aluminum metal remained below the country's consumption, and imports were necessary.

The Adriatic littoral was the principal bauxite producing area followed by the region of Bosnia and Hercegovina. The Vlasenice, Mostar Jajce and Bosanska Krupa mines located in Bosnia and Hercegovina and intensively developed in 1970 produced one-third of the total country's bauxite output.

Construction of the Titograd alumina and aluminum plant continued during 1970. When completed, the plant will have an annual capacity of 200,000 tons of alumina and 50,000 tons of aluminum metal. Reportedly, first metal production will start in the summer of 1971. The aluminum plant will be completed first, and alumina imports will be required until the alumina plant is completed.

Construction of an alumina plant at Mostar started early in 1970. The complex will have an annual capacity of 200,000 tons of alumina when completed at the end of 1972. Tentative plans also include the construction of a 50,000-ton-per-year aluminum electrolytic plant at Mostar.

Construction of a 50,000-ton-per-year aluminum electrolytic plant near Šibenik began in the fall of 1970. The plant will be part of Tvornica Lakih Metala Boris Kidrič Šibenik.

The East German Government granted a $66 million[2] credit for building a 300,000-ton-per-year alumina plant at Obrovac in Dalmacia and another 50,000-ton-per-year aluminum electrolytic plant at Šibenik. Construction planning was underway at the yearend.

The management of an existing copper-rolling mill near Sevojno in Serbia made arrangements to expand facilities, which would make the rolling of 50,000 tons of aluminum per year possible. New additions reportedly will be completed in the beginning of 1972.

Copper.—Major copper industry activities included the continued expansion of the Bor-Majdanpek mine and metallurgical complex and the search for new copper deposits.

Investigation of the Krivelj deposit in northeastern Serbia continued during 1970. The latest estimate shows reserves of 200 million tons of ore with an average copper content of less than 1 percent. The proximity of these reserves to Bor-Majdanpek facilities improves their attractiveness. Copper exploration was conducted in Bućim, Macedonia; Škofje kod Cerknog and Sebrelj in Slovenia and in Varine near Plevlje, Crna Gora.

The Bor-Majdanpek mining and metallurgical complex added a new section to the Bor flotation plant, and construction of a third section of Majdanpek flotation plant continued. When completed in 1972, the Majdanpek flotation plant will have a capacity to process 11 million tons of ore per year. Furthermore, a decision was made to start construction of a copper wire plant and to begin modernization and expansion of smelting facilities. The copper wire plant will produce about 30,000 tons of copper wire per year that will vary in diameter from 3 to 13 millimeters (approximately 1/10 inch to 1/2 inch). The smelter will be expanded by one new furnace for casting anodes.

Members of the Copper Institute, an integral part of the Bor-Majdanpek complex, have completed the design of an electrolytic copper plant to be built by a French company at Ketri, India.

Gold.—Exploration for gold was conducted in Macedonia with alluvial sands as the primary targets. Reportedly, important deposits were found near Djevdjelija, Kanonaska Reka, and Dudice. Some samples yielded 0.45 troy ounces of gold per ton. Evaluation of the Macedonian finds was not completed at yearend; preliminary results indicate that gold production apparently cannot be considered economical unless it is associated with another mineral commodity.

Iron and Steel.—Expansion plans for the steel industry continued to be implemented at a relatively slow pace, mainly because of financial problems. Although steel production has been constant in recent years, it is expected that output should increase in 1971, when new facilities are expected to be completed and other plants are modernized. The economic advantages of higher output of iron ore, pig iron, and ferroalloys will not be fully utilized, however, because of the delay in completing new steelmaking facilities.

Completion of the Tajmište mine in Macedonia in late 1969 and modernization of other mines influenced the 36-percent increase in iron ore output in 1970. Domestic ore had an average iron content of 30 to 36 percent.

A heavy-fluid separation plant started operating at the Vareš iron mine in Bosnia in Mid-1970. The new facility has an annual input capacity of 3 million tons of iron ore, with an average iron content of 30 percent. Output of concentrate with 37.5 percent iron content should reach 2.3 million tons per year. At yearend, studies were underway for a new beneficiation plant that would yield concentrates with an average iron content of 50 to 60 percent.

Zenica Integrated Iron and Steel Works remained the largest producer of iron and steel in Yugoslavia during 1970, and expansion of facilities there continued. A new iron ore agglomeration plant was completed, and construction of an oxygen convertor plant having two 100-ton Linz-Donowitz (LD) convertors was started. The plant is being built with Soviet assistance.

A modest steel plant with one electric furnace started production in Kaštel Sućurac near Split on the Adriatic coast. The furnace made by Brown Boveri has a ca-

[2] Where necessary, values have been converted from Yugoslavian Dinars (Din.) to U.S. dollars at the rate of Din. 12.5 = US$1.00.

pacity of 60,000 tons per year. Installation of a second furnace started during 1970, when completed annual output will reach 140,000 tons of steel. The plant has also continuous casting facilities.

Construction of the Smederevo iron and steel plant in Serbia continued. The first production of pig iron will be in 1971; completion of a 1-million ton-per-year oxygen convertor plant is scheduled for 1973.

Phase three of Skopje plant construction was underway during 1970. Plans call for an annual capacity of 900,000 tons. The British firm Davy-United and Wean Ltd., will deliver a continuous hydrochloric pickling line and acid regeneration plant. A continuous galvanizing section will have an annual capacity of 250,000 tons. A continuous coating line capable of applying different plastics and laminated plastic finishes to both sides of plates was also part of the Wean order. Wellman Engineering Corporation, a British firm, will provide a slab reheating furnace, 39 single-stack coil annealing furnaces and a continuous roll-forming line. The financial terms allow for up to 15 percent of the equipment to be supplied by Yugoslav subcontractors.

Lead and Zinc.—Although output of lead-zinc ore went up by 6 percent, production of lead and zinc metal dropped in 1970. Lower grade ores and large scale methods of production resulted in a lower recovery of metals. Domestic production of zinc concentrates was inadequate and imports were necessary. Reports indicated that shortages of lead and zinc concentrates will increase in the near future because lead and zinc mine expansion programs will not be able to meet the needs of smelters under construction. Planners expect domestic output to cover the demand by 1975.

Plans were completed for modernization of Trepča's largest mine, Stari Trg. The project includes sinking of a new shaft, installing an underground crushing plant, and building new flotation facilities at the mine site. When completed in 1975, the Stari Trg mine will increase its production from 600,000 tons of lead-zinc ore to 1 million tons per year. Reportedly, total cost of new investments will equal $20 million. A new 70,000-ton-per-year sulfuric acid plant was completed at Zvečan. Smelter gases will be used for the production of sulfuric acid.

At the old Rudnik mine near Gornji Milanovac, Serbia, intensive exploration was underway during 1970. Reportedly, results were good and an annual production of 200,000 tons was assured for many years. No other quantitative or qualitative details on new reserves were made public. In addition, plans were completed for modernization of the Srebrenica mine in Bosnia. Output should be brought to 450,000 tons per year and a new improved flotation plant will be operational by 1975. The development of a lead-zinc mine and beneficiation plant at Blagodat on Besna Kobila Mountain proceeded without delays and first production is expected in 1974. Initial annual capacity will be 300,000 tons of ore.

Apparently construction of the mine and flotation plant at Brskovo near Mojkovac in Crna Gora was completed. Planned output for 1971 calls for production of 33,000 tons of zinc concentrate, 18,000 tons of lead concentrate, and 125,000 tons of pyrites.

In addition to small improvements in Zvečan and Zorka facilities, the focal point of construction activities was the Zletovo smelter at Titov Veles in Macedonia. About 40 percent of construction work was completed and 7,000 tons of equipment was purchased in the United Kingdom, West Germany, and Belgium. Production is expected to start in 1972.

Magnesium.—Construction of Yugoslavia's first magnesium metal producing plant was planned at Jajce in Bosnia. According to reports, the plant capacity was set at 4,000 tons of metal per year of which 2,000 tons will be exported. Electrobosna (power producer in Jajce) and Magnohrom (producer of refractories) from Kraljevo agreed to invest $2 million each in the project. Some of the French-made equipment was on the plant site at yearend. Jajce has ample supplies of hydropower, water, and dolomite.

Manganese.—A plant for production of about 55,000 tons of ferro and silicomanganese is planned to go into production in 1973 at a site near Kičevo in Macedonia. Production of electrolytic manganese, manganese dioxide, and manganese carbonate is expected to start at a later date. Output of the new plant is based on manganese production of the Stogovo mine near Kičevo and on 15 million tons of manganese ore reserves in Macedonia.[3]

[3] Privredni Pregled (Belgrade). Sept. 15, 1970, p. 11.

Mercury.—Idria mine and mercury smelter in Slovenia (western Yugoslavia) remained the sole producer of mercury in the country during 1970. After years of exploration and development, a new mine at Ljubevče, southwest of the present mining area, became operational. Because of new ore reserves, a fourth rotary smelting furnace will be built.

Nickel.—Yugoslav authorities have formed FENI, an enterprise for development of nickel deposits located near Ržanovo and Studena Voda in the Kožuh Mountains in southern Macedonia. The ore reserves of 1.036 percent nickel were an estimated 44.5 million tons near Ržanovo and 1.7 million tons near Studena Voda. In general, there are two types of ore—compact pegmatite and schistose ore—which are almost equal in volume. In addition to nickel, the ore contains 31 percent iron; 0.06 percent cobalt; and 1.55 percent chromium. The nickel development program included construction of the following major facilities and operations: A mine with a capacity of 1.86 million tons at Ržanovo; a smelter at Ržanovo with an annual capacity of 50,000 tons of ferronickel averaging 25 percent nickel or about 12,000 tons of nickel plus cobalt metal; an oxygen plant; a powerplant at Kičevo; and ancilliary facilities and equipment. Total value of the project was estimated at $92 million. About one-half will represent foreign exchange goods.[4]

A nickel ore discovery in the Kosovo area, southern Serbia was announced during the year. Confirmed reserves of this deposit, known as "Dobrisevski Srpentinski Masiv" were set at 2.5 million tons. Other nickel ore reserves in Kosovo area totaled an estimated 17.5 million tons, of which 7.5 were in the Goleš Mountains. Facilities for beneficiating nickel ores in the Goleš area are supposed to be operational in 1971. Production of nickel metal will probably start in 1974. In the beginning ferronickel will be produced using a method developed in the U.S.S.R., and in a latter stage an electrolytic plant will produce nickel metal.[5]

Two additional new discoveries of nickel deposits were announced during the year. One is near the villages of Lipovac and Brezovac near Arandjelovac; about 20 million tons of 1.31 percent nickel ore has been confirmed. The other is near Vrnjačka Banja in Serbia; however, details on this deposit were not made public.

NONMETALS

Asbestos.—During 1970 domestic output of asbestos fiber covered about one-fourth of the country's demand. Only three of the nine known asbestos deposits were in production. Lack of financing prevented development of a strong asbestos industry.

To cut the imports of asbestos, expansion was centered around one of the largest asbestos producers in the country, Bosna Asbest located at Bosansko Petrovo Selo. Bosna Asbest accounts for about 70 percent of the country's total asbestos output. All facilities in the opencast mine were modernized, and preliminary work was completed to start underground production. Construction of a new hydroseparation plant and a new factory for asbestos cement sheet was under way in the winter of 1970. New investments will reach $7.2 million. When expansion is completed, the Bosna Asbest facilities will produce 16,000 tons of fiber and about 30,000 tons of asbestos cement sheet.

Reportedly, additional domestic and foreign funds were secured for further expansion of the Bosna Asbest enterprise. New facilities are planned to bring fiber output to over 40,000 tons.

Cement.—During 1970 cement output increased as a result of commissioning of a new plant and expansion of an existing one. However, imports of cement remained necessary, and the management of the industry continued efforts to expand the output.

The cement plant that was expanded during the year is located at Prvoborac, near Split on the Adriatic Sea. Reportedly, the plant has an annual capacity of 450,000 tons and is highly automated. Investments totaled $14.6 million; equipment was purchased in West Germany and Czechoslovakia.

Construction of a new cement factory in Kakanj, Bosnia, started in the fall of 1970. This plant will have an annual capacity of 650,000 tons per year when completed in 1974. Total investments of $16 million

[4] U.S. Embassy, Belgrade, Yugoslavia. State Dept. Airgram A-121, July 3, 1970, pp. 1-3; State Dept. Airgram A-122, July 5, 1970, pp. 1-2.

[5] Privredni Pregled (Belgrade). Jan. 13, 1971, p. 4.

were secured from domestic and foreign sources. Slag from the thermal plant at Catići will be the principal raw material.

The construction of a cement plant in Lukavac near Tuzla began. Output capacity will reach 350,000 tons annually, and completion was expected in 1972. The construction of a third unit at Usje near Skopje continued during 1970. When completed in 1972, total planned output will be 1.1 million tons.

Plans for building a new cement unit at the Podsused factory near Zagreb were completed during the year. The new unit will have an output capacity of 600,000 tons of cement per year. Natural gas will be used as fuel for the Podsused cement factory.

Management of a lignite mine near Plevje City signed an agreement for construction of a cement plant in the vicinity of the town with Progress-Invest. The plant will start production in 1973, and equipment will be purchased locally and in East Germany.

Preliminary plans are to build a 600,000-ton-per-year cement plant in Belgrade and a 400,000-ton plant in Kosjerić, Serbia.

According to a Yugoslav forecast, domestic output will fall short of demand by 1.5 million tons in 1971.

Fertilizer Materials.—Expansion and modernization of Yugoslavia's fertilizer industry, which processes imported raw materials, continued during 1970. The shortage of funds postponed development of the country's first phosphate mine, located at Lisina near Bosiljgrad. Latest exploration results set proven reserves at 40 million tons of ore containing about 12 percent P_2O_5. Plans call for a beneficiation plant that would produce a concentrate with 30 percent P_2O_5. Total mine and plant investments should reach $17.3 million.

The Trepča fertilizer plant, which produced only superphosphates, expanded to produce about 140,000 tons per year of mixed fertilizers.

Salt.—The new 75,000 ton-yer-year salt evaporation plant at Tuzla was being expanded during 1970. When completed, Tuzla facilities will have annual output capacity of 150,000 tons.

Stone.—New deposits of onyx were discovered near Tetovo in Macedonia. The onyx is green and red, and the deposits reportedly are large.

A deposit of blue marble was found near Kosjerić in Serbia with reserves reported as substantial. Under test, samples produced 32 square meters of marble slabs per ton.

Tuff.—A high-quality tuff deposit was discovered near Krapina and placed into production during 1970. Production from this deposit, with confirmed reserves of 4 million tons, amounted to about 150,000 tons in 1970. This tuff operation should aid in providing jobs for employees of coal mines being closed in the Krapina area.

Wollastonite.—The Srebrenica, open pit wollastonite mine near Brus in Serbia, started production in the fall of 1970. Geological exploration carried out over the last 3 years proved an ore containing about 90 percent wollastonite. During the year, several foreign countries showed interest to purchase for Yugoslav wollastonite. The Netherlands and Italy each received about 3,000 tons of ore, and 2,000 tons were delivered to domestic consumers.

MINERAL FUELS

During 1970 coal remained Yugoslavia's principal source of energy. The largest part of coal production consisted of low-rank coals. Significant quantities of anthracite and bituminous coal and coke were imported. Liquid fuels and natural gas occupied an increasing share of the energy market. Output of crude oil was modest, and covered only about 41 percent of the country's refinery's crude oil throughput of 7.1 million tons. Substantial imports of crude oil and other liquid fuels were necessary. As in the past, shortages of fuels persisted in large consumption centers during the winter. Furthermore, shortages of all kinds of fuels and electricity hampered industrial production. An inadequate pipeline system limited natural gas production and consumption.

Coal.—The coal industry again experienced a difficult year inspite of efforts made to modernize and rationalize coal production. Strikes, accidents, mine closures, and fuel market conditions reflected unfavorably on the coal industry performance in the first half of the year. Because of crude oil import problems, coal demand increased in the second half of the year. As a result, coal production in 1970 was higher by 7.3 percent, compared with 1969.

Most coal industry investment during

the year was for the introduction of mass mining methods and the purchase of new coal mining and beneficiation equipment. Lack of funds delayed programs at some mines, Banovici brown coal mine in Bosnia, which was abandoning its underground facilities, started opencast operations. New U.S.-made power shovels and 65-ton-capacity trucks were in operation at yearend. Similarly, underground operations at the Kostolac lignite mine in Serbia were replaced by opencast methods. In Slovenia, Trbovlje brown coal mine commissioned a new coal-cleaning plant facility that has a capacity of 200 metric tons of coal per hour.

A bituminous coal mine at Labin and five lignite mines in Croatia were closed during 1970. Several short strikes stopped production at three mines in central Bosnia and at Ivanec mine near Varaždin in Croatia. All strikes were organized to protest working conditions and low wages.

The country's major coal mine disaster resulted from a gas explosion in the Breza brown coal mine in central Bosnia, which killed 48 and injured 10. An underground fire forced the closure of one of the most productive shafts—Rasporodje—of the Zenica brown coal mine in central Bosnia. Self-ignition was listed as the cause.

Shortages of coke were serious during 1970, which caused several metallurgical plants to curtail production and, on occasion, to shut down certain facilities. To alleviate the problem, a 700,000-ton-per-year coking plant will be built at Lukavac, Bosnia. Split, on the Adriatic Sea, is being considered as the location for another coking plant.

Petroleum.—Petroleum industry developments were highlighted by the drilling of Yugoslavia's first two offshore exploration wells. This followed several years of offshore geological and geophysical surveying in the Adriatic Sea. The wells were drilled by the French firm Sociète des Forages en Mer "Neptun" for Industrija Nafte (INA) using the jack-up rig, Nepun No. 2. Both wells were drilled off the island of Dugi Otok and were dry. The first well, drilled close to the offshore boundry with Italy, was abandoned at the depth of 2,500 meters. The second well was drilled closer to the island of Dugi Otok and was abandoned at a depth of 4,639 meters. INA, however, was encouraged by its finding, and at yearend 1970 Neptun No. 2 was moving to a new location. The rig was manned by French and Yugoslavia technicians and was supported from a base at the port of Zadar.

Naftaplin, a division of INA, started production in the Ferdindovac oilfield located near the Hungarian border in the northern part of central Croatia. The field was discovered in 1959. According to reports, the field produced about 25,000 tons of crude oil and 4 million cubic meters of gas in 1970. When fully developed, production may reach 55,000 tons of crude per-year.

Abroad, INA relinquished 15 percent of its interest in an exploration concession in Jordan to a West German firm, pending approval of the Jordanian Government.

The development of the Beničanci field in eastern Croatia continued during 1970; however, details on the results of extension drilling were not released.

Naftagas found oil at 850 meters near Subotica, close to the Hungarian border in the northern part of Serbia. Other discoveries include oil finds near Lake Palić in Serbia, near Gajska Lepa, and in the general area of the Mokrin gasfield of northeastern Serbia.

Yugoslavia's six refineries operated at about 83 percent of capacity during the year. This reflected the irregular supply of crude oil and financial problems created by the rise in price for crude oil import, but prices for petroleum products sold on the domestic markets were fixed.

Rijeka refinery expansion was completed in January 1970. This raised the plant's annual capacity to about 4 million metric tons of crude oil. The expansion of the Bosanski Brod and Novi Sad refineries continued during the year. The Pancevo refinery was closed for slightly more than 30 days because of flood conditions following a dike collapse on the construction site of the hydropower plant at Iron Gates on the Danube. The collapse interrupted barge traffic on the river.

INA (with headquarters in Zagrels) and Naftagas (from Novi Sad) were the two principal state-owned petroleum enterprises operating in Yugoslavia during 1970.

INA, which operates in Croatia and Slovenia, accounted for about 70 percent of Yugoslavia's crude oil production, 53 percent of refinery output, and about 160,000 meters of drilling, mostly in the western part of the Pannonian Basin in 1970. The largest share of INA output came from Zutica and Struzec fields in the central part of Croatia. For the first time in many years INA did not fulfill its crude oil production plan. Internal difficulties that endangered the unity of INA reflected unfavorably on Naftaplin performance. The problem was later solved by compromise, which gave the entities forming INA increased autonomy.

Naftagas oilfields in Serbia accounted for about 30 percent of the country's production. Kikinda remained the largest oilfield of Naftagas. Estimates set the drilling activity of Naftagas at 60,000 meters in 1970.

At yearend 1970 Yugoslavia had plans for constructing two trunk pipelines. The first, financed by a consortium headed by INA, calls for a pipeline to connect the port of Rijeka on the Adriatic Sea with refineries at Sisak, Bosanski, Brod, and Panćevo. The section from Bosanski Brod to the Danube port of Opatovac is operational. Plans to complete the line and to construct a branch line to Hungary and Czechoslovakia were not implemented because of Russian intervention in Czechoslovakia.

The second trunkline from Ploće to Refinery Bosanski Brod was planned. Energoinvest of Sarajevo and the Bosanski Brod refinery will be the principal investors. According to the Yugoslav press, the country has no need for both pipelines. At yearend, discussions between INA and Energoinvest on the merits of both plans were inconclusive.

A gas-gathering system was completed in the Mokrin-Sever field and gas collecting installations were modernized. Development of Tilva and Mramorak gasfields continued during 1970 and Naftagas discovered a gas condensate field near Srpske Crnje in eastern Banat close to the Romanian border. Four wells about 2,000 meters deep were drilled. An initial production of 30,000 tons of condensate per year is expected. Reportedly, the gasfield is one of the country's largest.

The lignite gasification plant at Obilić and the gas pipeline connecting Obilić and Skopje were operational in the fall of 1970. Three gas generators went on stream with an aggregated annual capacity of about 480 million cubic meters. A 79-kilometer pipeline delivers the gas to a steel plant and other industries around Skopje. The calorific value of the produced gas is about 1,900 calories per cubic meter. The plant managers plan three more gas generators to start production when a new fertilizer plant is completed. Low-rank lignites from the nearby Metohija area are used. Kososvo lignite reserves of about 6 billion tons will provide ample raw materials for future gas plant operations.

The Mineral Industry of Zambia

By Gertrude N. Greenspoon [1]

The mineral industry of Zambia in 1970 reflected the loss of copper production resulting from a mine disaster in September. The copper industry, the principal source of revenue, registered an 18-percent decrease in output compared with 1969, and the value of copper production dropped to $908 million from $1,034 million [2] in 1969.

The Zambian Government continued its metal mines acquisition program and on January 1, 1971, through the Mining and Industrial Development Corp. of Zambia, Ltd. (Mindeco, Ltd.), will acquire a 51-percent interest in the Broken Hill mine of the Zambian Broken Hill Development Company, Ltd. A similar interest in the two Zambian-based copper companies had been acquired a year earlier.

Through the Industrial Development Corporation (INDECO), the Government acquired a 50-percent interest in AGIP Zambia, Ltd. and Shell B. P., Zambia, Ltd. and planned to build a $52 million oil refinery at Ndola.

Construction of Zambia's first manufacturing plant was virtually completed with operation expected early in 1971. The plant is located near Luanshya and will produce copper wire and cable. Previously, Zambia exported all its copper production. The plant will supply most of Zambia's requirements for electrical wire and cable, which may become important for export later. The Zambian Government holds a 51-percent interest in the plant where technical and management services are furnished by Phelps Dodge OA Metallverken, a joint U.S. and Swedish company.

On September 6, the Mineworkers' Union of Zambia (MUZ) and the copper companies reached agreement on a new wage structure. Two wage increases of 5 percent each are included in the agreement which became effective November 1, 1970, and runs to October 31, 1973. The first increase was retroactive to November 1, 1969, and the second increase became effective November 1, 1970. The agreement also includes improved leave benefits and provisions for early retirement. In return, MUZ will support measures for improving efficiency, to meet technological advancement and development, and to use every effort to curtail work stoppages.

Construction of the 1,100-mile Tanzania-Zambia Railways was initiated with cornerstone ceremonies at Dar es Salaam on October 26 and at Kapiri Mposhi on October 28. Work will begin from the Dar es Salaam section and when opened to traffic, construction will be started on the Zambian side. Capacity of the railway is 7 million tons in both directions, and it is estimated that the entire line will be completed by 1975. Total cost of the project is estimated at $400.4 million.

PRODUCTION

Value of mineral production dropped to $943 million in 1970 from more than $1 billion in 1969, chiefly because of the substantial decrease in copper output. Although electrolytic and blister copper accounted for 96 percent of the total value, decreases of 13 and 6 percent, respectively, were recorded in 1970 compared with 1969. Coal production rose to a new high with a 54-percent increase over that of 1969 and with 7 percent above the previous record in 1968.

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[1] Mineral specialist, Division of Nonferrous Metals.

[2] Where necessary, values have been converted from the Zambian currency kwacha to U.S. dollars at the rate of k1.00=US$1.40.

Table 1.—Zambia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970
METALS			
Cadmium ... thousand kilograms	11	6	12
Cobalt	1,197	1,798	2,052
Copper:			
Concentrate, copper content	36	----------	4
Blister	93,038	104,917	101,614
Electrolytic	572,063	642,576	507,964
Other	570	673	534
Gold [1] [e] ... troy ounces	5,000	5,000	500
Lead, refined	[r] 24,126	23,007	26,777
Manganese ore	[r] 25,400	25,659	[e] 30,000
Selenium [2] [e] ... kilograms	26,000	26,000	26,000
Silver [3] [e] ... thousand troy ounces	768	768	768
Zinc, electrolytic	[r] 52,374	50,165	52,612
NONMETALS			
Amethyst ... kilograms	17,270	114,172	35,172
Cement ... thousand tons	[r] 341	253	168
Gypsum	1,075	[e] 1,200	NA
Lime ... thousand tons	72	[e] 70	104
Limestone	644,833	772,291	741,193
Phyllite	32,890	63,093	56,171
Talc	----------	2,290	----------
MINERAL FUELS AND RELATED MATERIALS			
Coal ... thousand tons	[r] 574	397	613

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

[1] Chiefly contained in electrolytic copper, refinery muds, and blister copper.

[2] Contained in electrolytic copper, refinery muds, and blister copper.

[3] Refined silver and silver contained in electrolytic copper, refinery muds, and blister copper.

TRADE

In 1969, total value of exports from Zambia was $1,073 million, of which copper contributed $1,014 million. The United Kingdom was the principal recipient of Zambia's exports, followed by Japan and West Germany.

The value of total imports in 1969 was $437 million, of which mineral commodities accounted for $63 million. Despite record production of coal, Zambia continued to depend on imports to meet its demand.

Table 2.—Zambia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Antimony including alloys, all forms	23	---------	
Cadmium	9	8	Mainly to Republic of South Africa.
Cobalt	1,227	1,588	United Kingdom 1,255; mainland China 215; Australia 97.
Copper including alloys:			
Sludge	871	882	West Germany 569; Japan 313.
Slime	681	681	Sweden 422; West Germany 259.
Unwrought, crude:			
Anodes	5,349	3,190	United Kingdom 2,523; Austria 667.
Blister	r 90,631	107,124	Japan 59,804; West Germany 23,205; United Kingdom 12,215.
Refined:			
Wire bars	r 504,703	584,288	United Kingdom 168,803; Japan 109,435; Italy 76,205; West Germany 68,861; France 66,097.
Cathode form	40,267	33,169	Japan 12,975; United Kingdom 9,481; France 3,937.
Ingot and bar	857	923	West Germany 643; Japan 280.
Iron and steel semimanufactures, castings	r 7	---------	
Lead:			
Ingot and bar	16,354	25,891	Republic of South Africa 9,841; Italy 7,539; India 2,293; Iran 1,795.
Other semimanufactures	283	(1)	All to Southern Rhodesia.
Manganese ore and concentrate	17,487	---------	
Silver unworked troy ounces	76,097	49,163	All to Republic of South Africa.
Zinc ingot and bar	45,026	53,586	Yugoslavia 6,002; United Kingdom 5,847; United States 5,733; Greece 5,463; Republic of South Africa 4,657.
Other:			
Scrap metal, n.e.s	108	50	All to Republic of South Africa.
Nonferrous metal, n.e.s	32	---------	
NONMETALS			
Abrasives, natural, precious and semiprecious stones kilograms	---------	27,573	Netherlands 21,319; West Germany 4,893.
Cement for building, including hydraulic lime	44	202	Congo (Kinshasa) 193; West Germany 9.
Gem stones, excluding diamond value, thousands	$510,341	$593,765	West Germany $275,820; Hong Kong $234,261.
Lime, building	65	---------	
Limestone, calcined and dolomite	67	59	Norway 45; Republic of South Africa 14.
Talc	435	984	Republic of South Africa 789; Japan 172; United Kingdom 22.

r Revised.
1 Less than ½ unit.

Table 3.—Zambia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum semimanufactures	518	517	Republic of South Africa 284; Tanzania 86; United Kingdom 40; Italy 37.
Antimony:			
Powder including tellurium powder	4	2	All from United Kingdom.
Ingot and bar	53	29	Belgium 11; Bolivia 10; United Kingdom 7.
Arsenic acid	22	12	Republic of South Africa 10; United States 2.
Chromium ore and concentrates	814	1,960	Republic of South Africa 1,922; United Kingdom 38.
Cobalt including alloys, all forms	---------	5	All from Congo (Kinshasa).

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Copper:			
Copper sulfate	130	310	All from Republic of South Africa.
Metal including alloys, unwrought and semimanufactures	533	419	Republic of South Africa 168; United Kingdom 99; Congo (Kinshasa) 51; Italy 49.
Iron and steel:			
Ore and concentrate	37	38	All from Republic of South Africa.
Pig iron, sponge iron, and ferro-alloys	r 1,617	3,766	Republic of South Africa 3,741.
Ingots and other primary forms	144	11	All from Republic of South Africa.
Semimanufactures	r 124,673	119,074	Republic of South Africa 86,918; Japan 10,089; United Kingdom 10,075; West Germany 2,792.
Lead:			
Oxides	38	15	Republic of South Africa 9; United Kingdom 6.
Metal including alloys, unwrought and semimanufactures	51	56	Republic of South Africa 29; United Kingdom 22.
Mercury 76-pound flasks	5	12	All from United Kingdom.
Tin including alloys, unwrought and semimanufactures long tons	44	85	United Kingdom 38; Republic of South Africa 35; Japan 7.
Titanium oxide	91	301	Mainly from Republic of South Africa.
Zinc:			
Oxides	18	19	All from United Kingdom.
Metal including alloys, unwrought and semimanufactures	6	8	Congo (Kinshasa) 5; United Kingdom 3.
Other:			
Nonferrous ore and concentrate, n.e.s	7	51	Australia 23; Republic of South Africa 22; Norway 6.
Metallurgical residue (dust, ash, shavings)	2	1	All from Republic of South Africa.
Scrap	4	9	Do.
Nonferrous, n.e.s	41	28	United Kingdom 15; Republic of South Africa 11.
NONMETALS			
Abrasives:			
Pumice	5	6	All from Italy.
Grinding and polishing wheels and stone	r 101	125	Republic of South Africa 98; United Kingdom 9; West Germany 8; Italy 8.
Other, crude	3	32	Republic of South Africa 26; United States 4.
Asbestos, crude, washed or ground	127	-------	
Barite	75	146	Republic of South Africa 121; West Germany 25.
Boron materials (borax)	12	9	United States 7; Republic of South Africa 2.
Bromine kilograms	1,114	1,246	Mainly from United Kingdom.
Cement:			
Building including hydraulic lime	r 102,924	9,005	Congo (Kinshasa) 5,443; Republic of South Africa 1,986; Tanzania 730.
Clinker	25,174	---------	
Fire and furnace (including furnace mortar)	1,427	1,669	Republic of South Africa 1,439; Austria 168.
Clays:			
Crude:			
Fire	759	569	Republic of South Africa 334; United States 207.
Kaolin and cornish stone	1,299	1,500	Republic of South Africa 1,240; United Kingdom 148; Japan 45.
Fullers' earth	159	177	West Germany 81; United Kingdom 55; United States 36.
Products:			
Nonrefractory brick value, thousands	$245	$173	United Kingdom $70; Austria $66; Republic of South Africa $34.
Refractory brick do	$2,370	$1,568	Republic of South Africa $910; Austria $434; United Kingdom $154.
Diatomite and similar materials	311	286	United States 137; Republic of South Africa 75; Kenya 36.
Fertilizer materials:			
Anhydrous ammonia	42	57	Republic of South Africa 55; United Kingdom 2.
Other	59,345	54,340	Netherlands 24,014; Republic of South Africa 12,381; Italy 7,996.

See footnote at end of table.

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

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Graphite, natural	10	34	Republic of South Africa 24; United Kingdom 8.
Gypsum and plasters	21,687	19,099	Republic of South Africa 18,917.
Lime, building	142	397	All from Republic of South Africa.
Magnesite including magnesium carbonate	40,156	74,917	Republic of South Africa 72,885; United Kingdom 2,032.
Mica, all forms	2	3	All from Republic of South Africa.
Pigments, mineral:			
Iron oxide	129	146	United Kingdom 63; France 27; West Germany 25; Republic of South Africa 24.
Other ... kilograms	9,629	6,017	United Kingdom 5,105; United States 912.
Precious and semiprecious stones, except diamond ... value, thousands	$17,643	$88,026	United Kingdom $44,836; Republic of South Africa $22,903; Switzerland $4,971.
Pyrite (gross weight)	---------	22	All from Republic of South Africa.
Refractories, alumina sand ... kilograms	907	96,162	Republic of South Africa 58,060; Australia 26,308.
Salt	13,582	45,346	West Germany 24,710; Mozambique 8,649; Republic of South Africa 8,449.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	1,361	3,146	Belgium 1,543; West Germany 552; Italy 509; United Kingdom 319.
Caustic potash, sodic and potassic peroxide	24	20	Belgium 16; Netherlands 3.
Stone, sand and gravel:			
Dimension stone	1,578	210	Republic of South Africa 147; Italy 48; United Kingdom 8; Southern Rhodesia 7.
Limestone, calcined	497	1,311	All from Republic of South Africa.
Sand	4	88	Do.
Sulfur:			
Elemental, all forms	r 6,311	63	Republic of South Africa 43; United Kingdom 20.
Acid	8,313	6,242	Southern Rhodesia 6,001; Republic of South Africa 99.
Talc	42	57	United Kingdom 42; Republic of South Africa 8; Kenya 7.
Vermiculite	8	8	All from Republic of South Africa.
Other:			
Quartz, feldspar, fluorspar, and cryolite	---------	575	Republic of South Africa 518; West Germany 57.
Oxides, n.e.s	44	392	Republic of South Africa 366; United Kingdom 20.
Pigments, n.e.s	812	821	Republic of South Africa 753; United Kingdom 39; West Germany 15.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	182	393	Mainly from Republic of South Africa.
Coal and coal products:			
Coal and briquets	r 700,647	680,947	Southern Rhodesia 668,022.
Coke	r 85,704	79,861	All from Southern Rhodesia.
Gas, liquefied	615	2,355	Tanzania 1,330; Republic of South Africa 1,025.
Petroleum:			
Crude and partly refined ... 42-gallon barrels	---------	63	United States 49; United Kingdom 14.
Refinery products:			
Gasoline ... thousand 42-gallon barrels	809	1,112	Mainly from Iran.
Kerosine ... do	109	65	Iran 35; Tanzania 19.
Jet fuel ... do	r 191	159	Tanzania 110; Iran 47.
Distillate fuel oil ... do	r 1,321	1,585	Mainly from Iran.
Residual fuel oil ... do	r 213	107	Mainly from Tanzania.
Lubricating oils ... do	114	159	United Kingdom 87; Republic of South Africa 30; Kenya 19; United States 13.
Greases, jellies, and waxes	r 2,674	3,025	United States 1,258; Republic of South Africa 784.
Asphalt and bitumen	r 16,138	14,733	Iran 5,508; Kenya 4,869; Southern Rhodesia 1,094.
Other ... 42-gallon barrels	4,323	6,373	United States 4,038; Republic of South Africa 1,555; United Kingdom 611.
Coal and petroleum byproducts:			
Coal tar ... value, thousands	$87,808	$15,480	Republic of South Africa $13,048; United States $1,418.
Pitch, tar, and other coal products	215	761	United Kingdom 654; United States 67.
Petroleum shale and coal tar spirits, n.e.s ... 42-gallon barrels	4,555	27,559	Netherlands 25,649.

r Revised.

COMMODITY REVIEW

METALS

Copper.—Copper production fell from the record high of 747,500 tons in 1969 to 609,600 tons in 1970, principally as a result of the cave-in at the Mufulira underground mine on September 25. Partial production was reestablished by yearend, when the Prain shaft system was placed into operation 7 weeks ahead of schedule. Full output at Mufulira is not expected before 1972.

As part of the reorganization of the Anglo-American group, companies operating the Nchanga, Rhokana, Chingola, and Bancroft mines and the Rhokana refinery were merged into the Nchanga Consolidated Copper Mines, Limited, (NCCM), and reincorporated in Bermuda on June 26.

Mindeco, Ltd., will acquire a 51-percent interest in Kansanshi Copper Mining Co., Ltd., and the Kansanshi operation will become a part of NCCM. The mine is expected to be reopened in 1973 as an open pit. A plant using the Torco process will be built to treat the refractory ore, and the concentrate will be smelted at the Chingola or Rhokana division. Production will approximate 15,000 tons annually. At the Chingola division, the leach precipitation plant to treat concentrates from low-grade oxide ore was nearing completion. Production was expected about mid-1971. It is planned to replace leach precipitation by the liquid ion exchange process in 1973. About 55,000 tons additional copper per year would be produced by these plants. Other activities at NCCM include bringing into operation the old Bwana Mkubwa mine early in 1971 at a rate of 15,000 tons per year. By 1974 production of the NCCM group is expected to be 500,000 tons of copper per year, compared with 395,500 tons in 1970.

Operations of Roan Consolidated Mines, Limited (RCM), consisting of the Mufulira, Chibuluma, Chambishi, Kalengwa, and Luanshya divisions produced 342,700 tons of refined copper during the year (334,000 tons in 1969). All mines recorded an increase over the previous year except Mufulira where output was adversely affected by a cave-in on September 25, 1970. Part of the refined copper production was from concentrate stockpiled in previous years during periods of fuel shortages. Production of 175,500 tons of cathodes at the Ndola refinery was the highest on record.

The Kalengwa mine in its first full year of operation produced 4,154 tons of copper from high-grade ore treated at the Luanshya and Mufulira smelters. Lower grade ores were stockpiled awaiting completion of the concentrator at yearend. Output was expected to be at the annual rate of 17,000 tons in 1971.

Baluba Mines, Ltd., owned almost entirely by Roan Selection Trust (RST) International, Inc., and Zambia Copper Investments, Ltd., will be incorporated into the RCM group and developed into a 50,000-ton-per-year underground mine. The Government of Zambia will acquire a 51-percent interest in Baluba as a result of the 51-percent share of Mindeco, Ltd., in RCM. The Baluba mine will be operated as part of the Luanshya division, and production should be 22,000 tons per year by the second half of 1973. The combined output of Baluba and Luanshya should increase to 120,000 tons per year. Ore reserve at Baluba is estimated at 60 million tons, containing 2.71 percent copper and 0.17 percent cobalt. Copper concentrate will be smelted at Luanshya and Mufulira, and cobalt concentrate will be sent to Chambishi for producing cobalt hydroxide.

Capacity of RCM operations will increase from 310,000 to 375,000 tons of copper by yearend 1973. Ore reserve data for the group companies at the end of June 1970 were as follows:

Mine	Ore (thousand metric tons)	Copper (percent)
Mufulira	136,415	3.27
Luanshya	72,005	2.76
Chambishi	30,651	3.07
Chibuluma	6,089	4.80
Kalengwa	976	11.33

Lead and Zinc.—The Zambian Broken Hill Development Co., Ltd., produced 81,000 tons of lead and zinc in 1970, 10 percent more than in 1969 and a 7-percent increase over the previous record in 1968. In addition, 12,242 kilograms (6,045 in 1969) of cadmium and 184,900 troy ounces (89,100 in 1969) of silver were produced.

The Broken Hill Co., the only lead-zinc producer in the country, was formed in

London in 1904, and has been associated with the Anglo-American Corp. since 1925. The Zambian Government will acquire a 51-percent interest in the mine when it is integrated into NCCM. Since production began at Broken Hill, a total of 1,625,002 tons of lead and zinc was produced; zinc comprised 1,094,026 tons and lead 530,976 tons of the total output.

Following investigations of methods for treating refractory materials at the Broken Hill operation, which consist of newly mined ores, surface dumps, leach residues, and slags, it was found that the Waelz process was the most advantageous for the economic treatment of these materials. Bids have been requested for the installation of two Waelz kilns, one deleading kiln, and auxiliary equipment. This plant will increase metal output well above the current level of 80,000 tons and increase the life of the mine to 20 years even at higher production rates. Proven and indicated ore reserves at yearend 1970 totaled 3.2 million tons averaging 24.8 percent zinc and 11 percent lead compared with 3.0 million tons containing 24.1 percent zinc and 11.2 percent lead at the end of 1969.

NONMETALS

Fertilizer.—Construction continued on the fertilizer plant of Nitrogen Chemicals Co. of Zambia at Kafue. Production of ammonium nitrate was expected to be 68,000 tons annually, of which 50,000 tons would be used for agricultural purposes and the remainder as explosives in the mining industry.

Lime.—An expansion to double output by 1973 is planned by Zambia Lime Co. through construction of a larger plant. Lime production totaled 104,000 tons in 1970 but increased output is needed to meet the demands from mining companies for use in the copper smelting industry.

MINERAL FUELS

Coal.—Coal supplies were increased substantially as output rose to a record 613,000 tons in 1970, the fifth year of coal production. The closing of the Nkandabwe coalfield was more than offset by increased output from the Maamba coalfield. Coal, however, continued to be imported for the copper industry from the Wankie Colliery Co. Ltd. in Southern Rhodesia.

The Mineral Industry of the Islands of the Caribbean

By Staff, Bureau of Mines

CONTENTS

BAHAMAS [1]

Expansion of the aragonite (calcium carbonate) production facilities of Ocean Industries, Ltd., a subsidiary of the Dillingham Corp. of Hawaii, continued during 1970. In addition to the production figure shown in table 1, Ocean Industries dredged over 2 million tons of aragonite for use in expanding the area of an artificial island named Ocean Cay. This island, located south of Bimini, is to be used as an aragonite storage and export terminal.

An offshore exploration well was drilled during 1970 near Long Island in an exploration tract held jointly by Bahamas Gulf Oil, a subsidiary of Gulf Oil Corp.. and Bahamas California Oil, a subsidiary of Standard Oil Co. of California. This well, drilled to a depth of 17,500 feet was a dry hole. The jack-up rig used to drill this well was moved to a drilling site off Isaac Island during the latter part of the year. This site is located in an exploration tract held by Bahamas California Oil.

The Freeport refinery on Grand Bahama Island, operated by Bahamas Oil Refining Co., a subsidiary of New England Petroleum Corp. (65 percent) and Standard Oil Co. of California (35 percent), reached its designed crude oil throughput of 250,000 barrels per day during November 1970. This plant was constructed primarily for the purpose of supplying low-sulfur residual fuel oil to the east coast of the United States and at yearend was producing, on the average, 140,000 barrels per day of residual fuel oil with a sulfur content of 1 percent or less, primarily from almost sulfur-free Libyan and Nigerian crudes blended with higher sulfur crudes from Iran and Venezuela. Lighter products from the plant were being shipped to Western Europe.

Principal processing facilities at the Freeport refinery consisted of two 125,000-barrel-per-day atmospheric distillation units, a 75,000-barrel-per-day vacuum distillation unit, a 45,000-barrel-per-day naphtha treater, and two 40,000-barrel-per-day Merox units. According to plans announced near the end of 1970, the capacity of the plant is to be raised 130,000 barrels daily, primarily by the addition of a third atmospheric distillation unit. Desulfurization facilities are also to be added as a part of this expansion program in order to enable the refinery to process more high-sulfur crude oil from Venezuela.

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[1] Gordon W. Koelling, geographer, Division of Fossil Fuels.

Table 1.—Islands of the Caribbean: Production of mineral commodities

Area, commodity, and unit of measure [1]	1968	1969	1970 [p]
ANTIGUA [2]			
Petroleum refinery products: [e] [3]			
Gasoline thousand 42-gallon barrels	425	595	NA
Jet fuel and kerosine do	388	465	NA
Distillate and residual fuel oils do	2,683	2,824	NA
Other including refinery fuel and losses do	14	16	NA
Total do	3,510	3,900	NA
Sand thousand cubic meters	21	NA	NA
Stone crushed and broken do	49	NA	NA
BAHAMAS [2]			
Cement, hydraulic thousand metric tons	682	813	833
Petroleum refinery products:			
Jet fuel thousand 42-gallon barrels	--	--	4,100
Distillate fuel oil do	--	--	3,200
Residual fuel oil do	--	--	13,000
Other do	--	--	3,700
Refinery fuel and losses do	--	--	1,500
Total do	--	--	25,500
Salt thousand metric tons	800	680	621
Stone:			
Aragonite [4] do	--	[r] 561	2,142
Limestone (for cement only) do	NA	1,068	990
BARBADOS [2]			
Gas, natural:			
Gross production million cubic feet	97	108	116
Marketed production do	88	91	[e] 100
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	226	246	268
Kerosine do	101	105	89
Distillate fuel oil do	234	281	305
Residual fuel oil do	149	169	198
Other do	36	35	27
Refinery fuel and losses do	38	42	45
Total do	784	878	932
CUBA [2] [5]			
Cement, hydraulic thousand metric tons	780	[e] 800	[e] 850
Cobalt mine output, metal content [e] metric tons	1,300	1,500	1,500
Copper mine output, metal content [e] do	5,000	3,000	3,000
Iron and steel, crude steel [e] thousand metric tons	50	55	55
Nickel:			
Content of oxide product [e] metric tons	19,000	18,500	18,500
Content of sulfide product [e] do	14,700	16,700	16,700
Petroleum:			
Crude [e] thousand 42-gallon barrels	1,062	821	800
Refinery products: [e]			
Gasoline do	7,166	8,845	NA
Jet fuel do	1,230	1,518	NA
Kerosine do	769	949	NA
Distillate fuel oil do	5,849	7,212	NA
Residual fuel oil do	13,356	16,513	NA
Other do	1,077	1,329	NA
Refinery fuel and losses do	1,297	1,594	NA
Total do	30,744	37,960	NA
DOMINICA [2]			
Pumice used for aggregate metric tons	[e] 54,000	55,983	61,690
DOMINICAN REPUBLIC [2]			
Aluminum, bauxite, dry equivalent, gross weight [6] thousand metric tons	994	1,093	1,067
Cement, hydraulic do	[r] 327	390	492
Copper mine output, metal content do	[r] 106	477	425
Gypsum metric tons	100,378	[e] 100,000	[e] 100,000
Nickel, content of ferronickel product thousand metric tons	294	NA	NA
Salt do	17	[e] 17	[e] 17
Stone, limestone (except that for cement) do	NA	NA	48
GRENADA [2]			
Sand and gravel thousand cubic meters	34,365	19,267	27,524
Stone crushed and broken do	23,363	59,558	72,351
HAITI [2] [7]			
Aluminum, bauxite, dried, gross weight thousand metric tons	446	665	632
Cement, hydraulic do	[r] 42	50	63
Copper mine output, metal content metric tons	1,598	1,797	1,696
Gold mine output, metal content [e] troy ounces	3,000	3,000	3,000
Silver mine output, metal content [e] thousand troy ounces	17	17	17

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities—Continued

Area, commodity, and unit of measure [1]	1968	1969	1970 [p]
JAMAICA [2]			
Aluminum:			
Bauxite, dry equivalent of crude ore, gross weight thousand metric tons	8,525	10,499	12,009
Alumina (exports) do	922	1,155	1,689
Cement, hydraulic do	409	414	457
Clays for cement do	[e] 140	[e] 140	161
Gypsum metric tons	[r] 211,338	255,029	282,843
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	[r] 1,518	1,988	2,248
Jet fuel do	529	834	549
Kerosine do	442	501	672
Distillate fuel oil do	1,692	2,204	2,253
Residual fuel oil do	4,139	5,103	5,104
Other do	205	301	985
Refinery fuel and losses do	257	281	303
Total do	8,782	11,212	12,114
Sand and gravel:			
Sand:			
Glass thousand metric tons	[e] 9	12	15
Common[e] thousand cubic meters	841	904	NA
Gravel do	274	68	NA
Stone, limestone for cement and lime thousand metric tons	NA	NA	744
MARTINIQUE			
Clays do	57	50	NA
Pumice do	15	18	[e] 18
Salt do	NA	324	[e] 300
Sand do	302	46	NA
Stone (including gravel):			
Crushed and broken do	592	645	NA
Other [3] do	158	159	NA
NETHERLANDS ANTILLES			
Fertilizer materials:			
Phosphatic, crude phosphate rock do	93	113	[e] 110
Nitrogenous, manufactured (sales) do	207	[e] 220	NA
Petroleum refinery products:			
Gasoline, aviation thousand 42-gallon barrels	6,761	6,159	1,823
Gasoline, other do	27,014	35,496	30,130
Jet fuel do	28,150	21,590	14,662
Kerosine do	5,835	19,735	16,046
Distillate fuel oil do	29,604	27,532	27,857
Residual fuel oil do	156,444	170,716	200,160
Lubricants do	6,972	6,774	7,453
Other do	20,736	6,940	21,697
Refinery fuel and losses do	15,279	16,292	16,189
Total do	296,795	311,234	336,017
ST. LUCIA			
Sand and gravel [e] thousand metric tons	NA	NA	70
Stone crushed [e] do	NA	NA	520
ST. VINCENT			
Sand metric tons	30,582	NA	NA
Stone crushed do	25,001	NA	NA
TRINIDAD AND TOBAGO			
Asphalt, natural thousand metric tons	139	124	132
Cement, hydraulic do	210	243	[e] 254
Clays:			
Argillite thousand cubic meters	92	79	181
Other unspecified do	59	62	[e] 29
Fertilizer materials manufactured, nitrogenous thousand metric tons	585	624	605
Gas, natural:			
Gross production million cubic feet	151,445	137,503	121,060
Marketed production do	67,300	69,297	66,687
Gypsum metric tons	[r] 4,319	4,064	[e] 4,000
Natural gas liquids thousand 42-gallon barrels	164	158	168
Petroleum:			
Crude do	66,904	57,418	51,047
Refinery production:			
Gasoline, aviation do	[r] 1,851	2,099	1,677
Gasoline, motor do	[r] 19,601	20,081	19,392
Jet fuel do	16,302	15,181	12,141
Kerosine do	2,780	2,309	6,100
Distillate fuel oil do	18,068	17,116	15,269
Residual fuel oil do	85,337	88,271	91,501
Lubricants do	1,094	1,471	1,261
Other do	2,127	2,353	1,832
Refinery fuel and losses do	4,122	5,196	5,687
Total do	151,282	154,077	154,860

See footnotes at end of table.

Table 1.—Islands of the Caribbean: Production of mineral commodities—Continued

Area, commodity, and unit of measure [1]	1968	1969	1970 [p]
TRINIDAD AND TOBAGO—Continued			
Sand and gravel:			
Pitch sand ---- thousand cubic meters	10	28	12
Other sand and gravel ---- do	187	190	92
Stone:			
Diorite ---- do	NA	NA	3
Limestone ---- do	465	266	[9] 199
Porcellanite ---- do	6	43	35
Sulfur, elemental, byproduct ---- metric tons	3,359	4,301	4,194

[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 output 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 general information is inadequate to make reliable estimates of output.
[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 1966–69, Statistical Papers, Series J, No. 14, New York, 1971, pp. 58–59; total estimated from crude oil imports reported on p. 48 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 60,600 tons in 1969 and 109,775 tons in 1970.
[5] In addition, chromite, gypsum, iron ore, manganese ore, pyrite, and salt, all produced in significant quantities prior to the termination of publication of official statistics, presumably were produced during the period covered by the table, but information is inadquate 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] Includes volcanic tuff and materials used for fill, ballast, and other purposes.
[9] Excludes output for cement production; a total of 408,140 metric tons of limestone and clays (undifferentiated) was reportedly produced for this purpose.

BARBADOS [2]

General Crude Oil Co. of Houston, Texas, which held the only petroleum exploratory concession in Barbados, completed one exploratory well during 1970. This onshore well, North Point 1, was drilled to a depth of more than 13,000 feet before being abandoned as a dry hole. An additional exploratory well, Ruby 1, locateed at the southeastern end of the island, had been drilled to more than 7,300 feet by yearend.

Small quantities of crude oil and natural gas continued to be produced from the Turner Hall field.

The production of mineral commodities in Barbados is shown in table 1.

[2] Gordon W. Koelling, geographer, Division of Fossil Fuels.

Table 2.—Barbados: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	12	46
Copper metal including alloys, all forms	2	2
Iron and steel metal including alloys, all forms	710	803
Lead metal including alloys, all forms	18	340
Tin metal including alloys, all forms ... long tons	12	9
Zinc metal including alloys, all forms	3	1
Other:		
Ore and concentrate	1	--
Ash and residue containing nonferrous scrap	179	295
NONMETALS		
Cement	2	58
Clays and products (including all refractory brick)	1,102	295
Diamond, gem not set ... carats	--	74
Diatomite and other infusorial earths	--	1
Fertilizer materials	2	11
Salt	4	6
Sodium and potassium compounds	17	5
Stone, sand and gravel:		
Dimension stone	69	530
Gravel and crushed rock	13,455	2,146
Other crude nonmetals	67	7
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke excluding briquets	13	6
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	43	86
Kerosine and jet fuel ... do	224	212
Distillate fuel oil ... do	16	11
Residual fuel oil ... do	30	15
Lubricants ... do	6	1
Mineral jelly and waxes ... do	(1)	(1)
Other	8	8

[1] Less than ½ unit.

Source: Government of Barbados, Statistical Service, Overseas Trade, 1968, 386 pp.; 1969, 398 pp.

Table 3.—Barbados: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	116	123
Copper metal including alloys, all forms	34	35
Iron and steel:		
Scrap	--	61
Pig iron, ferroalloys and similar materials	17	10
Steel, primary forms	97	84
Semimanufactures	8,406	9,496
Castings and forgings	7	7
Lead metal including alloys, all forms	92	108
Silver unworked troy ounces	582	1,155
Tin metal including alloys, all forms long tons	375	553
Zinc metal including alloys, all forms	31	38
Other:		
Ore and concentrate	1	--
Oxides, hydroxides and peroxides of metal n.e.s	205	192
NONMETALS		
Abrasives, natural n.e.s	4	4
Asbestos	1	(1)
Cement	42,830	51,024
Chalk	72	2
Clays and products (including all refractory brick)	404	517
Diamond, industrial troy ounces	--	75
Diatomite and infusorial earths	17	45
Fertilizer materials:		
Crude	122	--
Manufactured	15,932	14,050
Ammonia	6	18
Lime	1,572	293
Mica, all forms	4	(1)
Salt	1,964	1,941
Sodium and potassium compounds	181	190
Stone, sand and gravel:		
Dimension stone	63	17
Gravel and crushed rock	304	253
Sand	24	5
Sulfur, elemental	(1)	(1)
Other n.e.s	46	78
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	2	--
Carbon black	(1)	(1)
Coal including briquets, all grades	21	209
Coke	78	40
Natural gas liquids, liquefied petroleum gas thousand 42-gallon barrels	2,130	2,560
Petroleum:		
Crude do	722	574
Refinery products:		
Gasoline do	4	55
Kerosine and jet fuel do	224	367
Distillate fuel oil do	657	540
Residual fuel oil do	1,289	783
Lubricants do	10	13
Mineral jelly and wax do	1	1
Other do	25	14
Mineral tar and other coal, petroleum or gas derived crude chemicals	2	3

[1] Less than ½ unit.

Source: Government of Barbados, Statistical Service, Overseas Trade, 1968, 386 pp.; 1969, 398 pp.

BERMUDA [3]

Little change occurred in the mining industry of Bermuda in 1970 as the island continued to rely on imports for the bulk of its mineral needs. The principal mineral commodities produced consisted of aggregates for the construction industry. Table 4 shows foreign trade in selected mineral commodities in 1968 and 1969.

[3] Harold J. Drake, physical scientist, Division of Nonmetallic Minerals.

Table 4.—Bermuda: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS AND REEXPORTS		
Petroleum refinery products:		
Gasoline:		
Aviation thousand 42-gallon barrels	131	188
Other do	873	618
Kerosine do	1	1
Jet fuel do	606	30
Residual fuel oil (bunkers) do	145	223
Scrap metal unspecified value, US dollars	128,762	137,474
IMPORTS		
Clay products (bricks) value, US dollars	9,998	9,322
Cement:		
Portland	12,259	1,409
Other	5,943	2,550
Coal	--	15
Fertilizers	1,036	1,056
Gypsum	273	244
Lime	1,884	2,686
Petroleum refinery products:		
Asphalt thousand 42-gallon barrels	18	14
Gasoline do	196	225
Jet fuel do	780	509
Kerosine do	108	245
Distillate fuel oil do	324	185
Residual fuel oil do	173	329
Lubricating oil do	8	8
Liquefied petroleum do	31	32
Salt	166	159
Sand, gravel, etc	36	13,154
Stone chips	83	156
Structural steel unspecified value, US dollars	580,109	1,248,922

Source: Report of the Customs Imports and Exports, Bermuda, 1968 and 1969.

CUBA [4]

Estimates of Cuban mineral production are shown in table 1. According to an article in the Engineering and Mining Journal,[5] the mining industry has stabilized after the chaotic early postrevolution years, and, in fact, new projects being planned in 1970 could result in a healthy mining industry in Cuba in the mid-1970's if brought to fruition.

COMMODITY REVIEW

Copper.—At the Matahambre, now known as the Capitan Alberto Fernandez copper mine, plans were being drawn up to mechanize the operation to take advantage of newly discovered extensions of the ore body. The extensions were reported to be large enough to sustain pre-1959 production levels for 10 years. Other copper-iron and copper-bearing pyrite deposits were being explored in 1970; production of copper and sulfuric acid is planned. However, it must be noted that production volume and grade of copper ore have been declining in recent years.

Nickel.—Nickel from mines at Nicaro and Moa Bay was the second highest foreign-exchange earner in 1970, surpassing tobacco, but not sugar. Nickel production, currently around 35,000 tons per year, was reportedly scheduled to reach 100,000 to 120,000 metric tons by 1980. Given Cuba's reserves of 17 million metric tons, its current production rate, and the overcoming of the shortage of engineers and technicians, the author of the Engineering and Mining Journal article stated that it was not an unrealistic goal. Nothing further has been learned regarding the nickel mine and refinery considered for construction at Punta Gorda.

Other.—Output of chromite from the Cayo del Medico mine in Oriente Province resulted in exports of a few thousand metric tons of ore. The Charco Redondo mine in Oriente Province produced metallurgical-grade manganese ore for local consumption. The Julio Antonio Mella pyrite mine in Pinar del Rio Province supplied ore to the Patricio Lumumba sulfuric acid plant.

Tables 5 and 6 show selected mineral trade between Cuba and Poland and Cuba and the U.S.S.R. in 1968 and 1969.

[4] Francis C. Mitko, economist, Division of Nonferrous Metals.

[5] Delinois, Serge L. Is Cuba Winning Battles to Develop Mining Industry? Engineering and Mining Journal, v. 171, No. 5, May 1970, pp. 86–94.

Table 5.—Cuba: Selected mineral commodity trade with Poland

(Metric tons)

Commodity	1968	1969
EXPORTS TO POLAND		
Chrome ore	17,475	9,614
Copper concentrate	1,481	587
Manganese ore	22,000	15,546
Other nonferrous concentrate	r 372	478
IMPORTS FROM POLAND		
Steel semimanufactures	511	810
Petroleum products	1,261	3,890

r Revised.

Source: Rocznik Statystyczny Handlu Zagranicznego (Foreign Trade Statistical Yearbook), 1969. Warsaw, 1970, 458 pp.

Table 6.—Cuba: Selected mineral commodity imports from U.S.S.R.

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	4,500	5,800
Copper metal including alloys, all forms	r 5,753	5,150
Iron and steel:		
Pig iron	45,600	85,400
Ferroalloys	2,100	1,900
Steel semimanufactures	201,200	283,600
Lead metal including alloys, all forms	1,000	1,100
Zinc metal including alloys, all forms	300	500
NONMETALS		
Asbestos	9,700	10,600
Cement	274,000	133,000
Fertilizer materials:		
Nitrogenous	287,500	217,800
Phosphatic	115,300	52,500
Potassic	97,900	80,800
Refractory materials	12,100	13,300
Sodium compounds n.e.s., caustic soda	25,900	25,900
Sulfur	97,600	111,200
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	3,500	3,000
Coal, bituminous thousand tons	21	24
Coke do	32	33
Petroleum, crude oil, and refinery products do	5,303	5,760

r Revised.

Source: Vneshnyaya Torgovlya S.S.S.R. za 1969 god (Foreign Trade of the U.S.S.R. for 1969). Moscow, 1970, 274 pp.

DOMINICAN REPUBLIC[6]

The country's only cement plant, the state-controlled Fabrica Dominicana de Cemento, increased its production capacity by 10 percent and announced plans to purchase two kilns with which the plant is expected to double its capacity and meet domestic demand for up to 8 or 10 years. A group of domestic investors and three foreign companies signed a contract worth $14 million to build a cement factory in Barahona, a port town in the southwestern part of the country. Construction was scheduled to begin in late 1970 and is to be completed within 2 years. The output is expected to augment the domestic supply for cement demands by residential and development construction. Part of the output will be exported to other Latin American countries and to the southern United States.

Toledo Mining Co. obtained a contract for exploration on three major mineral properties. The area, which covers approximately 140,000 acres, reportedly contains potential copper deposits from which preliminary examinations indicate substantial tonnages assaying more than 4 percent copper. The first property, El Mayor, was said to have a massive copper sulfide outcropping. The second property, El Cuaron, has potential gold reserves associated with the copper. The third, El Recodo, has gold and silver associated with the copper. Toledo Mining Dominicanas, C. por A., will

[6] E. Chin, chemist, Division of Nonferrous Metals.

be responsible for exploration and subsequent development programs.

In a joint venture with the J. R. Simplot Co., Honduras Rosario Mining Co. continued drilling at the Pueblo Viejo mine outlining a low-grade gold-zinc-silver-copper ore body that will lend itself to open pit extraction. The ore body is a mixture of oxide and sulfide minerals with the oxides occurring nearer the surface. Negotiations are continuing with government officials to secure a workable operating agreement. Honduras Rosario, meanwhile, is conducting engineering and feasibility studies on extraction, plant location, and tailings disposal.

Financing agreements have been completed for the $195 million ferronickel project, located in the Bonao area, 55 miles from Santo Domingo, of Falconbridge Dominicana C. por A. (Falcondo). The operation will be owned by Falconbridge Nickel Mines Ltd., Armco Steel Corp., and the Dominican Government. Production, scheduled to begin in 1972, will be at the rate of 63.4-million pounds of ferronickel per year. The product will have a nickel content of 35 to 40 percent with the balance being iron. Ore reserves proven so far at the site should provide for about 25 years of operation at the proposed level of extraction. In addition to the mining and processing elements of the facility, the project also comprises extensive supporting facilities, including power generation, a fuel pipeline, storage facilities, roads, water supply, and housing.

In early 1970, International Resources-Dyna Ray-Gaspedom completed a 3-month surface geology survey for petroleum and a Delta Exploration-operated seismic survey in the Azua and Bani area in July. No other oil exploration and drilling operations were carried out during the year.

Tenneco Inc., relinquished its two offshore exploration concessions late in the year. Gaspedom obtained a 2-year extension for its two onshore exploration concessions, and signed a technical assistance agreement with Kardor Canadian Oil, Ltd. By yearend, a total of 9,754 square miles of onshore and offshore concession area was held by International Resources-Dyna Ray-Gaspedom; Consolidated Petroleum, and Logrono.

Table 7.—Dominican Republic: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Copper including alloys, semimanufactures	832	831
Gold, silver, and platinum metal unworked and worked .... troy ounces	191,072	25,045
Iron and steel semimanufactures	50,960	48,195
Other nonferrous metals, all forms	1,440	2,123
NONMETALS		
Cement	3,805	3,893
Gem stones (including pearls), unmounted .... kilograms	181	2,260
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke including briquets	321	537
Petroleum refinery products:		
Gasoline .... thousand 42-gallon barrels	1,517	1,317
Kerosine and jet fuel .... do	267	401
Distillate fuel oil .... do	755	849
Residual fuel oil .... do	1,469	2,318
Lubricants .... do	44	52
Other .... do	203	227

HAITI [7]

Through its Development Bank, the Haitian Government entered into arrangements with Haiti Mineral Corp. of America for bauxite exploration and exploitation throughout the Republic of Haiti with the only exception being the present workings of the Reynolds Metals Co. The concession agreement is for a period of 30 years with a 20-year renewal option. Erection of an alumina plant was being considered, cost of which is estimated to be between $50 to $100 million. As part of its operations, Haiti Mineral Corp. stated that it would build roads and shipping facilities in addition to processing plants.

[7] E. Chin, chemist, Division of Nonferrous Metals.

International Consolidated Halliwell Ltd. of Canada expanded its exploration activities at its holdings in Haiti. The company has been producing copper from its Mémé copper mine for 10 years. Two separate areas are being investigated. One of these is the Roucan Grandeur sector of the main Sedren concession about 8,000 feet south of the Mémé mine. The other area, Plaisance-Limbe, lies in the northern part of the island and is held by a subsidiary, Campagnie Nationale d'Exploitation S.A. Work on this concession will be directed initially at Boucarie Creek.

According to the American Association of Petroleum Geologists, there were no oil licenses held in Haiti during 1970, and no oil drilling or exploration has been reported for several years.

JAMAICA [8]

During 1970 mineral industry activities in Jamaica continued to be confined primarily to bauxite mining and petroleum refining.

Jamaica continued to be the world's largest bauxite producer with production reaching close to 12 million tons for the first time. Kaiser Bauxite Co. remained the largest bauxite producer. Alcan Jamaica Ltd., Reynolds Jamaica Mines Ltd., Alcoa Minerals of Jamaica Inc., and Revere Jamaica Alumina Ltd. were the other bauxite miners.

Alumina production was approximately 1.7 million tons in 1970. Alcan Jamaica produced over 1 million tons at its Ewarton plant and at its expanded installations at Kirkvine. Aluminum Partners of Jamaica (Alpart) accounted for the remainder of alumina production in Jamaica at its plant at Nain. Alpart, jointly owned by Kaiser, Reynolds, and Anaconda, has a capacity of 875,000 annual tons of alumina and is planning to expand capacity to 1.3 million annual tons by mid-1972. Revere Jamaica continued construction of its 220,000 annual ton capacity plant in St. Elizabeth, which is scheduled for completion in 1972. Alcoa Minerals is building an alumina plant at Woodside, which is scheduled for 1971 operation with a 200,000-ton-per-year capacity. With new plants and planned plant expansions scheduled for operation in the next few years, Jamaica will have an annual alumina refining capacity of over 3.0 million tons in the mid-1970's.

Merland Explorations Ltd. continued extensive geochemical and geophysical exploration programs seeking copper in the mountains in the east central part of the island. Three areas, Eping Farm Whitfield Hall, Flint River, and Ugly River–Pencar River, were selected for further prospecting. Burrex Mines (Jamaica) Ltd., a wholly owned subsidiary of Burrex Mines has optioned its copper-molybdenum properties to Cominco Ltd. Cominco has conducted extensive geological mapping, geochemical surveying, some surface testing, and drilling. Test results are being assessed by Cominco, which has until yearend to determine whether it will continue exploration.

Signal Exploration (Jamaica) Co., a wholly owned subsidiary of Signal Oil and Gas Co., in partnership with Occidental Jamaica of Jamaica Ltd., a subsidiary of Occidental Petroleum Corp., was granted 24 oil prospecting licenses over a total area of 4,569 square miles, which are within the exploration license held jointly by the companies over an area of 6,314 square miles. The Signal-Occidental oil exploration license has terminated, and applications for new exploration licenses over the relinquished area are under consideration by the Government. Occidental and Signal drilled their first obligatory well on Pedro Bank, which was abandoned as dry.

The oil exploration license, held jointly by Weaver International Jamaican Corp., Taylor & Associates Jamaica Inc., Kirby Jamaica Inc., Tagor International Inc., and Oil & Gas Futures of Jamaica Inc., covering approximately 6,206 square miles of mainland and adjacent submarine areas, was extended for another year. The Weaver Group completed the evaluation of its geologic data and is scheduling the drilling of its first obligatory well.

Oil & Gas Futures assigned all of its interest in the Government Agreement and in the exploration license to Professional Oil Management Inc.

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[8] E. Chin, chemist, Division of Nonferrous Metals.

Jack Grynberg of Denver and Golden Eagle have lodged applications for oil exploration licenses over the area given up by Signal; the applications are under consideration by the Government. Previous applications by Jack Grynberg for oil prospecting licenses over the banks and cays northeast of Jamaica, comprising 418 square miles of land and submerged land are still pending.

Table 8.—Jamaica: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
Alumina	922,388	1,195,913
Bauxite	6,311,756	7,723,419
Cement	92,566	71,368
Gypsum	253,328	[1] 342,637
Petroleum refinery products (excluding bunkers):		
Gasoline thousand 42-gallon barrels	271	33
Kerosine and jet fuel do	34	50
Distillate fuel oil do	318	388
Residual fuel oil do	332	246
Lubricants do	e 15	116
Other do	--	833
IMPORTS		
Aluminum, all forms	2,379	NA
Copper, all forms	346	NA
Iron and steel, all forms	84,855	108,622
Petroleum:		
Crude thousand 42-gallon barrels	8,557	11,287
Refinery products:		
Gasoline do	134	54
Kerosine and jet fuel do	311	177
Distillate fuel oil do	743	313
Residual fuel oil do	1,774	1,325
Lubricants do	55	128
Other do	35	11

e Estimate. NA Not available.

[1] May include other crude nonmetals.

MARTINIQUE [9]

Geological studies of several mineralized zones and faulted areas have given indications of anomalies in copper, lead, zinc, and molybdenum. Further exploration of these areas is planned for 1971. Current mineral production is small and limited principally to nonmetallic construction minerals.

The construction of a 550,000-metric-ton-per-year oil refinery near Fort de France was completed. An adjacent fertilizer plant being built by Sun Oil Co. was nearly completed. The output of fertilizer is to be marketed principally in the Caribbean Islands. Cement clinker was imported and ground with gypsum in grinding plants on Martinique and Guadeloupe. The cement produced is distributed to the construction industry on the islands. Both islands import large quantitites of cement, manufactured fertilizers, and petroleum refinery products.

NETHERLANDS ANTILLES [10]

Although the area's two petroleum refineries reduced their labor force by more than 15,000 people in the past 20 years as a result of increased automation, refining remained the most important industry in the Netherlands Antilles during 1970, both in terms of its contribution to gross national product (over one-fifth of the total) and to employment (over 5,000 employees).

At yearend, a desulfurization unit with an output capacity of 75,000 barrels per day of residual fuel oil with a 1-percent sulfur content was under construction at the Aruba refinery of Lago Oil and Transport Co., a subsidiary of Standard Oil Co. (New Jersey). This unit is to use refinery pentanes as the hydrogen source for desulfurization. Completion of this unit was scheduled for 1971.

[9] Harold J. Drake, physical scientist, Division of Nonmetallic Minerals.

[10] Gordon W. Koelling, geographer, Division of Fossil Fuels.

A modernization program was initiated during 1970 at the Curaçao refinery of Shell Curaçao, N.V. This program was scheduled to be completed before the end of 1974.

In response to substantial salary and fringe benefit increases demanded in early 1970 by the union representing the employees of the Netherlands Antilles' only operating phosphate mine, the owner and operator of the mine, Mijnmaatschappij Curaçao, announced that it would be closed down upon expiration of the then existing labor contract at the end of April. However, a government proposal to resolve this impasse was approved by the company and by a government-supervised poll of the employees and plans to close the mine were shelved. This agreement specified that the mine employees were to receive a 7.5-percent raise but would be given no further increases for a 3-year period except for cost of living adjustments. It also allowed the company to reduce its employees from 488 to 400 by May 1970 and to 300 by 1973.

In September 1970, Aruba Chemical Industries, N.V., a subsidiary of W. R. Grace and Co., announced that it was discontinuing the production of urea and would limit its output to ammonia at its Aruba petrochemicals plant. This action was necessitated by export marketing problems resulting from the worldwide overcapacity of urea producing facilities. The halting of urea production was expected to result in a reduction of 110 employees in the company's existing 180-man work force.

Plans for the construction of a petrochemicals plant for the manufacture of base materials for plastics experienced a severe setback in November 1970 when the B. F. Goodrich Co. reportedly decided to withdraw from the project. This company was slated to supply 50 percent of the capital investment for the project and to contribute industrial techniques and patents for the process involved.

The output of mineral commodities in the Netherlands Antilles is shown in table 1.

Table 9.—Netherlands Antilles: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Iron and steel metal, scrap and other	4,975	4,653
Lead metal including alloys	--	13
Silver and platinum-group metal ......value	--	$5,833
Other nonferrous metals	814	2,238
NONMETALS		
Fertilizer materials:		
Crude	93,138	113,171
Manufactured:		
Nitrogenous	145,225	118,751
Other including mixed	805	--
Ammonia	22,337	39,907
Stone, sand and gravel	31,811	850
Other nonmetals	NA	72
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke including briquets	88	--
Petroleum:		
Crude ......thousand 42-gallon barrels	2,019	2,670
Refinery products:[1]		
Aviation gasoline ......do	6,695	6,159
Motor gasoline ......do	25,210	27,685
Kerosine and white spirit ......do	r 16,972	17,810
Jet fuel ......do	r 21,262	19,941
Distillate fuel oil ......do	r 25,985	22,764
Residual fuel oil ......do	r 137,930	147,681
Liquefied petroleum ......do	NA	316
Lubricants including greases ......do	r 6,723	6,013
Mineral jelly and wax ......do	258	247
Bitumen and other residues ......do	6,701	6,587
Other ......do	r 6,799	6,595

r Revised. 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 1968 and 1969).

Table 10.—Netherlands Antilles: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	138	250
Copper metal including alloys, all forms	343	279
Iron and steel semimanufactures	10,051	37,072
Lead metal including alloys, all forms	61	43
Nickel metal including alloys, all forms	--	2
Tin metal including alloys, all forms ... long tons	10	8
Zinc metal including alloys, all forms	78	123
Other:		
Nonferrous metal scrap	73	195
Base metals including alloys n.e.s	12	17
NONMETALS		
Cement	45,908	48,552
Clays and products (including all refractory brick):		
Crude	5,591	6,022
Manufactured	1,057	1,416
Diamond, gem not set or strung ... carats	2,440	1,905
Fertilizer materials:		
Crude	2	1
Manufactured	1,128	727
Gypsum and plasters	35	36
Lime	221	100
Precious and semiprecious stones, except diamond ... troy ounces	20	154
Salt	1,005	862
Sodium compounds	15,375	26,590
Stone, sand and gravel	11,091	7,116
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	12	14
Gas, liquefied petroleum, petroleum gas ... thousand 42-gallon barrels	354	271
Petroleum: [1]		
Crude ... do	253,636	285,450
Refinery products:		
Gasoline ... do	2,685	2,432
Kerosine and jet fuel ... do	1,466	342
Distillate fuel oil ... do	1,142	1,531
Residual fuel oil ... do	13,059	15,645
Lubricants ... do	90	117
Other ... do	3	21
Mineral tar and other coal, petroleum or gas derived crude chemicals	39	22

[1] Data obtained from refinery companies.

Source: Unless otherwise specified, Jaarstatistiek Van de In- en Uitoer 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) 1968 and 1969.

TRINIDAD AND TOBAGO [11]

Despite an 11-percent decline in crude oil output during 1970, petroleum production and refining accounted for about 25 percent of Trinidad and Tobago's gross national product, were the source of approximately 30 percent of government revenue and were responsible for over 80 percent of the country's total export receipts.

The rapid decline in crude oil production from a peak of 183,298 barrels per day in 1968 to 139,844 barrels per day during 1970 resulted largely from the depletion of several of the fields operated by Trinidad Northern Areas, Ltd., and Texaco Trinidad, Inc., the country's principal oil producing companies. However, secondary recovery and field development activities in progress or planned were expected to reverse this downward trend by late 1971 or early 1972. Indications were that water and gas injection programs initiated in the Guayaguayare fields of Texaco Trinidad, Inc., during 1970 would not only halt their declining output but would also restore them to their previous productivity. Plans were underway at yearend for the construction of at least one additional multiwell production platform in the offshore East Soldado field of Trinidad Northern Areas, Ltd., in order to offset declining output in the adjacent Soldado field. Production from the Trinidad-Tesoro Petroleum Co., Ltd., Galeota field located off Trinidad's east coast was expected to begin after completion of production and pipeline facilities during 1971. Another new east coast offshore discovery, the Radix field of Amoco Trinidad Oil Co., Ltd., was expected to begin producing in 1972.

[11] Gordon W. Koelling, geographer, Division of Fossil Fuels.

Seismic surveys were performed off both the northern and eastern coasts of Trinidad in 1970, but no onshore geophysical or geologic surveying was reported. A total of 112 development and 23 exploration wells with a combined total footage of 663,743 were drilled during the year. Only two of the exploratory wells drilled, including one in the East Queen Beach offshore acreage of Amoco Trinidad Oil Co., Ltd., were new field discoveries.

In March 1970, the Ministry of Petroleum and Mines announced that 17 bids had been received from 11 oil companies or groups of companies for exploration and production licenses covering 1,920,000 acres off the north coast of Trinidad. Following an analysis of these bids, the Ministry at midyear awarded nine permits covering about 79 percent of the acreage applied for. The Deutsche Erdölversorgungsgesellschaft, mbh (Deminex) -AGIP S.p.A. combine was granted two licenses totaling 414,600 acres, the Phillips Petroleum Caribbean. Ltd.-Cleary Petroleum Corp.-APCO Oil Corp. group received two permits also totaling 414,600 acres, Occidental of Trinidad, Inc., received two licenses with a combined area of 331,680 acres, the Amerada Hess Corporation of Trinidad and Tobago-565 Corp. (Ashland Oil & Refining Co.) combine was granted a permit covering 248,760 acres, and the Oceanic Exploration Co.-Santa Fe International Corporation Terra Trinidad and Tobago Ltd., group received a license covering 160,640 acres.

A strike against a U.S.-owned oil well service company, Halliburton-Tucker, Ltd., began at the end of October and was not settled until yearend. Halliburton was able to maintain fairly normal operations during the strike period with the use of supervisory and nonstriking personnel. However, a sympathy strike called against U.S.-owned oil comapnies in mid-December resulted in a few minor disruptions in operations.

At yearend, Texaco Trinidad, Inc., announced plans for the construction or desulfurization facilities at its Pointe-a-Pierre refinery. Included in these facilities will be a 100,000-barrel-per-day vacuum distillation unit, an 80,000-barrel-per-day hydrotreater, and a 250-ton-per-day sulfur recovery unit.

The production of mineral commodities in Trinidad and Tobago is shown in table 1.

Table 11.—Trinidad and Tobago: Exports and reexports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	69	93
Copper metal including alloys, all forms	400	264
Iron and steel:		
Scrap	477	7,380
Steel, primary forms	1	2
Semimanufactures:		
Bars, rods, angles, shapes, sections	89	206
Plates and sheets, all types	593	810
Other	193	38
Lead metal including alloys, all forms	69	61
Silver metal including alloys, all forms ... troy ounces	8,837	358
Tin metal including alloys, all forms ... long tons	92	131
Other, ash and residue containing nonferrous scrap	410	290
NONMETALS		
Barite and witherite	2	819
Clays and products (including all refractory brick)	237	2,339
Fertilizer materials manufactured:		
Nitrogenous	104,035	116,695
Other	37	4,095
Lime	8,066	9,979
Salt	95	30
Sodium and potassium compounds	1	5
Stone, sand and gravel	r 371	3,943
Other nonmetals	64	96
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	55,086	45,637
Coal	--	7
Gas, hydrocarbon, natural gas liquids	21,198	24,983
Petroleum:		
Crude and partly refined [1] ... thousand 42-gallon barrels	6,983	6,230
Refinery products:		
Gasoline ... do	20,150	20,943
Kerosine ... do	2,667	2,621
Jet fuel ... do	15,787	14,625
Distillate fuel oil ... do	16,579	15,330
Residual fuel oil ... do	76,725	80,810
Lubricants ... do	1,248	1,394
Other ... do	1,937	2,227
Mineral tar and other coal, petroleum, or gas derived crude chemicals	190,959	225,624

r Revised.
[1] 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, 1968, 433 pp.; 1969, 451 pp.

Table 12.—Trinidad and Tobago: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite and concentrate	--	11
Metal including alloys, all forms	434	955
Arsenic compounds	12	3
Chromium ores and concentrate	--	26
Copper:		
Ore and concentrate	17	2
Copper sulfate	28	9
Metal including alloys, all forms	115	155
Iron and steel:		
Scrap	246	1,665
Pig iron, ferroalloys and similar materials	16	14
Steel, primary forms	1,006	1,626
Semimanufactures:		
Bars, rods, angles, shapes, sections	15,270	17,697
Universals, plates and sheets	8,986	18,860
Tubes, pipes, fittings	24,689	15,973
Other	140	1,441
Lead:		
Ore and concentrate	245	2
Metal including alloys, all forms	193	149
Nickel metal including alloys	4	8
Platinum-group metals including alloys, all forms ... troy ounces	14	162
Silver including alloys ... do	51,035	61,642
Tin metal including alloys, all forms ... long tons	4,417	1,240
Zinc metal including alloys all forms	26	69
Other:		
Ore and concentrate	14	5
Ash and residue containing nonferrous metals	53	11
Metals including alloys, all forms	8	9
NONMETALS		
Abrasives, natural	22	27
Barite and witherite	r 14,971	67
Cement	4,043	3,801
Clays and products (including all refractory brick):		
Crude	617	159
Products	r 2,334	2,422
Feldspar	30	488
Fertilizer materials:		
Crude	16	1
Manufactured:		
Nitrogenous	179	318
Phosphatic	2,333	499
Potassic	2,741	4,280
Other including mixed	1,370	2,055
Lime	10	33
Magnesite	100	46
Mica, all forms	27	11
Precious and semiprecious stones, except diamond ... troy ounces	705	544
Salt	10,706	11,076
Sodium and potassium compounds n.e.s	5,576	7,309
Stone, sand and gravel:		
Dimension stone	r 590	966
Gravel and crushed rock	r 243	401
Sand	13	6
Other	r 8,959	13,757
Sulfur	44,788	19,114
Other n.e.s	625	684
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	57	51
Coal and coke	190	185
Gas, hydrocarbon, natural gas liquids	127	190
Petroleum: [1]		
Crude and partly refined ... thousand 42-gallon barrels	91,447	103,762
Refinery products:		
Gasoline ... do	r 32	7
Kerosine and jet fuel ... do	118	747
Residual fuel oil ... do	r 1,636	820
Lubricants ... do	r 49	43
Mineral jelly and wax ... do	r 1	1
Other ... do	r 98	43
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r 173	148

r Revised.
[1] 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, 1968, 433 pp.; 1969, 451 pp.

The Mineral Industry of Central America

By Burton E. Ashley [1] and Ronald C. Briggs [2]

CONTENTS

INTRODUCTION

The mineral industry of Central America is of little significance in international terms, but in most cases it is important to the economy of the individual country.

Honduras and Nicaragua are of some importance for base and precious metal output, with Honduras ranked 10th among world silver producers in 1969. Most of the countries produce construction materials, such as stone and sand and gravel, the importance of which to the domestic economy is often overlooked. Petroleum refineries within the countries also contribute to the local economy.

Exploration underway in 1970 gave hope for future significant production of copper, alumina, and nickel.

A metallogenic map [3] of Central America, with text, was published in 1970.

BRITISH HONDURAS [3]

Mineral and mining activity in British Honduras was limited during 1970 and of little importance to the national economy. The only mining activity reported was the production of limestone, marl, and sand and gravel for use in local construction. Both the public and private sectors shared in the production of these construction aggregates. The increase in limestone production, as shown in table 1, resulted from the construction of a new apron at the Belize International Airport. Government consumption of construction aggregates increased, but private construction declined, accounting for the decrease in sand and gravel production.

Several companies and individuals held or are holding exploration, prospecting, or mining licenses. Activity was limited, and no ventures proved successful. No mineral deposits of commercial value were discovered.

Four companies were engaged in oil exploration. These companies were conducting preliminary surveys and had not reported the discovery of any commercially attractive oil reserves.

The Ministry of Trade and Industry granted one development concession to a U.S.-owned corporation to build a fertilizer mixing plant. Prosser Fertilizer and Agrotic Co., Ltd., proposes to build a 12,000-ton-annual-capacity plant. Basic fertilizer materials will be imported. Some local mineral products, such as lime, will be utilized.

Foreign trade data for 1970 were not

[1] Physical scientist, Division of Nonferrous Metals.
[2] Physical scientist, Division of Nonmetallic Minerals.
[3] Dengo, G., and Enrique Levy. Mapa Metalogenetico de America Central; 1:2,000,000. Instituto Centroamericana de Investigacion y Tecnologia Industrial (ICAITI), Guatemala, Publicaciones Geologicas del ICAITI No. 3, 1970, 57 pp. (with tables and maps).
[4] Prepared by Ronald C. Briggs.

available for publication, but 1968 figures in table 2 indicate the normal magnitude for such trade. Exports and reexports of mineral commodities are usually limited to small quantities of scrap metal, salt, cement, and petroleum products.

Table 1.—Central American Areas: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
BRITISH HONDURAS			
Limestone [e]	135,000	134,000	146,000
Marl [e]	31,000	93,000	105,000
Sand and gravel [e]	576,000	222,000	193,000
COSTA RICA			
Cement	132,177	158,459	178,500
Diatomite [e]	10,000	15,000	19,000
Fertilizer materials manufactured:			
Nitrogenous, gross weight	28,000	36,000	40,000
Mixed and unspecified, gross weight	52,000	49,000	60,000
Gold [e] troy ounces	500	500	500
Lime [e]	8,000	8,000	10,400
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	482	510	488
Kerosine do	125	144	141
Distillate fuel oil do	858	894	839
Residual fuel oil do	460	570	527
Liquefied petroleum gas do	--	4	4
Salt [1]	12,000	8,864	7,551
Stone, sand and gravel:			
Limestone and other calcareous material [e]	230,000	240,000	250,000
Sand and gravel [e]	95,000	105,000	136,500
Other [e]	175,000	350,000	455,000
EL SALVADOR			
Aluminum metal, semimanufactures	915	907	908
Cement	154,400	141,713	166,694
Fertilizers manufactured:			
Phosphatic	8,937		
Nitrogenous	2,868	60,911	64,565
Mixed	41,607		
Gold, fine troy ounces	--	--	2,301
Gypsum	--	--	5,552
Iron and steel, steel semimanufactures	35,670	32,942	16,662
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	946	575	305
Kerosine do	369	229	163
Jet fuel do	84	69	--
Distillate fuel oil do	1,064	549	310
Residual fuel oil do	869	743	357
Liquefied petroleum gas do	147	74	50
Salt	24,230	27,223	31,357
Silver, fine troy ounces	--	--	153,516
Stone, limestone, and seashells	223,795	209,910	387,686
GUATEMALA			
Antimony mine output, metal content	15	100	261
Cement thousand tons	180	187	225
Feldspar	1,900	2,000	2,500
Gypsum	7,700	7,725	7,710
Iron ore and concentrate [2]	3,657	3,000	1,618
Lead:			
Mine output, metal content	472	[r] 60	1,087
Metal, including secondary	200	225	75
Lime	17,200	17,400	21,990
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	1,314	1,281	936
Kerosine and jet fuel do	547	580	380
Distillate fuel oil do	1,498	1,586	1,562
Residual fuel oil do	1,544	1,759	1,702
Liquefied petroleum gas do	79	96	107
Quartz	22,800	10,900	17,770
Stone, sand and gravel, crushed and broken:			
Limestone thousand tons	580	590	312
Dolomite	2,034	2,040	NA
Other (volcanic ash)	42,000	45,000	44,180
Tungsten mine output, metal content	12	--	--
Zinc mine output, metal content	--	931	
HONDURAS			
Antimony mine output, metal content	260	113	343
Cadmium mine output, metal content	128	153	187
Cement	128,750	131,727	150,549
Gold troy ounces	6,150	6,223	3,333

See footnotes at end of table.

Table 1.—Central American Areas: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 p
HONDURAS—Continued			
Gypsum	6,561	7,659	9,205
Lead mine output, metal content	13,175	13,839	15,965
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	e 569	678	898
Jet fuel ... do	e 49	21	48
Kerosine ... do	e 97	182	230
Distillate fuel oil ... do	e 471	1,013	1,524
Residual fuel oil ... do	e 439	1,587	2,127
Other ... do	e 34	36	52
Refinery fuel and losses ... do	e 51	209	256
Total ... do	1,710	3,726	5,135
Salt	22,505	27,802	27,000
Silver ... thousand troy ounces	4,397	3,905	3,816
Stone:			
Dimension stone, marble	1,410	NA	1,401
Crushed and broken	199,211	228,327	244,374
Zinc mine output, metal content	14,783	16,006	20,040
NICARAGUA			
Cement	101,601	109,046	136,000
Copper mine output, metal content	11,517	4,158	3,361
Gold mine output, metal content ... troy ounces	193,008	120,011	115,173
Gypsum and anhydrite, crude	14,000	30,000	30,000
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	880	660	927
Kerosine and jet fuel ... do	219	228	253
Distillate fuel oil ... do	741	673	933
Residual fuel oil ... do	682	614	922
Liquefied petroleum gas ... do	56	67	110
Salt, marine	NA	NA	e 10,000
Silver, mine output ... troy ounces	415,847	247,148	216,838

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Does not reflect total country production.
[2] Used in cement manufacture, except for 18 tons in 1970.

Table 2.—British Honduras: Foreign trade of selected mineral commodities

(Metric tons unless otherwise specified)

Imports	1967	1968	1969
Cement and lime	9,797	19,482	NA
Fertilizers, manufactured	2,067	4,682	NA
Iron and steel, semimanufactures	1,906	2,914	NA
Petroleum refinery products ... thousand 42-gallon barrels	r 308	420	373
Salt	732	684	NA

r Revised. NA Not available.

COSTA RICA [5]

Plans to produce bauxite and alumina in Costa Rica progressed on schedule, and the groundwork was laid for future construction of a plant and infrastructure.

Entreprise de Recherches et d'Activités Pétrolières (ERAP) continued petroleum exploratory work in the northern part of the country. The Government was considering granting exploratory concessions along the Pacific coastal and offshore areas to Continental Oil Co. and Petrolera Centroamericana, S.A., among others.

PRODUCTION

Increased output was registered in nearly all mineral categories in 1970 with appreciable gains in cement, diatomite, fertilizers, and construction materials. Road building programs over the next few years should increase demand for ballast and other highway construction materials.

Refinery input and output decreased because of pipeline interruptions caused by floods. Refinery shutdowns resulted from time to time because of lack of storage facilities at Limón.

TRADE

Mineral commodity exports from Costa Rica are small, the most important categories being iron and steel semimanufactures

[5] Prepared by Burton E. Ashley.

and fertilizer materials. Exports of all mineral commodities were generally down in 1969 compared with 1968 levels.

Chief imports were fertilizer materials, iron and steel products, and mineral fuels. Fertilizer and steel product imports rose 7 percent and 21 percent, respectively, over 1968 levels, but imports of petroleum products decreased 30 percent. Crude oil imports gained 12 percent over the preceding year.

Tables 3 and 4 show details of Costa Rican foreign trade in minerals for 1968 and 1969.

Table 3.—Costa Rica: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum, metal, including alloys, all forms	13	18	Mainly to Honduras.
Iron and steel, metal, including alloys, all forms	10,813	9,601	Do.
Lead metal, including alloys, all forms	9	14	All to Guatemala.
Other metals, nonferrous, all forms, n.e.s	80	92	West Germany 45; Nicaragua 30.
NONMETALS			
Abrasives, natural	9	--	
Asbestos	--	24	All to Nicaragua.
Cement	178	272	Mainly to Nicaragua.
Clays and products	209	135	Do.
Diatomite and other infusorial earths	186	74	Panamá 40; Nicaragua 33.
Fertilizer materials manufactured:			
Nitrogenous	21,677	14,077	Mexico 5,040; Nicaragua 3,664; El Salvador 3,471.
Other, including mixed	30,576	27,660	Panamá 10,433; El Salvador 5,790; Mexico 5,040; Nicaragua 4,629.
Gypsum	24	--	
Lime	5	16	All to Panamá.
Pigments, mineral, crude	124	2	Honduras 1; Nicaragua 1.
Salt	7	22	All to Nicaragua.
Stone, sand and gravel:			
Dimension stone	195	40	Mainly to Panamá.
Sand and gravel	--	1	All to the United States.
Other nonmetals, n.e.s	r 933	207	Mainly to Nicaragua.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products thousand 42-gallon barrels	212	114	Panamá 58; Panama Canal Zone 30.

r Revised.

Source: Ministerio de Industria y Comercio, Dirección General de Estadística y Censos. Comercio Exterior de Costa Rica (Foreign Commerce of Costa Rica). San José, Costa Rica, 1968, 428 pp.; 1969, 520 pp.

Table 4.—Costa Rica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum, metal including alloys, all forms	1,146	1,264	Panamá 437; San Salvador 214; Italy 149.
Copper:			
Copper sulfate	20	29	United Kingdom 15; West Germany 14.
Metal, including alloys, all forms	216	311	Japan 116; Mexico 82.
Iron and steel:			
Scrap	22	--	
Pig iron, ferroalloys, and similar materials	--	15	Mainly from West Germany.
Steel, primary forms	15,687	18,074	Belgium-Luxembourg 13,037; West Germany 3,491.
Semimanufactures	55,476	67,344	Japan 29,061; United States 13,408; West Germany 8,108.
Lead, metal including alloys, all forms	138	117	West Germany 37; Denmark 20; United States 18.
Nickel metal including alloys, all forms	5	5	West Germany 2; United Kingdom 1.
Platinum group and silver including alloys:			
Platinum group troy ounces	932	3,922	Mainly from United States.
Silver do	18,551	8,295	Do.
Tin metal including alloys, all forms long tons	8	29	West Germany 17; United States 7.
Zinc metal including alloys, all forms	1,027	1,453	Japan 577; Mexico 372; Canada 325.
Other:			
Ore and concentrate of base metals, n.e.s	558	224	Mainly from United States.
Metals including alloys, all forms	2	24	Mainly from Panamá.

See footnotes at end of table.

Table 4.—Costa Rica: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS			
Abrasives, natural, n.e.s	174	46	West Germany 20; United States 15.
Asbestos	298	457	Mainly from Canada.
Boron materials, oxide and acid	21	47	West Germany 18; United States 12.
Cement	2,152	3,275	Japan 1,946; Mexico 638; West Germany 401.
Clays and products (including refractory brick):			
Crude	1,388	767	United States 396; United Kingdom 328.
Products	3,613	5,967	Mainly from Nicaragua.
Diamond, industrial carats	125,000	90,000	Republic of South Africa 50,000; United States 40,000.
Diatomite and other infusorial earths	346	440	United States 238; Mexico 202.
Feldspar	--	9	All from United States.
Fertilizer materials, crude and manufactured:			
Nitrogenous	56,448	67,860	West Germany 15,763; Curacao and Aruba 12,816; Colombia 10,089; Netherlands 4,365.
Phosphatic	20,295	17,894	Mainly from United States.
Potassic	22,952	25,134	Do.
Other, including mixed	19,824	16,612	Netherlands 7,016; United States 4,441.
Graphite, natural	10	23	Japan 13; United States 5.
Gypsum and plasters	6,489	5,408	Mainly from Nicaragua.
Lime	4	9	Mainly from France.
Mica, all forms	7	(1)	All from United States.
Pigments, mineral, including processed iron oxides	1	3	Mainly from United States.
Precious and semiprecious stones, except diamond kilograms	111	87	Mainly from West Germany.
Salt, including brines	4,105	3,925	Mainly from Nicaragua.
Sodium and potassium compounds, n.e.s	1,283	1,236	Do.
Stone, sand and gravel	304	181	Italy 89; Guatemala 60; Mexico 20.
Sulfur, elemental, all forms	37	47	West Germany 29; United States 10.
Talc, steatite, soapstone, and pyrophyllite	267	257	Italy 158; United States 57.
Other nonmetals, n.e.s	15	4	West Germany 3; United States 1.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon	966	465	Colombia 364; Canada 45.
Coal and coke, including briquets	253	176	West Germany 117; United States 51.
Gas, hydrocarbon, natural gas liquids thousand 42-gallon barrels	45	53	Mainly from Venezuela.
Petroleum:			
Crude and partly refined do	2,039	2,281	Do.
Refinery products:			
Gasoline do	170	155	Mainly from Curacao and Aruba.
Kerosine do	65	74	Trinidad and Tobago 44; Curacao and Aruba 22.
Distillate fuel oil do	203	183	Curacao and Aruba 120; Venezuela 47.
Lubricants do	82	83	United States 33; Trinidad and and Tobago 30.
Mineral jelly and wax do	14	16	Mainly from United States.
Other, bitumen and other residues	8,967	7,558	Mainly from Venezuela.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	346	526	Mainly from United States.

[1] Less than ½ unit.

Source: Ministerio de Industria y Comercio, Dirección General de Estadística y Censos. Comercio Exterior de Costa Rica (Foreign Commerce of Costa Rica). San José, Costa Rica, 1968, 428 pp.; 1969 520 pp.

COMMODITY REVIEW

Metals.—*Bauxite.*—A contract was signed in April between the Government of Costa Rica and Alcoa of Costa Rica, Inc., which clears the way for Alcoa to commence its bauxite-alumina operation in that country.[6] The bauxite mining operation will be located in southern Costa Rica near San Isidro de El General. It was expected that Alcoa would build a $60 million alumina plant with capacity of 440,000 tons per year. About 1.3 million tons of bauxite will be required annually. The 25-year contract calls for utilization of 120 million tons of bauxite and is automatically renewable for an additional 15 years if Alcoa has spent or invested at least $150 million during the first 25 years.

The Costa Rican Government was to

[6] Metals Week. V. 41, No. 19, May 11, 1970, p. 25.

spend $11 million for port facilities on the Pacific coast and a 30-mile highway from port to plant. Alcoa must complete the alumina plant within 4 years of the time that the port and highway are completed.

The possibility of an aluminum smelter was considered in that Alcoa agreed to sell 55,000 tons of alumina annually to any smelter that might be built.

In August, discovery of a lateritic bauxite deposit was announced through the Ministry of Industries and Commerce.[7] The deposit, situated between Paraíso and Cervantes de Cartago, was estimated to have reserves of between 12 and 15 million tons of ore. Containing a high proportion of gibbsite, the grade was reported at 44 percent total alumina with 30 percent recoverable. This grade was said to be similar to that found in the Alcoa concession.

Copper.—Minas de Talamanca, S.A., was conducting mining and exploration operations over an area of 28 square kilometers on the Inter-American highway about 20 kilometers north of San Isidro de El General. Reserves were not estimated, but the deposit appears to be of vein type with chalcocite, malachite, and azurite. The average grade of ore was not reported, but it was said that in some veins chalcocite of sufficient purity was found to allow direct bagging of the crushed ore, all of which had been shipped to Germany. Silver and gold were also reported associated with the ore.

Nonmetals.—*Fertilizer Materials.*—It was reported that Esso Chemical Co. arranged for the sale of its 97-percent interest in Fertica, S.A., to Guanos y Fertilizantes de Mexico, S.A., which is largely owned by the Mexican Government.

Sulfur.—Brameda Resources Ltd. continued appraisal of the Gongora sulfur deposit. Some 138,000 cubic yards of overburden had been stripped to expose the top of the sulfur-bearing horizon. Test drilling was in progress to further appraise the deposit.

EL SALVADOR [8]

The mineral industry of El Salvador was not of great importance to the economy, but planned projects under consideration could increase the share which minerals contribute. Under the terms of a commercial agreement signed between El Salvador and Korea, the two countries may (among other things) enter into a joint agreement to construct a cold-rolling mill for steel flat products in El Salvador. Previously abandoned gold properties were being reexamined for renewed operation.

Early in 1970 the International Development Association (IDA) approved credit equivalent to $5.6 million for electric power generation development in El Salvador. The project will assure adequate power for the capital, San Salvador, and will strengthen the power grid to the industrialized eastern part of the country.

The Comisión Ejecutiva Hidroelectrica del Rio Lempa (CEL) was to be responsible for execution of the project, which should be completed in 1973 at a total cost of $7 million. Future plans of CEL for power development may make use of geothermal resources which were being studied by the United Nations Development Programme. Preliminary reports indicated that there was potential for commercial power generation.

In general, El Salvador policy favors incoming foreign investment which does not compete with established enterprises—particularly those conducted by El Salvador nationals. As is common in many countries, new investment is more welcome if a national is included in the firm.

PRODUCTION

El Salvador reported its first output of gold and silver since 1960. (See Commodity Review for details.) Cement production increased 18 percent over that of 1969, and smaller gains were shown in manufactured fertilizer and salt output. The considerable rise in limestone production was a reflection of gains made in cement output. Steel semimanufactures and petroleum refinery products registered losses compared with results in 1969.

Table 1 details mineral production in El Salvador during 1968–70 inclusive.

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[7] Dóndoli, César. Localization de un Horizonte Lateritico Bauxitico en la Zona de Paraíso de Cartago. Ciudad Universitaria Rodrigo Facio, Informes Tecnicos y Notas Geologicas, No. 36, June 1970, 21 pp.

[8] Prepared by Burton E. Ashley.

Table 5.—El Salvador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
Cement	45,538	48,525
Fertilizer materials, manufactured	32,570	35,982
Iron and steel, metal	19,404	14,461
Petroleum, refinery products ... thousand 42-gallon barrels	767	678
Salt	9,124	9,860

Source: Ministério de Economia, Anuario Estadistico, v. 1 Exportacion, 1969.

Table 6.—El Salvador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum including alloys:			
Unwrought	841	1,172	All from the United States.
Semimanufactures	1,247	883	United States 456; France 126; West Germany 105; Belgium-Luxembourg 80.
Copper:			
Copper sulfate	6	4	West Germany 2; United States 1.
Metal, including alloys, all forms	1,550	922	Mainly from the United States.
Iron and steel:			
Ore and concentrate	132	--	
Scrap	1,445	125	United States 87; West Germany 25.
Pig iron, ferroalloys, and similar materials	159	219	Guatemala 144; West Germany 26; Norway 22.
Steel, primary forms	36,322	31,693	Mainly from Belgium-Luxembourg.
Semimanufactures	29,995	35,950	Japan 12,390; Belgium-Luxembourg 6,353; United States 4,408; Guatemala 3,133.
Other	3	10	Mainly from Guatemala.
Lead metal including alloys:			
Unwrought	49	123	Mexico 72; West Germany 25; Guatemala 16.
Semimanufactures	197	181	West Germany 72; United States 44.
Nickel metal including alloys, all forms	3	(1)	All from West Germany.
Silver metal including alloys ... troy ounces	3,890	4,919	Mainly from the United States.
Tin metal including alloys:			
Unwrought ... long tons	5	4	Netherlands 2; United States 1.
Semimanufactures ... do	19	13	Mainly from the United Kingdom.
Zinc metal including alloys, all forms	649	893	Japan 625; Canada 249.
Other:			
Ore and concentrates	1	--	
Ash and residue containing nonferrous metals	3	21	Mainly from Guatemala.
Base metals, including alloys, n.e.s	2	11	Mainly from West Germany.
NONMETALS			
Abrasives, natural: Pumice, emery, natural corundum	(1)	6	United States 3; West Germany 1; Italy 1.
Asbestos	1,019	754	Canada 660; Republic of South Africa 93.
Boron materials, oxide and acid	7	4	United States 2; West Germany 2.
Cement	39,879	49,867	Guatemala 38,781; Honduras 9,369.
Clays and products (including all refractory brick):			
Crude clays, n.e.s.:			
Kaolin	746	781	Guatemala 442; United States 197; Netherlands 104.
Other	45	81	United States 45; Guatemala 21.
Products	1,563	1,321	United States 492; Guatemala 177; West Germany 165.
Diamond, industrial ... carats	20,000	60,000	United States 30,000; Costa Rica 20,000.
Diatomite and other infusorial earths	588	499	United States 296; Guatemala 125.
Feldspar and fluorspar	2	--	

See footnotes at end of table.

Table 6.—El Salvador: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude	201	(1)	All from West Germany.
Manufactured:			
Nitrogenous	93,778	100,244	West Germany 31,273; United States 26,548; Belgium-Luxembourg 19,764.
Phosphatic	16,368	32,077	Mainly from the United States.
Potassic	1,823	3,293	Do.
Other, including mixed	37,027	53,764	United States 14,908; West Germany 13,297; Italy 8,685.
Graphite, natural	1	2	West Germany 1; Italy 1.
Gypsum and plasters	3,165	3,758	Guatemala 2,270; Honduras 1,444.
Lime	1,561	1,669	Mainly from Guatemala.
Mica, all forms	6	11	Guatemala 8; United States 3.
Precious and semiprecious stones, except diamond kilograms	33	47	West Germany 23; France 14.
Salt (excluding brines)	157	121	Mainly from the United States.
Sodium and potassium compounds, n.e.s	2,288	3,237	Nicaragua 2,141; United States 471.
Stone, sand and gravel:			
Dimension stone	2,426	4,444	Mainly from Guatemala.
Gravel and crushed rock	1,046	1,237	Netherlands 991; West Germany 189.
Other	2,436	3,986	Mainly from Guatemala.
Sulfur, elemental, all forms	3	3,256	Mainly from the United States.
Talc, soapstone, and pyrophyllite	142	100	United States 61; Italy 16; Panama Canal Zone 12.
Other n.e.s	425	332	Spain 290; Mexico 26.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6,508	5,631	Venezuela 3,594; Netherlands Antilles 2,016.
Coal and coke, including briquets	311	367	Mainly from West Germany.
Natural gas liquids 42-gallon barrels	2	28	Mainly from Venezuela.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	3,490	2,195	All from Venezuela.
Refinery products:			
Gasoline do	35	59	Netherlands Antilles 45; Guatemala 13.
Kerosine do	16	14	Netherlands Antilles 6; Venezuela 5.
Gas oil, diesel oil do	2	2	All from Netherlands Antilles.
Lubricants do	38	33	United States 16; Jamaica 9; Netherlands Antilles 6.
Mineral jelly and wax do	14	14	Mainly from the United States.
Other, bitumen and other residues do	1	1	Do.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	282	145	United States 70; United Kingdom 57.

1 Less than ½ unit.

Source: Ministério de Economia. Anuario Estadistico, Comercio Exterior. V. I, 1968, 850 pp.; 1969, 443 pp.

COMMODITY REVIEW

Metals.—*Gold and Silver.*—Cía Minera San Cristobal, S.A. (MSC) is 100 percent owned by the Government-sponsored Instituto Salvardoreño de Fomento Industrial (INSAFI). The property, comprising the MSC interests, was formerly called Minerales Montecristo. The old Montecristo mine, idle for some years, is located at El Divisadero, in the Department of Morazán.

INSAFI reportedly leased MSC to Canadian Javelin, Ltd., over a 5-year term for $1 million. If ore value attains $70 per ton, Canadian Javelin has an option to buy the property, with further payments to MSC in the form of royalties.

The mill was reportedly commissioned on March 15, 1970.[9] No details of the mining plan or reserves were available.

It was reported that the San Sebastian gold mine was being reopened by Cía Minera San Sebastian, a Nevada corporation.[10] A 100-ton-per-day mill was being completed while development work was in progress. Underground mining was found to be necessary after a drilling program showed that open pit operation was not feasible.

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9 World Mining. Catalog Survey Directory. V. 6, No. 7, June 25, 1970, p. 150.

10 Work cited in footnote 9.

GUATEMALA [11]

Guatemala's small mineral industry has potential for considerable expansion, considering the negotiations in progress for nickel production and reports of prospecting and prospects.

Final negotiations were underway for development of a large nickel-producing complex near Lake Izabal by International Nickel Co. of Canada Ltd. and The Hanna Mining Co. Basic Resources International Ltd. reportedly[12] had spent about $5 million on prospecting its concessions of 3 million acres. Monsanto Co. joined Basic on a joint venture basis on an oil-sulfur drilling prospect on the Las Tortugas structure in the Department of Alta Verapaz. Monsanto paid $100,000 to Basic and agreed to drill five wells on about one-third of the concession. In return, Monsanto would earn a 50-percent interest in the property when a 50-million-barrel reserve of oil was developed. One of the wells drilled reportedly had a show of 32.41 gravity oil at 60° F.

An important contribution to the general knowledge of North American geology was published in the form of a geological map of the Republic of Guatemala.[13] The map was published in four sheets at the scale of 1:500,000. The contour interval for the topographic base is 200 meters. The map contains information that has not been published elsewhere. Standard North American symbols were used, and the legend is in Spanish and English.

PRODUCTION

Production of nonmetallic construction materials generally declined from levels of the preceding year. Manufacture of cement recorded a 20-percent increase, but refinery output decreased about 12 percent. The largest increases in production of nonmetals were recorded in quartz, 63 percent, and lime, 26 percent. Production of lead rose by 17-fold over the 1969 level.

COMMODITY REVIEW

Metals.—*Copper.*—Exploratory work on a copper property discovered in 1967 by Basic Resources International Ltd. proceeded to the stage that reserves so far proved appear to justify commencement of milling and mining. In late 1970, it was reported[14] that Sumitomo Metal Mining Co., Ltd., and Basic had executed a letter of intent in regard to the Oxec copper prospect. According to the agreement, Sumitomo was to purchase all concentrates produced from the property for a period of 7 years. Sumitomo would also advance funds for the purchase of the equivalent of 1 year's design capacity of the concentrator which was to be built. A 1,000-ton-per-day concentrator was originally considered, but that figure could be revised upward with discovery of further reserves. The sum to be advanced by Sumitomo should be adequate to pay for commissioning the mine and mill; Sumitomo would be repaid the amount of the advance during the first 5 years of operation.

In March 1970 proven ore reserves were reported at 1.1 million tons averaging 2.62 percent copper, and 215,078 tons of probable ore averaging 2.13 percent copper.

Nickel.—The International Nickel Co. and the Government of Guatemala continued discussions which could lead to investment of $250 million to develop the nickel property near Lake Izabal. Agreement had not been reached at yearend, but it was expected that mutually satisfactory arrangements could be agreed upon in early 1971. It was expected that the Government of Guatemala would hold a share in the enterprise; financing would have to be found outside the country.

Exploraciones y Explotaciones Mineras Izabal S.A., the operating company in Guatemala, is held by the International Nickel Co. of Canada, Ltd., and The Hanna Mining Co. in proportions of 80 percent and 20 percent, respectively. When fully operational, production was planned at a rate of 60 million pounds of nickel annually.

Zinc, Cadmium, Lead, and Silver.—Minas de Oriente, S.A. (MINORSA), a subsidiary of Minnesota Mining and Manufacturing Co., shipped[15] 500 tons of

[11] Prepared by Burton E. Ashley.
[12] Journal of Commerce. V. 305, No. 22,230, July 10, 1970, p. 1.
[13] Bonis, Samuel, Otto Bohnenberger, and Gabriel Dengo. Mapa Geológico de la Republica de Guatemala. Instituto Geográphico Nacional, Guatemala, 1970.
[14] Engineering and Mining Journal. V. 171, No. 11, November 1970, p. 354.
[15] Skillings' Mining Review. V. 59, No. 47, Nov. 21, 1970, p. 4.

zinc-cadmium concentrates and 125 tons of lead-silver concentrates to Japan in late 1970.

The ore was mined during underground exploration at the Ballena and Montenegro mines and milled at the 35-ton-per-day pilot plant at La Canada. About 100 men were employed in the mining and concentrating operations. Exploration continued at the mines.

Nonmetals.—*Cement.*—Cementos Novella, S.A., planned to invest $10 million for a new cement plant in the Department of El Progreso. The new plant was to have a capacity of 1,000 tons of cement daily.

Fertilizers.—Construction continued on the plant of Fertilizantes del Istmo Centro-Americana, S.A.; it cost $1.6 million and has a capacity of 60,000 tons per year of mixed fertilizers. Completion was expected in late 1970 or early 1971. Guanos y Fertilizantes de Mexico, S.A., had a substantial interest in the plant. Raw materials will probably come from Mexico, and about 60 percent of production will be exported to Mexico; the remainder of the output was to be distributed in Guatemala and other countries of the Central American Common Market.

It was reported that a broad-gauge spur line was being built from the Mexican border to the plant's location at Tecún Umán, Municipio de Ayutla.

Mineral Fuels.—*Petroleum.*—Texas Petroleum Co., a subsidiary of Texaco Inc., announced plans to increase the capacity of its refinery at Escuintla to 14,000 barrels per day from the originally rated 8,500 barrels. Lummus Co., which built the original refinery in 1964, was awarded the expansion contract.

Esso Standard Guatemala, S.A., was granted concession rights over 125,366 hectares offshore from the Pacific Coast.

HONDURAS [16]

The mining industry in Honduras is not large, but increasing interest indicates potential for growth. Discoveries of iron ore and opal were reported in the Department of Lempira, but no details were available. New York and Honduras Rosario Mining Company (NYH) continued mining and development at its El Mochito mine; in addition, further exploration was being carried out near El Mochito on a base metal prospect.

Cía. Minera Los Angeles, S.A., was sold to a group in the name of International Metals Ltd. of Hong Kong. Moramulca Mines, S.A., which began operations in 1968, was in the process of liquidation by the shareholders. It was reported that the mine was unprofitable at an average ore grade of 0.24 ounce of gold and 4.5 ounces of silver per ton.

Cía. Interamericana de Desarrollo de Honduras suspended its antimony mining activities in mid-1970 because of the decline in world prices.

The joint United Nations-Government of Honduras mineral exploration project, which began in early 1970, was extended to June 1972. Eight foreign technicians were active in appraising the mineral potential of 10,800 square kilometers in western Honduras adjacent to the Guatemalan border. As has been customary in such projects, the entire prospective area was declared a national mineral reserve; it was expected that the Government would solicit bids from private companies to further examine any favorable prospects found.

It was reported that $2.25 million was invested in petroleum exploration during 1970. Fourteen exploration permits were awarded during the year, comprising 7 million square hectares offshore and about 800,000 square hectares onshore.

No drilling was done in 1970, but there was considerable prospecting activity in progress. It was expected that some exploratory drilling would start by 1972 in order to meet conditions under which some exploration permits were granted.

The new Honduran Mining Code was published in the Official Gazette on August 13, 1970. The text of the law is divided into 15 Titles, containing a total of 153 Articles. The law was designed to encourage new investment in mining by requiring a more rapid relinquishment of properties that are not under active development.

Of interest to producers was the 4-percent production tax put on the value of

[16] Prepared by Burton E. Ashley.

gold and silver and the 2-percent tax on other metals and nonmetals.

Article 147, under Title XIV, states that within 5 years of the date on which the law becomes valid, the Secretariat of Natural Resources, the Central Bank of Honduras, and the investing companies must install smelting plants so that the ore which was customarily exported as concentrates shall be processed in Honduras.

PRODUCTION

Mine production of base metals in 1970 increased satisfactorily over 1969 levels with gains of 15 percent and 25 percent in lead and zinc, respectively. Production of precious metals, however, decreased with a 46-percent drop in gold output and a 2-percent drop in silver. Cadmium production increased 22 percent. Nonmetallic construction material is also produced in Honduras, but quantities in some categories are not regularly reported. In 1970 clay, sand and gravel production amounted to 1,435, 35,087, and 52,238 cubic meters, respectively.

During its second full year of operation Refinería Texaco de Honduras, S.A. recorded increased levels of product output over those of the preceding year. Total output of products gained 39 percent, and refinery throughput increasd 38 percent.

TRADE

Chief Honduran mineral exports by value and volume consisted of base and precious metals contained in concentrates. Exports of nonmetallic minerals and mineral fuels were insignificant. Exports of metal-containing ores were nearly all consigned to the United States. Minor export trade of nonmetallic minerals and mineral fuels was directed to neighboring countries. Chief imports were of iron and steel shapes, fertilizer materials, and mineral fuels. Iron and steel came in nearly equal quantities from Belgium-Luxembourg, West Germany, and the United States. West Germany provided over one-third of the fertilizer materials, with the Netherlands and Mexico supplying the remainder. Venezuela supplied most of the crude oil imports, and minor quantities of products came from neighboring countries.

Tables 7 and 8 detail the foreign mineral trade of Honduras for 1968 and 1969.

COMMODITY REVIEW

Metals.—*Gold, Silver, Lead, Zinc, and Cadmium.*—NYH reported lower financial gains at its El Mochito mine as a result of general world economic conditions. Expansion of the mine proceeded on schedule with increase of reserves and higher tonnage milled. Grade of ore delivered to the mill increased for lead and zinc content but decreased for silver and gold.

Total ore reserves (assured and probable) increased 16 percent to 2.1 million tons. Average grade of the reserves was reported as follows: gold, 0.008 ounce per ton; silver, 12.3 ounces per ton; lead, 9.23 percent; and zinc, 9.73 percent.

There were 268,095 tons of ore mined and 270,025 tons milled. Average grade of ore per ton, delivered to the mill, was reported at 7.7 percent lead and 8.3 percent zinc; gold and silver content was 0.016 and 14.5 ounces per ton, respectively.

Content of mill concentrates for the year was as follows: silver, 3.6 million ounces; gold, 3,333 ounces; lead, 16,568 tons; zinc, 20,474 tons; and cadmium, 385,863 pounds.

Average number of employees increased to 1,207 compared with 1,110 for the preceding year.

Iron and Steel.—Trefiladora Centroamericana, S.A. de C.V. (TREFICA), temporarily located in Tegucigalpa, began producing barbed wire in later 1970. The principal stockholder, and technical partner, is the Bekaert Group of Belgium, with a share interest of 55 percent; the National Development Bank of Honduras holds 14 percent of the shares and Honduran nationals hold the remaining interest. Bekaert has been the traditional supplier of barbed wire to Honduras, and its trademark, "Motto", has become synonymous with "barbed wire" there.

The plant uses imported wire and produces 60,000 rolls per 8-hour shift annually. Each roll contains 400 varas, at about 33 inches to the vara (1,100 feet). The plant began working with two shifts per day in order to supply the Honduran demand alone. A roll of the finished wire retailed for $8.25.

The initial phase of the investment cost $250,000, and the second phase, to be completed in 1972, will cost an additional $750,000. The completed plant will be located at San Lorenzo and, at that time, will be able to manufacture the basic wire, thus doing away with the need for imports.

The plant employs 17 Honduran nationals and one Belgian manager.

Table 7.—Honduras: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Antimony, ore and concentrate	188	55	United States 37; United Kingdom 17.
Cadmium, ore and concentrte	113	162	All to United States.
Copper, ore and concentrate	--	11	Do.
Gold worked or unworked troy ounces	6,005	7,221	NA.
Iron and steel, metal and alloys, all forms	359	1,173	El Salvador 850; Nicaragua 207.
Lead, ore and concentrate	12,826	12,771	All to United States.
Silver:			
Ore and concentrate thousand troy ounces	3,865	3,191	Do.
Metal, including alloys do	851	504	Do.
Zinc:			
Ore and concentrate	9,719	16,289	Do.
Metal, including alloys	5	--	
Other:			
Ash and residue, containing nonferrous metals	161	136	West Germany 57; Netherlands 38.
Metals, including alloys, all forms	--	224	Mainly to United States.
NONMETALS			
Cement	28,231	14,315	El Salvador 10,227; British Honduras 3,905.
Clays and products	58	51	Mainly to El Salvador.
Fertilizer materials, crude	29	--	
Gypsum	930	1,493	Do.
Lime	52	10	All to El Salvador.
Salt	6,613	4,652	Mainly to Nicaragua.
Stone:			
Dimension stone	36	65	Nicaragua 35; El Salvador 30.
Other stone	71	129	El Salvador 71; Nicaragua 56.
Other nonmetals n.e.s	177	--	
MINERAL FUELS AND RELATED MATERIALS			
Gas, hydrocarbon, natural and artificial	--	8	All to Nicaragua.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	144	298	Mainly to Dominican Republic.
Distillate fuel oil do	606	324	Panama Canal Zone 216; Dominican Republic 49.
Residual fuel oil do	--	1,284	Panama Canal Zone 834; Panamá 304.
Lubricants 42-gallon barrels	17	592	Jamaica 135; Costa Rica 113; El Salvador 106; Guatemala 85.

NA Not available.

Source: Secretaría de Economía y Hacienda. Dirección General de Estadística y Censos. Comercio Exterior de Honduras (Foreign Commerce of Honduras). V. 1, 1968, 135 pp.; 1969, 164 pp.

Table 8.—Honduras: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum, metal including alloys, all forms	392	509	United States 151; El Salvador 99; West Germany 83.
Copper:			
Copper sulfate	108	149	Mainly from United States.
Metal, including alloys, all forms	66	107	Do.
Iron and steel including alloys, all forms	29,855	35,186	Belgium-Luxembourg 8,691; West Germany 8,689; United States 7,090.
Lead metal including alloys	50	52	United States 23; Mexico 21.
Nickel metal including alloys	(1)	--	
Silver metal including alloys troy ounces	6,044	1,511	Mainly from United States.
Tin metal including alloys, all forms long tons	10	10	Do.
Zinc metal including alloys	49	53	Do.
Other:			
Ore and concentrate	(1)	9	Mainly from Guatemala.
Ash and residue, containing nonferrous metals	38	1	All from United States.
Metals, including alloys, all forms	3	10	Mainly from United States.
NONMETALS			
Abrasives	--	27	Mainly from United States.
Asbestos	1,835	285	Mainly from Canada.
Cement	9,190	4,499	El Salvador 2,898; West Germany 491.
Clays and products (including all refractory brick):			
Crude kaolin and other clay earths	810	427	Mainly from United States.
Products, including nonclay brick	2,010	1,562	United States 533; Nicaragua 511; El Salvador 273.
Diatomite and other infusorial earths	201	509	Nicaragua 284; United States 190.
Fertilizer materials, crude and manufactured	37,696	35,260	West Germany 12,701; Netherlands 9,594; Mexico 3,196.
Gypsum and plasters	28	31	United States 17; West Germany 10.
Lime	489	322	Mainly from West Germany.
Salt	1,312	553	Mainly from El Salvador.
Sodium and potassium compounds	2,335	1,088	United States 569; West Germany 167; France 154.
Stone, sand and gravel:			
Dimension stone, crude and partly worked	307	478	Mainly from Guatemala.
Sand, quartz, and other rock	141	150	Austria 40; Belgium-Luxembourg 40; West Germany 29.
Sulfur, elemental, all forms	448	682	Mainly from West Germany.
Talc and steatite	72	59	Italy 26; United States 19.
Other n.e.s	3	2	Mainly from West Germany.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, natural	--	1	All from United States.
Coal and coke, including briquets	208	347	United States 245; West Germany 101.
Gas, hydrocarbons, natural and artificial	2,111	486	Mainly from El Salvador.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	2,179	3,495	Mainly from Venezuela.
Refinery products:			
Gasoline do	493	271	El Salvador 161; Netherlands Antilles 83.
Kerosine and jet fuel do	140	55	Mainly from El Salvador.
Gas oil, diesel oil do	792	439	Netherlands Antilles 221; El Salvador 167.
Residual fuel oil do	--	4	Mainly from El Salvador.
Lubricants do	48	51	United States 30; Netherlands Antilles 10.
Other do	6	42	Netherlands Antilles 22; Netherlands 8.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4,758	5,966	Mainly from United States.

[1] Less than ½ unit.

Source: Secretaría de Economia y Hacienda, Dirección General de Estadística y Censos. Comercio Exterior de Honduras (Foreign Commerce of Honduras). V. 2, 1968, 135 pp.; 1969, 280 pp.

NICARAGUA [17]

The minerals industry of Nicaragua is not of great importance to that country's economy and does not figure in listed key economic indicators. Expansion of copper mining, development of a base metals property, new salt production, and added capacity in petroleum refining and petro-

[17] Prepared by Burton E. Ashley.

chemicals should provide a welcome addition to the mineral industry. Exploration for petroleum was underway, and a number of companies were active in drilling and geophysical work.

Nicaragua's long range power needs may be supplied from geothermal sources. A $500,000 survey financed by the U.S. Agency for International Development has as its purpose the locating of subsurface reservoirs of steam or hot water. Texas Instruments Inc. was carrying out the survey contract in the western part of the country. Initial efforts were to be concentrated in the San Jacinto—Tisate area where manifestations of subsurface geothermal activity are evident in surface hot spring emanations. It was expected that the survey would require about 14 months to complete.

The organic law of the National Nuclear Energy Institute was officially published as Decree 36–70 on June 22, 1970. The decree created the Instituto Nacional de Energia Nuclear (INEN) as a state entity responsible to the President through the Minister of Economy. INEN was to be responsible for all technical and functional aspects of the national interest in nuclear energy. Regulations implementing the organic law were to be published later.

PRODUCTION

Output of copper, gold, and silver declined in 1970 from the 1969 results and was down substantially from 1968 levels. Cement production increased by nearly 25 percent, and product segments of petroleum refining showed definite advances.

Table 1 lists the mineral production of Nicaragua for the years 1968 through 1970.

TRADE

Exports of mineral commodities in 1970 were valued at $315,323. Of that amount, 93 percent of the value was provided by exports of copper, gold and silver in various forms. Copper ore and its concentrates were mainly consigned to West Germany and the gold and silver shipments went to the United States and Mexico. Minor amounts of nonmetallic construction material were traded to neighboring countries.

Total value of imported mineral commodities amounted to $28.2 million, with mineral fuels, iron and steel, and fertilizer materials accounting for 88 percent of the expenditure. The remaining imports were largely of metals, with minor values provided by nonmetals.

All of the imported crude oil came from Venezuela, and the oil products were mostly supplied by the United States and the Netherlands Antilles.

Tables 9 and 10 detail foreign trade in minerals for Nicaragua during 1968 and 1969.

Table 9.—Nicaragua: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum	735	55
Copper, ore and concentrate	26,566	19,237
Gold unworked or partly worked ... troy ounces	137,734	107,673
Iron and steel:		
Scrap	NA	34
Steel, primary forms, ingots	NA	10
Semimanufactures	NA	3,726
Silver including alloys ... troy ounces	159,693	168,052
Other including alloys, all forms	NA	625
NONMETALS		
Cement	NA	181
Clays and products, crude	NA	7
Gypsum	6,293	--
Lime	NA	(1)
Salt	3,205	3,343
Stone, sand and gravel	NA	11,594
Other minerals	NA	330
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon, natural gas liquids	NA	448
Petroleum products ... 42-gallon barrels	NA	8

NA Not available.
[1] Less than ½ unit.

Source: Republica de Nicaragua. Memoria de la Recaudación General de Aduanas and Memoria de la Dirección General de Aduanas. 1968, 286 pp; 1969, 262 pp.

Table 10.—Nicaragua: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	735	852
Copper:		
Copper sulfate	13	2
Metal, including alloys, all forms	120	68
Iron and steel:		
Scrap	1	1
Pig iron, ferroalloys, and similar materials	51	101
Steel, primary forms	70	5,325
Semimanufactures	46,626	48,251
Lead metal including alloys	132	131
Silver including alloys troy ounces	6,945	5,081
Tin metal including alloys, all forms long tons	21	24
Zinc metal including alloys, all forms	898	1,135
Other metals including alloys	23	12
NONMETALS		
Abrasives, natural	32	4
Asbestos	170	154
Cement	1,907	2,907
Clays and products (including all refractory brick):		
Crude	4,533	4,180
Products	1,301	866
Fertilizer materials:		
Nitrogenous	44,824	12,195
Phosphatic	14,670	8,669
Potassic	2,419	16,893
Other	10,865	1,473
Graphite	3	3
Lime	425	1,472
Mica, all forms	7	1
Salt (excluding brines)	16,832	25,431
Sodium and potassium compounds, n.e.s	NA	318
Stone, sand and gravel	650	855
Sulfur	145	110
Other, n.e.s	3,550	1,698
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	22	--
Coal, all grades, including briquets	11	8
Coke and semicoke	107	137
Gas, hydrocarbon, natural gas liquids	861	1,232
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	2,363	2,359
Refinery products:		
Gasoline do	199	224
Kerosine do	74	70
Distillate fuel oil do	146	209
Lubricants do	52	40
Mineral jelly and wax do	9	11
Other do	33	37
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	8,670	5,433

NA Not available.

Source: Republica de Nicaragua. Memoria de la Recaudación General de Aduanas and Memoria de la Dirección General de Aduanas. 1968, 286 pp.; 1969, 262 pp.

COMMODITY REVIEW

Metals.—*Copper.*—La Luz Mines Ltd., controlled by Falconbridge Nickel Mines Ltd., encountered delays in its expansion program at the Rosita copper mine operation. At midyear mining and milling results were up to expectations, and a 48-percent processing gain was made over the previous year. Quantity of metal in concentrates declined considerably from 1969 because lower grade and more refractory ores were treated. As a result, gross value of metals recovered declined by 36 percent. The following tabulation details results for 1969 and 1970 (fiscal years ending September 30).

	1969	*1970*
Tons of ore mined and milled	294,791	435,223
Short tons of contained copper	4,861	3,339
Ounces of contained gold	14,335	7,103
Ounces of contained silver	82,533	71,631
Gross value of metals	$7,213,969	$4,609,319

Operating costs per ton milled declined from $6.96 in 1969 to $5.59 in 1970.

Proven and probable ore reserves in 1970 were reported at nearly 2.0 million tons containing 0.87 percent copper and 0.006 ounce of gold per ton. In 1969 proven and probable ore reserves were calculated at 1.5 million tons containing 1.21 percent copper and 0.016 ounce of gold.

Additional possible reserves in 1970 amounted to 4.6 million tons containing 0.86 percent copper and 0.002 ounce of gold per ton; possible ore reserves in 1969 were reported at 3.5 million tons containing 1.12 percent copper and 0.002 ounce of gold per ton.

The foregoing reserve figures are not directly comparable because the 1969 figures were based on 0.5-percent copper cutoff grade, whereas the 1970 figures were based on a copper cutoff grade of 0.35 percent.

Exploration drilling and prospecting programs were in progress at yearend.

Empresa Minera de el Setentrion, in which Noranda Mines Ltd. has a 61-percent interest, treated 114,000 tons of ore averaging 0.62 ounce of gold per ton. Proven reserves were increased to 205,000 tons averaging 0.54 ounce of gold per ton. A drainage level at a depth of 700 feet was completed; as a result, the hot water level was lowered enough to allow work on the 600-foot level in the Panteon vein. Work was underway to establish drainage on the 900-foot level.

Neptune Gold Mining Co. continued work at its lead-zinc operation at the Vesubio mine, near Bonanza. The shaft was sunk to 715 feet; stations were opened on the 1040- and 750-foot levels, and pump and crusher stations were excavated. Construction of the 500-ton-per-day mill was 25 percent completed at yearend.

Nonmetals.—*Salt.*—In May 1970 a solar salt works was opened by Salinas Nicaraguenses, S. A. (SANISA), near the mouth of the Tamarindo River, on the Pacific coast. Cost of the plant was $1.43 million, of which 80 percent is held by the Sucesión Somoza and 20 percent by the National Development Institute.

SANISA's first-stage operation was scheduled to produce 20,000 tons of crude industrial salt annually. A second stage was planned to expand production capacity for export to the Central American Common Market.

Output from first-stage operations was to supply the local Electroquimica Pennsalt, S.A., caustic soda-chlorine complex; heretofore, industrial salt had been imported from Mexico at an annual foreign exchange cost of about $400,000.

Salt output in Nicaragua has been almost entirely oriented to supplying the local market. Recovery methods were primitive, which resulted in a high-cost, low-quality product. In 1967 there were 51 salt recovery operations, of which 46 were solar works and five used the boiling method. Per capita consumption is slightly less than 12 kilograms annually; the high consumption, by central American standards, was attributed to the high consumption of meat among the population.

Mineral Fuels.—*Petroleum.*—Esso Standard Oil Co. built a new 12,500-barrel-per-day refinery near Managua. The old 6,000-barrel-per-day plant was on standby for future use when needed. This gives Nicaragua effective refining capacity of 18,500 barrels per day. The new plant produces two grades of gasoline, in addition to kerosine, jet fuel, diesel fuel, residual fuel oil, and liquefied petroleum gas.

Crude oil supply comes by means of a pipeline from Puerto Somoza, 58 kilometers distant on the Pacific coast.

Shell Oil Co. was reported to have plans to drill two test wells offshore from Laguna de Perlas, in the same general area where a slight show of oil was found in 1969.

Occidental Petroleum Corp. spudded in a wildcat well about 100 miles off the east coast of Nicaragua. This was one step in the exploration program covering 7.5 million acres held offshore from Nicaragua, Honduras, and Jamaica. Signal Oil and Gas Co., Inc., is a partner in the program.

Sunlite Oil Co. Ltd. took a 5-percent interest in about 2 million acres held by a group that was not named. This interest covered a wildcat test that was being drilled on the Rivas anticline in western Nicaragua. Sunlite also had an option to earn a 5-percent interest in a 250,000-acre concession held by the same group on the Atlantic coast.

Petrochemicals.—In January 1970, Polimeros Centroamericanos, S.A. (POLICASA) celebrated the inauguration of its polyvinyl chloride resin plant. The raw material, vinyl chloride monomer, was to be imported from the United States. Japanese interests held 45 percent of the stock with the remainder held by development institutions and local private investors.

POLICASA estimated that by 1974 annual output of resin will attain 10,000 tons for formulation into 12,500 tons of polyvinyl chloride compounds. The Company expects that 20 percent of production will be used domestically with the remaining 80 percent absorbed by Central American Common Market countries.

Japanese technicians were to assist the plant's production management.

PANAMÁ [18]

Active exploration for copper and prospecting plans for oil could have considerable impact on the economy of Panamá if any measure of success results.

Exploration was in progress for copper in western Panamá near the Costa Rican border. Other concessions in the same general area were held by major U.S. mining companies, and prospecting campaigns were expected.

Mobil Exploration Panamá, Inc., negotiated leases in the Gulf of Panamá; the contract carried commitments for exploration and possible drilling.

The second phase of the mineral survey which was being carried out jointly by the United Nations and the Panamá Government continued. The survey area was in a mineral belt in the Cordillera along the San Blas coast toward the Colombian border. The area was thought to be similar in geology and mineralization to Cerro Petaquilla, a copper-molybdenum prospect found through United Nations-Panamá joint efforts. At yearend, the Panamanian Government had not yet negotiated a contract with private interests for a commercial investigation of the Cerro Petaquilla area.

The International Bank for Reconstruction and Development (IBRD) announced a loan of $42 million for the development of the large Bayano hydroelectric project. The loan was made to the Instituto de Recursos Hidraulicos y Electrificacion (IRHE) and guaranteed by the Government of Panamá. Total cost of the project was equivalent to $58.3 million; the IBRD loan was expected to cover the requirements for foreign exchange. It was expected that the additional power to be generated upon completion of the project would total 196 megawatts; this will include generation by hydroelectric development, a steam unit, and small diesel capacity. With installation of this added capacity, IRHE will become the major electric power supplier in Panamá.

The geology and paleontology of the Canal Zone and adjoining parts of Panamá were described.[19]

COMMODITY REVIEW

Metals.—*Copper.*—Canadian Javelin Ltd. was actively prospecting in the Cerro Colorado concession over which it controlled copper and molybdenum rights. The concession, containing 74,976 hectares, was held by Pavonia, S.A., but Javelin announced its intention to exercise its option to acquire all outstanding shares of Pavonia.[20]

Prospecting included geochemical work, test pitting, trenching, and the drilling of six shallow exploratory holes. About 5 miles of access trails along the contours of the mountainous prospect had been cut.

No estimate could be made of the prospect's commercial feasibility, but Javelin planned a considerable drilling program.

The concession lies in the area of the San Felix and Colorado Rivers in the districts of Chiriqui Grande, and San Felix in the Provinces of Boca del Toro and Chiriqui.

The Gaceta Oficial of June 17, 1970, published exploration contracts pertaining to copper concessions granted to Kennecott Panamá, Inc., and Asarco Exploration Co. of Canada, Ltd.

Kennecott had four separate concessions totaling more than 101,727 hectares lying in the Province of Boca del Toro. Asarco was granted three concessions totaling over 23,838 hectares lying in the Provinces of Boca del Toro and Chiriqui.

Concession rights for both companies run for 6 years; in addition, in both cases the contracts contain a provision whereby, if a new mining law is promulgated, the

[18] Prepared by Burton E. Ashley.

[19] Woodring, W. P. Geology and Paleontology of Canal Zone and Adjoining Parts of Panamá. Description of Tertiary Mollusks (Gastropods: Eulimidae, Marginellidae to Helminthoglyptidae). U.S. Geol. Survey Prof. Paper 306-D, 1970, 452 pp.

[20] The New York Times. Apr. 3, 1971, p. 40.

concessionnaires will have the option of accepting the new code or of renouncing their rights.

Iron Ore.—It was reported that Sumitomo Shoji[21] planned to establish a joint venture with Panamanian interests to mine and export 1.6 million tons of iron sand to Japan over the period 1971–77. It was estimated that the iron sand reserve in the Balboa district on the Pacific coast was some 2.5 million tons averaging 62 to 63 percent iron containing 7 percent titanium but no phosphorus, sulfur, or alumina. About 85 to 90 percent of the sand produced was larger than 100 mesh.

The Panamá Iron Sand Development Co. was to be established in Panamá with the capital of $100,000 shared equally by Sumitomo and Minera Chanu, S.A., a Panamanian organization.

Nonmetals.—*Cement.*—Cemento Panamá was to invest $3.5 million to double its cement capacity from 5 million to 10 million bags annually.

Mineral Fuels.—A decree authorizing the award of petroleum exploration concessions to Mobil Exploration Panamá, Inc., was published in the Gaceta Oficial on October 5, 1970.

The exploration concession comprised two tracts in the Gulf of Panamá with a total of 499,518 hectares. The concession was a special contract which was negotiated outside the framework of the Mineral Resources Code.

Exploration rights were for a period of 7 years, renewable twice for an additional 2 years each time. With discovery of commercial quantities of petroleum or helium, an exploitation right will be granted over an area not larger than 200,000 hectares for a period of 25 years; a 5-year extension could be granted on the original terms, or a 10-year extension could be negotiated on terms to be determined at the end of the original 25-year period.

If commercial exploitable deposits are discovered, Panamá is obligated to grant a transportation concession to the company, which will include the right to build and operate a pipeline across the Isthmus to the Atlantic coast to transport oil produced by the Panamá Company.

Panamá will receive a 12.5 percent royalty on production to be paid either in cash or oil, at the option of the state. The company must commence drilling its first well within 3 years, a second well before the end of 5 years, and a third well before the end of the seventh year.

Annual rentals per hectare were also set in the contract, as well as the minimum amount per year that must be spent on exploration. The company will pay income tax according to rates set forth in Decree No. 33 of February 12, 1970. The rates will not be changed for the duration of the exploration concession or during the first 25 years of the exploitation concession.

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[21] Japan Metal Bulletin, No. 2545, May 21, 1970, p 2.

The Mineral Industry of Other South American Areas

By J. M. West,[1] Robert A. Whitman,[1] and Avery H. Reed [2]

CONTENTS

ECUADOR [3]

Oil remained the center of attention in Ecuador during 1970 following discoveries in 1967 of oil in the country's largely unexplored eastern jungle region. Approximately eight companies and consortiums involving 21 U.S. corporations and one British firm held concessions in the El Oriente region of Ecuador. Of these, the consortium of Cía. Texaco de Petróleos del Ecuador, C.A., and Gulf Ecuatoriana de Petróleos, S.A. (Texaco-Gulf), which struck oil on its first attempt in 1967, had completed a total of 11 successful wells out of 14 wildcat attempts for an exceptional record. In addition, Texaco had completed through 1970 about 35 development wells in its new fields with only one dry hole reported. Over 20 additional wells were slated for drilling in 1971.

Another consortium, the World Ventures Group, composed of seven U.S. firms headed by Taylor and Associates, was also successful in the El Oriente region with completion of four of six wildcat holes in 1969–70 drilling. A consortium headed by Anglo-Ecuadorian Oilfields Ltd., a subsidiary of the British Burmah Oil Co., and including Union Oil Co. of California and Superior Oil Co., was scheduled to begin drilling exploratory wells in the area in mid-1971.

Through 1970 total investment in these new exploratory and development efforts totaled an estimated $100 million; it was planned that nearly as much would be expended in 1971 alone. Exports of approximately 1 million barrels per day of oil were expected to be available within 5 years. Construction progressed on a 318-mile, 26-inch pipeline from Lago Agrio over the Andes Mountains to deliver Texaco-Gulf's production to the north Ecuadorian seaport of Esmeraldas. Initial pipeline capacity was planned for 250,000 barrels per day. Pipeline completion was expected about mid-1972.

Ada de Exploración Petrólera, S.A. (Adexco), a consortium of eight companies, drilled several additional wells in 1970 in the Gulf of Guayaquil. Several wells were completed by Minas y Petróleos del Equador, S.A., in the Tiputini area of Ecuador; results were sufficient enough that three additional wells were planned for 1971.

Anglo-Equadorian Oilfields with over 430 producing wells in late 1970, reported a more than 13-percent drop in production to 990,000 barrels for the year. The firm imported 5.5 million barrels to supply its company operations in 1970. Imports of 6.5 million barrels were planned for 1971 to maintain requirements.

The Corporación Estatal Petrólera Ecuatoriana (C.E.P.E.) was due to be established under terms of Decree No. 146, which was to be published in January

[1] Physical scientist, Division of Nonferrous Metals.
[2] Physical scientist, Division of Nonmetallic Minerals.
[3] Prepared by J. M. West.

1971. Assets of the new corporation were to include rights to areas currently open to exploration and development for oil and to areas thenceforth returned by concession holders; installations, pipelines, machinery, and other equipment that becomes the property of the Government upon the expiration of existing concessions; and 40 percent of all government revenue resulting from surface taxes and development levies.

Studies and investigations continued on copper-molybdenum deposits about 130 miles southeast of Guayaquil, which have been discovered in the past several years through United Nations efforts. Japan's Overseas Mineral Resources Development Corp. held a contract with the Ecuadorian Government for a 4-year study of the deposit, including prospecting, test-drilling, and economic feasibility determination. The deposit reportedly averaged over 0.65-percent copper and was potentially large.

Table 1.—Other South American Areas: Production of mineral commodities

Area, commodity, and unit of measure	1968	1969	1970 p
ECUADOR [1]			
Cadmium mine output, metal content ... kilograms	404	1,028	e 1,040
Cement, hydraulic ... thousand metric tons	434	456	e 456
Coal, lignite ... metric tons	71	NA	NA
Clays, kaolin ... do	r 573	(2)	e 500
Copper mine output, metal content ... do	557	533	e 550
Gas, natural:			
Gross production ... million cubic feet	5,837	5,849	10,176
Marketed production e ... do	500	500	500
Gold mine output, metal content ... troy ounces	8,659	7,287	e 7,300
Natural gas liquids:			
Natural gasoline ... thousand 42-gallon barrels	113	128	85
Liquefied petroleum gases ... do	39	12	48
Total ... do	152	140	137
Petroleum:			
Crude oil ... do	1,815	1,567	1,447
Refinery products:			
Gasoline ... do	2,783	2,584	2,667
Jet fuel ... do	401	435	612
Kerosine ... do	569	631	490
Distillate fuel oil ... do	1,489	1,527	1,842
Residual fuel oil ... do	1,901	2,329	2,827
Lubricants ... do	5	4	3
Other ... do	39	28	60
Refinery fuel and losses ... do	169	189	218
Total ... do	7,356	7,727	8,719
Silver mine output, metal content ... troy ounces	136,204	82,163	e 80,000
Sulfur, elemental from ores ... metric tons	147	4,895	e 5,000
Zinc mine output, metal content ... do	114	208	e 210
FRENCH GUIANA			
Clays, all types ... do	10,000	1,200	NA
Gold mine output, metal content ... troy ounces	5,099	3,590	e 3,600
Sand and gravel and stone:			
Sand ... thousand metric tons	104	102	NA
Gravel and crushed stone ... do	708	258	NA
GUYANA [1]			
Aluminum:			
Bauxite, dry equivalent, gross weight ... do	3,772	4,306	e 4,560
Alumina ... do	270	303	e 305
Diamond:			
Gem e ... thousand carats	28	r 21	24
Industrial e ... do	38	r 31	37
Total ... do	66	52	61
Gold mine output, metal content ... troy ounces	4,088	2,102	4,433
Manganese ore, gross weight ... metric tons	130,760	--	--
PARAGUAY			
Cement, hydraulic ... thousand metric tons	24	37	63
Clays:			
Kaolin e ... metric tons	180	450	600
Other e ... thousand metric tons	395	430	450
Gypsum ... metric tons	r 3,455	3,500	6,000
Lime ... do	18,200	19,133	21,000

See footnotes at end of table.

Table 1.—Other South American Areas: Production of mineral commodities—Continued

Area, commodity, and unit of measure	1968	1969	1970 [p]
PARAGUAY—Continued			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	421	385	482
Jet fuel do	50	44	40
Kerosine do	124	121	150
Distillate fuel oil do	474	460	395
Residual fuel oil do	182	203	216
Other do	18	41	48
Refinery fuel and losses do	108	110	108
Total do	1,377	1,364	1,439
Pigments, natural mineral, ocher metric tons	25	15	[e] 40
Sand thousand metric tons	361	420	450
Stone:			
Dimension do	58	65	72
Crushed and broken:			
Limestone do	62	80	140
Other [e] do	1,310	1,420	1,500
Talc, soapstone, and pyrophyllite metric tons	75	90	120
SURINAM			
Aluminum:			
Bauxite, gross weight thousand metric tons	[r] 5,658	5,450	[e] 5,340
Alumina do	892	967	[e] 1,000
Metal, primary do	44	53	53
Clays, common [e] metric tons	2,200	3,170	3,200
Gold mine output, metal content troy ounces	4,702	2,389	1,137
Sand and gravel:			
Sand:			
Common [e] thousand metric tons	110	120	120
Stone sand do	4	18	17
Gravel [e] do	10	10	10
Stone crushed and broken do	66	[e] 80	141
URUGUAY			
Aluminum, secondary metric tons	250	400	[e] 400
Cement, hydraulic thousand metric tons	515	467	501
Clays:			
Refractory metric tons	10,311	NA	NA
Other do	56,205	146,958	172,505
Coke, gashouse do	19,653	16,295	17,386
Feldspar do	441	1,238	1,105
Gas manufactured million cubic feet	934	913	920
Gem stones, semiprecious:			
Agate [3] metric tons	96	74	79
Amethyst [3] do	NA	NA	17
Iron and steel:			
Iron ore (for cement production) do	2,200	--	1,150
Steel, crude do	8,500	13,900	16,232
Steel, semimanufactures do	32,566	[e] 35,000	[e] 41,200
Lime [e] thousand metric tons	60	51	61
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	[r] 2,035	2,333	2,252
Jet fuel do	124	158	176
Kerosine do	1,131	1,316	1,308
Distillate fuel oil do	[r] 1,920	2,315	2,610
Residual fuel oil do	[r] 4,042	4,971	5,346
Lubricants do	--	2	3
Other do	[r] 362	507	586
Refinery fuel and losses do	272	349	676
Total do	9,886	11,951	12,957
Sand and gravel:			
Sand:			
Common thousand metric tons	1,343	2,293	1,578
Glass do			17
Gravel do	150	216	[e] 220
Stone:			
Dimension do	13	67	[3] 35
Crushed and broken:			
Alum schist metric tons	NA	NA	497
Dolomite thousand metric tons	17	34	41
Limestone do	818	741	909
Quartz metric tons	143	620	798
Other (including ballast) thousand metric tons	495	524	775
Sulfate, natural metric tons	334	58	NA
Sulfur, elemental byproduct [e 4] do	80	110	120
Talc, soapstone, and pyrophyllite (gravel) do	2,208	2,306	1,634

[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 and gravel, and stone) undoubtedly is also produced, but production is not reported and available general information is inadequate to make reliable estimates of output levels.

[2] Less than ½ unit.

[3] Exports.

[4] Recovered from refinery gases.

Table 2.—Ecuador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Copper:		
Ore and concentrate	--	2,593
Metal scrap	575	--
Gold concentrates (calaverite)	2	--
Iron and steel	46	61
Lead concentrate	1,358	--
Nickel	--	(1)
Zinc	r 215	549
Other ore and concentrate	--	520
NONMETALS		
Salt	--	2,000
MINERAL FUELS AND RELATED MATERIALS		
Petroleum, crude ... thousand 42-gallon barrels	--	350

r Revised.
1 Less than ½ unit.

Table 3.—Ecuador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968
METALS		
Aluminum:		
Oxide (alumina) and hydroxide	9	9
Metal including alloys, all forms	935	1,154
Arsenic, all forms ... kilograms	NA	4,118
Copper including alloys, all forms	643	708
Gold including alloys, all forms ... troy ounces	25,303	69,413
Iron and steel:		
Scrap	34	76
Pig iron, ferroalloys, and similar materials	148	43
Steel, primary forms	11,384	16,526
Semimanufactures	77,336	84,884
Lead:		
Oxide (litharge)	162	124
Metal including alloys, all forms	345	406
Mercury ... 76-pound flasks	NA	125
Silver including alloys ... troy ounces	6,719	16,815
Tin metal including alloys, all forms ... long tons	31	12
Titanium metal including alloys, all forms	290	--
Zinc metal including alloys, all forms	54	180
NONMETALS		
Abrasives, natural	NA	24
Asbestos	622	900
Barite and witherite	24	10
Cement	2,312	3,030
Chalk	83	619
Clays and products (including all refractory brick):		
Bentonite	132	461
Kaolin (china)	25	40
Other	1,000	93
Diatomite and other infusorial earths	322	375
Feldspar and fluorspar	NA	31
Fertilizer materials crude and manufactured:		
Nitrogenous	5,439	14,655
Phosphatic	9,600	15,192
Potassic	6,615	6,718
Other including mixed	7,183	7,055
Graphite	NA	2
Gypsum and plasters	35	81
Iodine ... kilograms	NA	904
Mica, all forms	22	12
Salt (excluding brines)	38	56
Sand and gravel	NA	6
Sodium compounds	4,142	5,559
Sulfur, all kinds	142	82
Talc, soapstone, and pyrophyllite	237	204
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	4,589	2,915
Carbon black	671	677
Coal including briquets, all grades	309	46
Coke and semicoke	318	278
Gas, hydrocarbon, natural	NA	167
Petroleum:		
Crude ... thousand 42-gallon barrels	5,798	2,143
Refinery products:		
Gasoline ... do	185	250
Jet fuel ... do	57	--
Lubricants ... do	95	59
Other ... do	37	36
Mineral tar and other coal, petroleum, or gas derived crude chemicals	345	911

NA Not available.

FRENCH GUIANA [4]

There are very few minerals being mined in French Guiana. The production of gold in 1970 was about the same as that produced in 1969. About 1,000 kilograms of columbite-tantalite were exported as a result of a program to locate and evaluate new deposits. Probably the most important development occurred when the Aluminum Company of America (Alcoa) agreed to join Péchiney Co. of France in a plan to mine bauxite in French Guiana and convert it to alumina at the Paranam plant of the Suriname Aluminum Co. (Suralco) in Surinam. The plan must have the approval of the French Government.

GUYANA [5]

Production of bauxite in 1970 increased slightly above that of 1969. Mining employment, principally for bauxite, increased every quarter and, during the last quarter, had exceeded that for the first quarter of 1968.

During November, a strike over wages against the Demerara Bauxite Co. Ltd. (DEMBA) was averted through the intercession of the Prime Minister. Both the mine workers' union and DEMBA agreed to submit the dispute to arbitration.

The Government of Guyana announced in November that discussions would be held with DEMBA on the subject of governmental acquisition of a controlling interest in the bauxite and alumina operations of the country. Later the Government specified that it sought a majority interest (at least 51 percent), management control, and repayment to be made from future after-tax earnings on capital value computed for income-tax purposes.

At yearend DEMBA had practically completed the expansion of its MacKenzie alumina plant to 365,778 metric tons per year.

Metal-grade bauxite deposits are requiring the stripping of increasing tonnages of overburden; this is a costly process. Future expansion probably will be in calcined-grade bauxite, which commands a higher price.

An exploration license covering 2,225 square miles on the Continental Shelf was awarded to Comoro Exploration Ltd. Seismic testing was planned for another 1,000 square miles if the contract was awarded.

[4] Prepared by Robert A. Whitman.
[5] Prepared by Robert A. Whitman.

Table 4.—Guyana: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite:		
Dried	1,806,280	1,761,473
Calcined	596,642	874,016
Oxide (alumina)	248,151	300,868
Copper scrap	180	373
Manganese ore and concentrate	99,159	29,282
Platinum group troy ounces	32	--
Other nonferrous ore and concentrate n.e.s.	--	1,022
NONMETALS		
Clays and products	--	2,791
Diamond, all grades carats	70,724	--
Stone, sand and gravel: Gravel and crushed rock	10	--

Table 5.—Guyana: Imports of mineral commodities

(Metric tons unless other specified)

Commodity	1968	1969
METALS		
Aluminum including alloys, all forms	363	392
Copper including alloys, all forms	57	60
Iron and steel: Pig iron, crude steel and semimanufactures	36,070	23,125
Silver unworked and partly worked troy ounces	5,889	--
NONMETALS		
Cement	61,283	142,596
Clays and products (including refractory brick)	2,407	NA
Fertilizer materials crude and manufactured	36,636	32,057
Lime	5,451	NA
Salt	3,298	3,219
Sodium compounds n.e.s. hydroxide	21,919	38,689
Stone, limestone	18,580	13,845
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	129	NA
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	352	380
Kerosine do	202	200
Distillate fuel oil do	516	773
Residual fuel oil do	2,027	3,814
Lubricants do	35	17
Asphalt do	71	--
Other do	2	29
Mineral tar and other petroleum or gas derived crude chemicals	210	NA

NA Not available.

PARAGUAY [6]

Mineral production in Paraguay continued to expand. New annual records were established for the production of most commodities. The total value of nonmetallic minerals produced expanded from $6,974,000 in 1969 to $8,371,000 in 1970, an increase of 20 percent. The total value of petroleum refinery products expanded from $9,635,000 in 1969 to $11,910,000 in 1970, an increase of 24 percent.

[6] Prepared by Avery H. Reed.

Table 6.—Paraguay: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal, all forms	53	74
Copper metal, all forms	195	187
Iron and steel, all forms	23,142	19,483
Lead metal, all forms	64	71
Tin metal, all forms long tons	30	16
NONMETALS		
Crude minerals and manufactures	6,147	4,257
Cement	8,551	4,917
Salt	20,636	21,567
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	4,958	1,425
Solid including coal, lignite, and briquets	52	95
Petroleum:		
Crude thousand 42-gallon barrels	1,184	1,110
Refinery products:		
Gasoline do	58	35
Kerosine do	5	--
Distillate fuel oil do	(2)	39
Residual fuel oil do	157	102
Lubricants do	28	34

[1] In addition to the commodities listed individually, Paraguay reported the importation of "precious stones and metals" totaling 18.3 tons in 1968 and 31.8 tons in 1969.

[2] Less than ½ unit.

Source: Banco Central del Paraguay, Departamento de Estudios Económicos. Boletin Estadístico Mensual. No. 127, December 1968; No. 139, December 1969.

A survey of existing and proposed transportation facilities was planned. In a country the size of California, there were only 6,300 kilometers of roads, of which only 720 kilometers were paved.

Argentina was planning to build a $700 million hydroelectric complex on the Parana River west of Encarnación. Paraguayan approval is required, even though Paraguay has neither the need for the power nor the resources to contribute to the project financially.

Brazil was planning to build a $2 billion hydroelectric complex on the Parana River at Guairá Falls. Paraguayan approval also is required, even though Brazil has offered to finance the entire project.

The Government-owned cement plant increased its capacity. The cement was used mainly at Asunción, but some was exported to Argentina and Brazil.

Prospecting for petroleum in western Chaco continued, but the results were negative.

COMMODITY REVIEW

Nonmetals.—New records were established for each of the following items:

Cement.—Cement shipments expanded to 63,000 metric tons, 70 percent above the 1969 record.

Clays.—Production of common clay increased to 450,000 tons, 5 percent above the 1969 record.

Lime.—Lime production was 21,000 tons, 10 percent above the 1969 record.

Sand and Gravel.—Production of common sand increased to 450,000 tons, 7 percent above the 1969 record.

Stone.—Production of crushed stone increased to 1,640,000 tons, 9 percent above the 1969 record. Dimension stone production was 72,000 tons, 11 percent above the 1969 record.

Mineral Fuels.—Total refinery products increased to 1,439,000 barrels, 5 percent above 1969 and 5 percent above the 1968 record. Every product except jet fuel and distillate fuel set individual annual records. Crude oil for the refinery is imported from Africa and barged up the river to Asunción.

SURINAM [7]

Shipments of bauxite declined about 7 percent in 1970 compared with 1969, but shipments of alumina increased nearly 4 percent. Shipments of metal were about the same as in 1969. The United States and Canada received 95 percent of the bauxite exported from Surinam. However, only 32 percent of the alumina and almost no metal went to the two North American countries. Apparently the reduction in shipments was due to a slowdown of customs and dock workers rather than to any lack of production. Shipments of alumina to Eastern European countries dropped from 17 percent of the total in 1969 to 7 percent of the total in 1970.

Aluminum Company of America (Alcoa) has agreed to join with Péchiney Co. of France in a plan to mine bauxite in French Guiana and convert it to alumina in the plant of Alcoa's subsidiary, Suriname Aluminum Co. (Suralco), at Paranam, Surinam. The plan, subject to the approval of the French Government, would require a 50-percent expansion of Suralco's plant sufficient to produce up to 500,000 tons of alumina from French Guianese ore.

The Government heard proposals from a number of foreign aluminum producers to develop the bauxite deposits in the Bakhuys Mountains of western Surinam. In July, the Government and Reynolds Metals Co. signed a statement of intent covering two projects. One project calls for 50–50 participation by Reynolds and a government development corporation in the exploration and mining of bauxite in the Bakhuys Mountains, the production of alumina, and, if a power source is ultimately developed, the construction of reduction facilities. The Government corporation has the right of first refusal on the development by Surinam of new power sources. Reynolds will provide day-to-day management of the project; the Government will provide rail transportation to deliver bauxite to an alumina plant that will be constructed at Apoera, the dredging of the Courantyne River to enable barging of the alumina to the coast, and land for townsites. The alumina plant will have an initial capacity of at least 200,000 tons per year. The second project involves exploration and development work by Reynolds in the Coppename River area. The Gov-

[7] Prepared by Robert A. Whitman.

ernment has an option to participate in any alumina or reduction plants that are built in connection with this project.

Production of other minerals is very limited. There apparently is no longer any production of clay in commercial amounts. Reportedly, there were 1,137 troy ounces of gold production, and 288,000 metric tons of sand and gravel and crushed stone.

There was little petroleum activity. Elf Surinam drilled and abandoned an onshore well west of Coronie. Shell was reported to be continuing some onshore drilling of shallow wells.

Table 7.—Surinam: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Bauxite	r 3,785,870	3,677,857
Oxide (alumina) and hydroxide	r 702,167	856,452
Metal including alloys unwrought	r 43,857	53,688
Copper including alloys unwrought	113	150
Gold troy ounces	93	1,201
Iron and steel:		
Steel, primary forms	67	87
Semimanufactures	3	31
Lead unwrought	69	11
NONMETALS		
Sand, clays, earth	7,405	3,854
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline 42-gallon barrels	791	83
Kerosine do	139	--
Distillate fuel oil do	114	--
Residual fuel oil do	7	--
Lubricants do	548	282
Other do	35	1,801

r Revised.

Table 8.—Surinam: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys	275	431
Copper metal including alloys	129	99
Gold unworked or partly worked troy ounces	4,822	10,120
Iron and steel:		
Steel, primary forms	r 4,094	6,203
Semimanufactures	r 8,801	10,758
Lead including alloys, semimanufactures	30	41
Magnesium including alloys	23	53
Tin metal long tons	24	9
Zinc metal	--	45
Other	10	24
NONMETALS		
Abrasives, natural, crude	4	3
Asbestos	981	--
Cement	45,916	48,161
Chalk	271	283
Clays and products:		
Crude n.e.s. [1]	28	63
Products including refractory brick and cement	2,565	2,246
Diatomite and other infusorial earths	82	22
Fertilizer materials:		
Nitrogenous	5,868	7,105
Phosphatic	190	221
Potassic	65	51
Other including mixed	172	377
Lime	2,642	1,528
Salt	1,418	1,293
Stone and gravel:		
Dimension stone	55	90
Gravel and crushed rock	31,689	1,767
MINERAL FUELS AND RELATED MATERIALS		
Coal including briquets, all grades	16,845	26,270
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	188	197
Kerosine do	44	46
Distillate fuel oil do	595	574
Residual fuel oil do	2,241	2,331
Lubricants do	28	32
Liquefied petroleum gas do	50	41
Asphalt and bitumen, natural [2] do	45	41
Other do	2	1
Mineral tar and other coal, petroleum, or gas derived crude chemicals	168	86

r Revised.
[1] Includes some sand and other earth.
[2] May include some natural asphalt.

Table 9.—Bauxite, alumina, and aluminum shipments from Surinam
(Metric tons)

Company and destination	1968	1969	1970
BAUXITE			
Suriname Aluminum Co.:			
United States and Canada	2,004,748	2,039,225	2,103,790
Western Europe	110,575	125,647	135,893
Other	22,961	12,631	18,947
Total	2,138,284	2,177,503	2,258,630
N.V. Billiton Mij.:			
United States	1,056,775	1,010,396	1,038,294
Canada	579,502	487,610	111,648
Western Europe	9,408	--	4,788
Other	1,901	2,348	80
Total	1,647,586	1,500,354	1,154,810
Grand total	3,785,870	3,677,857	3,413,440
ALUMINA			
Suriname Aluminum Co.:			
United States	386,207	314,732	217,253
Western Europe	191,128	194,976	220,839
Total	577,335	509,708	438,092
N.V. Billiton Mij.:			
United States	60,747	60,442	[1] 70,156
Western Europe	65,667	146,365	325,881
Eastern Europe	--	144,231	59,834
Total	126,414	351,038	455,871
Grand total	703,749	860,746	893,963
ALUMINUM			
Suriname Aluminum Co.:			
Western Europe	23,023	45,478	52,535
Far East	12,348	4,821	--
Other	8,179	3,488	828
Total	43,550	53,787	53,363

[1] United States and Canada.

URUGUAY [8]

Mineral production in Uruguay was about the same as in recent years, with no apparent trend for expansion in the near future. The physical volume of mineral commodities produced was 5 percent below the 1969 record but was the second highest recorded.

Production of iron ore, cement, clays, lime, and crushed stone increased, but production of sand and gravel and of dimension stone declined.

Values for mineral commodities produced were not available. The most valuable commodities were cement, crushed stone, dimension stone, sand and gravel, and lime. The total value of these commodities is estimated at $36 million, an increase of 3 percent over that of 1969.

Usinas Electricas y Telefonos del Estado (UTE), the autonomous government enterprise responsible for providing electric power and telephone services in Uruguay, received a loan of $18 million from the World Bank for the further development of electric power in Uruguay. Of the total, $10 million is earmarked for the Palmar hydroelectric complex and $6 million for renewing the power distribution net in Montevideo.

COMMODITY REVIEW

Metals.—*Aluminum.*—Production of secondary and semimanufactured aluminum was about the same as in recent years.

Iron and Steel.—A small quantity of iron ore was produced. Production of semimanufactured steel products increased 18 percent over that of 1969.

Nonmetals.—*Cement.*—Cement production recovered from the prolonged 1969 strike and was only 3 percent below the 1968 record.

[8] Prepared by Avery H. Reed.

Clays.—Production of clays was about 26,000 tons more than in 1969 and some 106,000 tons more than in 1968.

Lime.—Lime production increased 20 percent, but was 13 percent below the 1967 record.

Sand and Gravel.—Production of sand and gravel was 30 percent below the 1969 record, but was the second highest year recorded.

Mineral Fuels.—Output of petroleum refinery products increased 8 percent owing mainly to the record production of distillate fuel oil, which was 13 percent above the 1969 record.

The Mineral Industry of Other European Countries

By Joseph B. Huvos,[1] F. L. Klinger,[2] David G. Willard,[3] and Richard F. Stevens Jr.[4]

CONTENTS

ALBANIA [5]

In 1970, Albania's small mineral industry continued to grow rapidly; industry as a whole grew at an average of 12.9 percent per year instead of the planned 10 percent for the 5 years extending from 1966 to 1970. The mineral extraction and processing industry had virtually no worldwide significance except in the case of chromite, of which the country produced almost 8 percent of the world's output in 1970. The mineral industry remained of substantial importance to the country's economy, with an output estimated to have been worth over £16.8 million ($47 million) in 1967. In addition to chromite, Albania produced copper ore, blister copper, copper wire, nickeliferous iron ore, crude petroleum, natural asphalt, cement, and small quantities of lignite. Information on the performance of the mineral industry was scarce. Official Albanian sources indicated only fulfillment of plans or percentages of increase in production of commodities. Most of the products of the mineral industry were exported.

In 1970, there were several major developments in the mineral industry of Albania; construction work was performed with the aid of mainland China on the Bulqizë chromite ore concentrator, the Rreps copper ore concentrator, the Laç copper smelter and refinery, copper-sulfate and sulfuric acid plants; the Elbasan metallurgical combine, and the 250-megawatt hydroelectric project on the Drin river at Shkodër. The Puka volcanic glass mine was commissioned; the Fier fertilizer complex was expanded; the Armen salt deposits were discovered; and at Stalin (Kuçovë) a third section of the coking plant was inaugurated.

PRODUCTION

Official production figures for mineral commodities produced in Albania in 1970 were not available, but Albania published percentage increases in the output of selected commodities for 1969, as compared with the previously published figures for 1960 to 1964. Figures for 1970, for the most part, were calculated on a similar basis from data published in the foreign press. In 1970, the last year of the fourth 5-year plan, industrial output as a whole was said to be 83 percent higher than 5 years earlier, corresponding to an average yearly increase of 12.9 percent. Production of chromite, nickeliferous iron ore, and copper ore and products increased substantially; however, the emphasis shifted to semimanufactured products in the case of copper.

[1] Foreign mineral specialist, Division of Fossil Fuels.
[2] Physical scientist, Division of Ferrous Metals.
[3] Economist, Division of Nonmetallic Minerals.
[4] Physical scientist (Metallurgy), Division of Ferrous Metals.
[5] Prepared by Joseph B. Huvos.

Table 1.—Other European Countries: Production of mineral commodities

Area, [1] commodity, and unit of measure	1968	1969	1970 p
ALBANIA [2]			
Cement, hydraulic ---- thousand metric tons	302	328	e 360
Chromium, chromite, gross weight ---- do	388	429	468
Coal, lignite ---- do	579	e 640	668
Copper:			
Mine output, metal content [3] ---- metric tons	5,430	5,222	5,588
Smelter output (blister) ---- do	5,430	5,222	5,588
Iron ore, nickeliferous, gross weight ---- thousand metric tons	405	405	540
Petroleum: [4]			
Crude ---- thousand 42-gallon barrels	7,573	8,767	9,995
Refinery products:			
Gasoline ---- do	400	527	e 650
Distillate fuel oil ---- do	813	992	e 1,200
Other (not further identified) ---- do	4,285	6,007	7,450
Total ---- do	5,498	7,526	e 9,300
DENMARK [2]			
Cement, hydraulic ---- thousand metric tons	r 2,278	2,607	2,604
Clays, kaolin crude and washed e ---- metric tons	18,000	18,000	18,000
Coal, lignite ---- thousand metric tons	760	431	e 400
Coke, gashouse ---- do	294	161	e 160
Diatomaceous materials:			
Diatomite e ---- do	20	20	20
Moler e ---- do	r 220	220	220
Fertilizer materials manufactured:			
Nitrogenous, gross weight [5] ---- do	80	112	94
Phosphatic, gross weight [5] ---- do	483	551	526
Mixed and unspecified, gross weight [5] ---- do	r 172	239	250
Fuel briquets, lignite briquets ---- do	22	NA	NA
Iron and steel:			
Iron ore (less than 42 percent iron), gross weight ---- do	19	31	e 30
Pig iron and blast furnace ferroalloys ---- do	186	207	215
Crude steel [6] ---- do	457	482	473
Steel semimanufactures ---- do	452	428	e 425
Lead metal, secondary (including alloys) [5] ---- metric tons	10,157	11,423	10,050
Lime (quicklime and agricultural) ---- thousand metric tons	168	e 190	e 190
Peat, fuel e ---- do	6	6	6
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	r 9,401	11,229	11,008
Jet fuel ---- do	r 488	608	584
Kerosine ---- do	r 977	915	752
Distillate fuel oil ---- do	r 14,368	19,172	21,358
Residual fuel oil ---- do	r 19,088	26,114	31,795
Lubricants ---- do	--	--	--
Other ---- do	r 2,963	3,707	4,775
Refinery fuel and losses ---- do	3,617	4,753	5,162
Total ---- do	50,902	66,498	75,434
Salt ---- thousand metric tons	150	[5] 246	[5] 341
ICELAND			
Aluminum smelter production, primary ---- metric tons	--	12,400	37,956
Cement, hydraulic ---- thousand metric tons	100	93	85
Diatomite ---- metric tons	2,750	7,600	13,239
Fertilizer materials manufactured, nitrogenous:			
Gross weight ---- do	24,336	24,350	22,621
Nitrogen content ---- do	2,847	2,849	2,647
Pumice ---- do	NA	NA	11,000
Sand:			
Calcareous ---- thousand metric tons	273	252	NA
Calcareous ---- thousand cubic meters	NA	NA	144
Stone:			
Dimension ---- thousand metric tons	37	18	NA
Crushed and broken ---- do	88	87	NA
SWITZERLAND			
Aluminum smelter production, primary ---- metric tons	76,855	77,060	91,490
Cement, hydraulic ---- thousand metric tons	4,321	4,534	4,797
Coke, gashouse ---- do	r 305	279	164
Gas manufactured ---- million cubic feet	13,344	13,121	13,981
Gypsum e ---- thousand metric tons	100	100	100
Iron and steel:			
Pig iron and blast furnace ferroalloys ---- do	22	25	28
Electric furnace ferroalloys ---- do	6	6	9
Crude steel ---- do	453	500	524
Steel semimanufactures ---- do	490	515	545
Lime ---- do	147	150	145

See footnotes at end of table.

Table 1.—Other European Countries: Production of mineral commodities—Continued

Area,[1] commodity, and unit of measure	1968	1969	1970 [p]
SWITZERLAND—Continued			
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	6,044	6,860	7,149
Jet fuel do	456	704	1,096
Kerosine do	39	39	54
Distillate fuel oil do	14,211	15,659	16,457
Residual fuel oil do	9,231	10,336	11,215
Lubricants do	--	--	--
Other do	1,577	1,980	2,267
Refinery fuel and losses do	2,924	2,162	3,342
Total do	34,482	37,740	41,580
Salt thousand metric tons	255	267	333

[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 and 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; distillate fuel oil—7.46; total refinery products—6.672. The other (unidentified) product figures are derived by subtracting the converted gasoline and distillate fuel oil quantities from the converted total for refinery products. Presumably, this figure excludes refinery fuel, but sources do not make this clear.
[5] Sales.
[6] Apparently excludes shipyards' production of steel castings.

TRADE

Minerals and related products accounted for the major part of Albania's exports in 1970. Chromite alone was important at the world trade level.

In 1970 Albania had concluded trade protocols with 40 different countries and had agreements with some 140 foreign firms. Mainland China was undoubtedly the most important of Albania's foreign trade partners. More than half of Albanian exports were estimated to go to mainland China, which in turn granted large credits under favorable conditions and supplied necessary equipment and supplies for the Albanian economy.[6]

In 1970, East Germany and Poland had trade volumes of about $16.4 million and $15.1 million respectively, with Albania; Romania had about $2 million; Italy and West Germany had trade volumes of about $6.3 million and $4 million respectively.[7]

Chromite, nickeliferous iron ore, blister copper, and copper cathodes and wires were the main metals exported with the share of copper products increasing gradually over that of blister copper; crude oil, bituminous flux, and natural bitumen were the other main export items.

Coke, iron and steel, other semimanufactured products, and cement were the principal imported commodities.

COMMODITY REVIEW

Metals.—*Chromium Ore.*—It was reported that chromium ore mining exceeded production plans of unspecified magnitude at Kallë in the Tropojë district.

A chromium ore concentrator at Bulqizë is to be commissioned during 1971, according to official government releases.

Copper.—Copper is generally found in Albania in the northern region where basic and semiacid intrusive rocks are associated with copper sulphides.

At present chalcopyrite ores containing about 3 percent copper are mined mainly in the Rubik region, at Kurbnesh, Gjegjan, Tuç, and Spaç. Testing of deposits continued at Thirrë, Lajthizë, and Gegaj in the same region, at Vithkuq and Rehovë in the south and Tropojë in the extreme north. In addition to the concentrators at Kurbnesh and the new plant at Spaç a new concentrator was being built at Rreps. It has been assumed, but not confirmed, that Rubik, Kukës, and Gjegjan also have ore concentrating plants. Most chalcopyrite concentrate is transported to Rubik for conversion to blister, which is also produced at Kukës and Gjegjan. The country's only elecrolytic refinery, which proc-

[6] Borba (Belgrade). V. 49, No. 277, Oct. 4, 1971.
[7] The Economist (London). Quarterly Economic Review, Albania. No. 1, 1971, p. 11.

Table 2.—Albania: Foreign trade in selected mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
Asphalt and bitumen, natural	23,000	19,000
Cement, hydraulic [2]	11,581	6,437
Chromite	379,000	409,000
Copper:		
Blister	1,475	688
Cathodes	1,777	1,622
Wire bar	1,445	1,762
Nickeliferous iron ore	394,000	398,000
Petroleum: [3]		
Crude thousand 42-gallon barrels	1,414	567
Refinery products:		
Bituminous flux do	2,285	3,291
Other unspecified do	336	462
IMPORTS		
Aluminum unwrought and semimanufactures [2]	93	133
Asbestos, crude	400	NA
Barite and witherite [2]	800	1,417
Cement, hydraulic	2,000	3,000
Carbon black	320	343
Coke	24,030	24,426
Copper unwrought and semimanufactures [2]	75	58
Fertilizer materials:		
Crude, phosphatic [4]	65,000	52,000
Other	1,000	1,000
Iron and steel:		
Pig iron [2]	5,736	6,820
Steel, primary forms [2]	782	--
Semimanufactures [2]	13,065	16,096
Petroleum products: [3]		
Gasoline [2] thousand 42-gallon barrels	--	188
Distillate fuel oil [2] do	56	53
Other unspecified [2] do	1	(5)
Other crude nonmetals, n.e.s [2]	101	157

NA Not available.
[1] Compiled from official Albanian trade returns unless otherwise specified.
[2] Compiled from trade returns of trading partner countries reported in: Statistical Office of the United Nations. Supplement to the World Trade Annual, 1968 and 1969 editions, Walker and Company, N.Y., 1969 and 1970.
[3] Converted from reported figures in metric tons, using the following conversion factors: crude oil—one metric ton equals 6,672 barrels; bituminous flux—one metric ton equals 6.06 barrels; other unspecified products—one metric ton equals 7.0 barrels; gasoline—one metric ton equals 8.50 barrels; distillate fuel oil—one metric ton equals 7.46 barrels.
[4] All imported from Morocco.
[5] Less than ½ unit.

esses all domestic blister copper, is at Rubik.

Some blister copper and cathodes were still exported, but most copper was processed at Shkodër, where, with mainland China's help, a wire plant was built in 1965. The plant consists of an automatic rod-rolling mill, drawing lines, and eight poly-vinyl-chloride coating machines.

Some copper was converted at Durës into cuprous oxide, and a copper sulfate plant was under construction at Fier. At Laç a copper smelter, a refinery, a copper sulfate, and a sulfuric acid plant were under construction.

A typical Albanian blister analysis was 99.45 percent copper, 0.168 percent silver, 0.002 percent gold, 0.15 percent sulfur, 0.007 percent tin, 0.002 percent antimony, 0.018 percent iron, and 0.01 percent each of lead, zinc, cadmium, arsenic, aluminum, and nickel.[8]

Iron Ore, Nickeliferous.—In 1970, as a result of extensive mine development, it was reported that the quantity of nickeliferous iron ore mined increased substantially.

Iron and Steel.—A cast iron foundry was inaugurated at Pogradec, according to government sources. At Elbasan, there was news of continued construction (with mainland China's aid) of a new metallurgical combine; it will have an annual capacity for 250,000 tons of steel and a processing capacity of 800,000 tons of iron ore, probably of the nickeliferous variety.

[8] Metal Bulletin (London). No. 2, February 1971, pp. 34–35.

Uranium.—In November 1970, a nuclear radiation laboratory was inaugurated at Tirana. The purpose of the laboratory is the industrial and agricultural application of radioactive isotopes.

Nonmetals.—*Cement.*—It has been reported that a volcanic glass mine was commissioned in December at Puka. Simultaneously it was reported that the Vaso Kadija cement plant located in Shkodër began using volcanic glass for the production of cement.

At Tirana, the Josif Pashko construction materials combine has completed the reconstruction of a cement factory, thereby increasing its output about 50 percent. No data were given concerning the capacity and size of plants mentioned here.

Fertilizers.—It was reported that the Fier nitrogen fertilizer complex was being expanded in 1970. It was not stated if the expansion consisted of a urea plant. There were negotiations underway with Greece for the purpose of exporting 5,000 tons of ammonium nitrate fertilizer to Greece.

The Laç granulated superphosphate plant was in the news for over-fulfillment of unspecified production plans; the facility raised production plans for the year 1971. As reported, the Laç plant registered unspecified increases in output of sulfuric acid, some of which was exported, calcined soda, and sodium silicate.

Salt.—Salt deposits of undisclosed lateral dimensions and, reportedly, 46 meters thick were discovered at Armen, in the Drovjan i Sarandë region.

Mineral Fuels.—*Bitumen (natural).*—It was claimed that bitumen extraction had been essentially mechanized and production had increased. It was also claimed that, compared with 1938 figures, 1969 production had increased 700 percent for bituminous gravel, 243 percent for natural bitumen, and 218 percent for pure bitumen.

Coal.—Lignite production increased 4 percent during 1970. There were several reports on individual lignite mines having exceeded their production plans, but no explicit production figures were published. At Stalin, a third section of the coke plant was commissioned, increasing its nonspecified production capacity by 40 percent, construction of a thermoelectric powerplant was progressing in Korçë in 1970. Total installed Albanian generating capacity was said to be 205 megawatts. At Shkodër, on the Drin River, the Mao Tse-tung hydroelectric plant under construction, with mainland China's assistance, will have an installed capacity of 250 megawatts; the plant has been under construction since 1967 and was to be commissioned during 1971 according to Yugoslav sources.[9]

Albania will have surplus electric power during the period 1972–74, and Yugoslav officials were discussing imports of Albanian power, at a cost of 18 paras (1.2 cents) per kilowatt in daytime and 9 paras (0.6 cent) at night; if negotiations end successfully, 220-kilovolt powerlines would be constructed from Titograd to Shkodër, from Nrutok to Elbasan, from Spitja to Vojnik, and from Struga to Perenajsa. At present the Albanian power distribution system is 110 kilovolts.

Petroleum.—During 1970, crude oil production increased 14 percent after having previously increased 140 percent during 1960 through 1969.

A new tectonic map of Albania has been compiled by the Geology and Minerals Study and Designs Institute of Albania on a scale of 1:500,000. This map, together with the existing 1:200,000 geological map, was expected to play a great role in the discovery of new Albanian mineral deposits.

Plans were released for increasing the drilling footage for petroleum, to improve deep drilling techniques in calcareous strata, and to improve production methods for highly viscous crude oils; but no figures were given on these projects.

There were no official data on the extent of crude oil reserves, but at the beginning of 1970, there were estimates that Albanian reserves were about 3 million barrels.[10]

Mainland China's aid to Albania for the 1970–75 plan period included the construction of a 1.5 million-ton-per year-capacity oil cracking plant.

It was reported that two new sections have been recently commissioned at the oil refinery in Stalin. One will produce sulfonates, and the other will produce fuel oil.

It was reported that at the Cerrik oil re-

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[9] Ekonomska Politika (Belgrade). July 26, 1971.

[10] World Oil. V. 171, No. 3, Aug. 15, 1970, p. 132.

finery, a benzene and a solvent naphtha unit were put on stream with a capacity of 1,000 tons per year.

There was a report that a plastics plant built with mainland China's assistance was inaugurated at yearend in Durrës. The type of plastic made and the plant's capacity were not specified.

DENMARK (INCLUDING GREENLAND) [11]

Stone, clays, diatomaceous earth, other construction materials, and salt continued to be the principal products of Denmark's small mining and quarrying industry. The industry employed about 1,200 persons in 1970, and the gross value of production was probably less than $20 million. The mineral- and metal-processing industries were estimated to employ an additional 26,000 persons, including about 18,000 in nonmetallic mineral processing, 6,000 in the manufacture of basic metal products, and 1,500 in processing of petroleum and coal.

A major development in 1970 was the negotiation of offshore boundary agreements with West Germany. This was followed by the announcement that several discoveries of oil and gas had been made since 1966 in the Danish sector of the North Sea.

Exploration projects in Greenland appeared to increase; metallic minerals were sought on the mainland and oil and gas in offshore areas.

PRODUCTION

Volume indices of production for different sectors of the mineral industry were available only for the first three quarters of 1970. Average indices for the first 9 months of 1969 and 1970 were as follows:

Industry sector	(1968=100) 1969	1970
Mining and quarrying	115	122
Primary metal works	106	112
Nonmetallic mineral processing	117	117
Chemicals	119	120
Petroleum and coal processing	109	117
All industry	108	111

Source: Statistiske Efterretninger. No. 6, 1971, pp. 2–3.

Although almost no production data for individual mineral commodities was available from government statistics, increased domestic sales or exports were indicated in 1970 for clays, chalk, diatomaceous earth (moler), gravel, and salt. In the metal- and fuel-processing industries, which are supplied mainly by imports, the principal gains appeared to occur in sales or exports of unwrought and semifabricated copper and aluminum, and in petroleum products.

TRADE

In 1970, imports of mineral commodities by Denmark were valued at about $1.1 billion, and exports were valued at about $275 million. Iron, steel, and mineral fuels were the principal items, accounting for more than 70 percent of the value of imports and 60 percent of the value of exports.

Greenland's trade in mineral commodities was mainly limited to imports of coal and petroleum products and exports of cryolite and small quantities of building stone.

Danish trade in mineral commodities in 1968 and 1969 is detailed in the following tables:

[11] Prepared by F. L. Klinger.

Table 3.—Denmark: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Oxide and hydroxide	143	113	United Kingdom 79; Kenya 12.
Metal including alloys:			
Unwrought including scrap	3,216	3,091	Sweden 1,271; Belgium-Luxembourg 977; West Germany 598.
Semimanufactures	[r] 2,652	3,696	Sweden 1,137; West Germany 546; United Kingdom 485.
Antimony including alloys	110	103	Brazil 42; Sweden 21; Venezuela 21.
Copper:			
Matte	--	44	All to Sweden.
Metal including alloys:			
Scrap	4,931	3,480	West Germany 1,904; Belgium-Luxembourg 968; Sweden 399.
Unwrought	1,307	811	West Germany 516; Sweden 295.
Semimanufactures	2,580	2,449	United Kingdom 1,100; Sweden 359; West Germany 357.
Iron and steel:			
Ore and concentrate	16,467	24,273	West Germany 14,443; United Kingdom 4,630; Belgium-Luxembourg 3,201.
Roasted pyrite	103,111	119,493	West Germany 117,293; Sweden 2,200.
Metal:			
Scrap	72,067	23,575	West Germany 10,802; Norway 7,236; Sweden 4,358.
Pig iron including cast iron	521	654	Sweden 638; Netherlands 9.
Sponge iron, powder and shot	213	231	West Germany 226; Thailand 5.
Spiegeleisen	--	9	All to Sweden.
Ferroalloys	--	537	West Germany 535.
Steel, primary forms	[r] 2,643	3,415	Norway 3,356; Sweden 16.
Semimanufactures:			
Bars, rods, angles, shapes and sections	101,198	98,562	West Germany 45,288; United Kingdom 24,373; Sweden 18,330.
Universal plates and sheets	129,989	105,961	Sweden 37,711; Norway 28,089; West Germany 26,541.
Hoop and strip	956	1,425	Sweden 920; Norway 359; West Germany 107.
Rails and accessories	14,872	25,083	Italy 14,493; West Germany 5,309; Netherlands 2,500.
Wire	2,499	2,939	Sweden 2,523; Norway 219; Finland 144.
Tubes, pipes and fittings	12,982	12,712	Sweden 8,050; Poland 1,364; Norway 943.
Castings and forgings, rough	[r] 3,128	4,890	Sweden 2,415; West Germany 848; Norway 484.
Total semimanufactures	[r] 265,624	251,572	
Lead including alloys:			
Scrap	--	57	All to West Germany.
Unwrought	[r] 5,750	4,538	Norway 1,404; Sweden 624; Switzerland 526.
Semimanufactures	77	116	Norway 59; Iceland 47.
Magnesium including alloys, all forms	45	102	United States 62; West Germany 21; Norway 13.
Manganese oxides	3	--	
Nickel including alloys, all forms	[r] 207	359	West Germany 169; United Kingdom 67; Sweden 66.
Silver:			
Waste and sweepings ..... value, thousands	[r] $1,274	$1,248	West Germany $518; United Kingdom $235; Sweden $216.
Metal including alloys, all forms ..... do	[r] $189	$1,048	West Germany $554; United States $384; Sweden $57.
Tin including alloys:			
Scrap ..... long tons	[r] 108	47	All to West Germany.
Unwrought ..... do	[r] 1,014	1,464	Hungary 442; Czechoslovakia 403; Venezuela 103.
Semimanufactures ..... do	55	51	Sweden 41.
Titanium dioxide	88	34	Finland 30.
Zinc:			
Oxide	9	16	Iceland 7; Sweden 3; West Germany 2.
Metal including alloys:			
Scrap including blue powder (dust)	[r] 3,323	3,312	West Germany 1,578; Norway 497; France 395.
Unwrought and semimanufactures	473	235	Greece 49; Netherlands 44; Norway 41.

See footnotes at end of table.

Table 3.—Denmark: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Other:			
Ash and residues containing nonferrous metals	r 5,013	5,383	Sweden 1,772; Netherlands 1,467; West Germany 1,286.
Oxides, hydroxides, and peroxides of metals n.e.s	4	198	United States 99; United Kingdom 38; Canada 18.
Base metals including alloys, all forms n.e.s	116	266	Sweden 89; West Germany 75; Brazil 42.
NONMETALS			
Cement	178,705	155,811	Brazil 36,370; Argentina 24,834; Sweden 20,340.
Chalk	22,641	20,948	West Germany 7,005; Sweden 6,751; Norway 3,096.
Clays and products (including all refractory brick):			
Crude n.e.s	4,762	3,506	Finland 1,657; Sweden 1,395; Norway 191.
Products:			
Refractory [1]	38,178	43,242	West Germany 7,810; United Kingdom 6,084; Netherlands 5,983.
Nonrefractory	109,355	91,468	West Germany 63,186; Norway 17,863; Sweden 7,414.
Cryolite	28,800	45,400	NA.
Diamond:			
Gem not set or strung ____ value, thousands	r $67	$44	Sweden $18; Belgium-Luxembourg $14; Finland $8.
Industrial ____ do	$6	--	
Diatomite and other infusorial earths	97,470	92,935	West Germany 47,078; United Kingdom 29,831; Sweden 4,851.
Feldspar and fluorspar	255	117	United Kingdom 80; Australia 20; Norway 17.
Fertilizer materials:			
Crude:			
Phosphatic	7	67	United Kingdom 31; West Germany 24; Norway 12.
Potassic	11	--	
Other	504	195	All to Sweden.
Manufactured:			
Nitrogenous	25	5,210	India 5,200.
Phosphatic	11,467	59,129	East Germany 29,585; U.S.S.R. 17,795; Switzerland 11,650.
Potassic	3	1	Mostly to Sweden.
Other including mixed	704	684	Sweden 645; United Kingdom 16; Norway 11.
Lime	25,653	18,712	Norway 12,073; Sweden 5,236; West Germany 914.
Pigments, mineral including processed iron oxide	r 141	131	Finland 53; West Germany 42; Norway 14.
Salt	11,117	3,173	Norway 1,748; Sweden 1,089; Iceland 300.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	r 43,880	56,538	West Germany 55,180; Sweden 153.
Worked	r 3,116	1,063	Norway 533; Sweden 190; West Germany 163.
Dolomite, chiefly refractory grade	2	8	Sweden 5; Norway 2.
Gravel and crushed rock ____ thousand tons	1,667	2,118	West Germany 2,096; Sweden 15.
Limestone (except dimension)	98,421	110,538	Sweden 52,019; West Germany 40,727; Norway 12,027.
Quartz and quartzite	69	69	West Germany 35; Sweden 22.
Sand excluding metal bearing	118,096	131,799	Sweden 107,975; West Germany 10,455; Finland 7,498.
Sulfuric acid	8,993	7,621	United Kingdom 7,410; Iceland 211.
Talc, steatite, soapstone, and pyrophyllite	100	236	Sweden 79; Norway 69; Iceland 24.
Other n.e.s.:			
Crude	2,277	3,218	West Germany 2,406; Sweden 315; Norway 251.
Slag, dross, and similar waste, not metal bearing	73,222	48,583	West Germany 48,393; Sweden 189.
Oxides, hydroxides of magnesium, strontium, and barium	17	4	Sweden 3.

See footnotes at end of table.

Table 3.—Denmark: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	151	83	Turkey 23; Sweden 21; Finland 9.
Carbon black and gas carbon	237	269	Sweden 115; Norway 61; Turkey 38.
Coal and coke including briquets	r 79,852	88,134	Sweden 48,882; Norway 26,592; West Germany 12,652.
Peat including peat briquets and litter	r 2,836	4,430	West Germany 2,831; Italy 1,068; Norway 217.
Petroleum refinery products:			
Gasoline thousand 42-gallon barrels	2,682	2,788	Sweden 2,296; United Kingdom 257.
Kerosine and jet fuel do	73	128	Sweden 112; Norway 16.
Distillate fuel oil do	2,194	2,610	Sweden 2,181; Norway 429.
Residual fuel oil do	1,540	4,309	Sweden 3,095; Netherlands 598; Norway 344.
Lubricants do	65	139	Norway 99; Sweden 21.
Other do	280	385	Norway 216; Finland 145.
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r 16,123	2,520	Norway 1,354; Sweden 895; Iceland 173.

r Revised. NA Not available.

[1] Including those of magnesite, diatomite, and other refractory materials.

Table 4.—Denmark: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Oxide and hydroxide [1]	1,230	618	United States 332; West Germany 193; France 53.
Metal including alloys:			
Scrap	3,136	1,572	Norway 849; United Kingdom 374; Sweden 265.
Unwrought	10,003	13,897	Norway 7,300; Canada 4,241; United Kingdom 1,630.
Semimanufactures	19,022	23,829	Sweden 4,439; West Germany 3,649; Switzerland 3,411.
Antimony including alloys, all forms	67	109	Mainland China 68; West Germany 20.
Cadmium including alloys, all forms	24	23	Norway 14; Belgium-Luxembourg 6.
Chromium oxide and hydroxide	400	423	West Germany 147; France 132; United States 100.
Cobalt including alloys, all forms	24	32	Belgium-Luxembourg 16; France 8.
Copper including alloys:			
Scrap	182	236	Iceland 122; Liberia 47; West Germany 32.
Unwrought	4,233	3,934	Belgium-Luxembourg 3,180; West Germany 469; Peru 118.
Semimanufactures	r 25,252	28,984	Sweden 12,757; West Germany 4,357; Belgium-Luxembourg 3,316.
Iron and steel:			
Ore and concentrate	1,020	1,596	Sweden 950; Norway 576.
Roasted pyrite	5,483	14,067	Spain 9,013; Norway 3,874; West Germany 1,180.
Metal:			
Scrap	1,034	41,982	East Germany 28,233; Poland 3,965; West Germany 3,634.
Pig iron including cast iron [2]	r 22,750	25,454	West Germany 8,500; Norway 7,505; U.S.S.R. 5,223.
Ferroalloys	r 15,138	15,390	Norway 13,519; Sweden 773; U.S.S.R. 439.
Steel, primary forms	r 158,364	155,656	Norway 58,609; West Germany 50,219; Sweden 42,949.
Semimanufactures:			
Bars, rods, angles, shapes, sections [3]	r 344,687	433,489	West Germany 129,208; Belgium-Luxembourg 74,789; France 67,492.
Universals, plates and sheets	r 454,157	655,133	West Germany 204,851; Sweden 117,051; Belgium-Luxembourg 82,967.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Semimanufactures—Continued			
Hoop and strip	r 63,891	81,615	Belgium-Luxembourg 35,595; West Germany 25,834; Netherlands 5,913.
Rails and accessories	18,762	20,276	France 11,501; West Germany 5,900; Belgium-Luxembourg 1,671.
Wire	r 19,478	21,979	West Germany 7,458; Belgium-Luxembourg 6,520; Sweden 3,904.
Tubes, pipes, and fittings	r 120,943	164,947	West Germany 62,742; France 27,648; United Kingdom 27,648.
Castings	r 35	1,877	Norway 1,784; Switzerland 26.
Total semimanufactures	r 1,021,953	1,379,316	
Lead:			
Oxides	1,233	1,203	Mexico 488; Sweden 201; West Germany 80.
Metal including alloys:			
Scrap	6,015	9,799	Hungary 3,756; Norway 2,981; Singapore 662.
Unwrought	11,264	10,828	Sweden 4,448; South-West Africa 3,195; Canada 1,720.
Semimanufactures	586	686	West Germany 470; United Kingdom 115; Belgium-Luxembourg 94.
Magnesium including alloys, all forms	r 123	174	Norway 105; West Germany 17; Italy 14.
Manganese:			
Ore and concentrate	r 9,350	9,106	Brazil 2,839; Netherlands 2,780; mainland China 2,200.
Oxides	1,523	1,544	Japan 969; Netherlands 265; Belgium-Luxembourg 252.
Mercury ... 76-pound flasks	r 348	580	Yugoslavia 223; Spain 90; Sweden 75.
Molybdenum including alloys, all forms	4	15	West Germany 10; Austria 4.
Nickel:			
Ore and matte	r 42	16	All from United Kingdom.
Metal including alloys:			
Unwrought including scrap	r 101	73	United Kingdom 63; Sweden 4.
Semimanufactures	r 486	774	West Germany 262; United Kingdom 245; Sweden 112.
Platinum group and silver including alloys, all forms:			
Platinum group ... value, thousands	$533	$680	Switzerland $204; West Germany $169; Netherlands $153.
Silver ... do	$5,161	$4,321	United Kingdom $1,781; West Germany $1,053; Netherlands $491.
Tin including alloys:			
Scrap ... long tons	r 260	281	Italy 59; Hungary 44; Singapore 41.
Unwrought ... do	1,106	1,147	Mainland China 510; United Kingdom 148; West Germany 129.
Semimanufactures ... do	r 78	88	Sweden 52; West Germany 31.
Titanium, oxides	6,150	6,925	United Kingdom 1,627; Netherlands 1,623; Norway 1,549.
Tungsten including alloys, all forms	r 5	5	Sweden 4.
Zinc:			
Oxide	1,624	2,034	West Germany 1,153; Netherlands 342; East Germany 280.
Metal including alloys:			
Blue powder, including scrap	535	675	Norway 344; United Kingdom 115; Belgium-Luxembourg 77.
Unwrought	r 10,819	13,297	Norway 4,181; Netherlands 2,808; Belgium-Luxembourg 1,781.
Semimanufactures	6,301	6,863	Yugoslavia 2,990; Belgium-Luxembourg 1,659; Poland 1,171.
Other:			
Ore and concentrates of base metals n.e.s	r 715	595	Australia 323; United Kingdom 101; Norway 51.
Ash and residue, containing nonferrous metals	1,535	1,334	Sweden 1,156; Switzerland 68; West Germany 68.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Other—Continued			
Metals including alloys, all forms:			
Metalloids	1,599	1,810	West Germany 1,056; Sweden 322; Norway 282.
Alkali, alkaline earth and rare earth metals	354	364	West Germany 363.
Pyrophoric alloys	7	7	United States 4; Austria 2.
Base metals including alloys, all forms n.e.s	138	193	Mainland China 68; West Germany 28.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	3,554	8,157	West Germany 6,261; Spain 952; Netherlands 429.
Dust and powder of precious and semiprecious stones value, thousands	r $38	$47	Belgium-Luxembourg $40.
Grinding and polishing wheels and stones	889	1,092	Sweden 401; West Germany 267; Austria 170.
Asbestos	r 25,126	24,929	Canada 13,707; Cyprus 4,554; Republic of South Africa 4,144.
Barite and witherite	r 937	1,125	West Germany 945; mainland China 114; France 66.
Boron:			
Crude natural borates	1,831	2,253	United States 1,259; West Germany 744; Turkey 200.
Oxides and acids	r 237	129	France 60; United States 38; mainland China 20.
Cement	6,485	25,967	Sweden 12,157; Iceland 10,182; United Kingdom 1,940.
Chalk	2,008	4,672	West Germany 3,008; France 1,161; United Kingdom 376.
Clays and products (including all refractory brick):			
Crude, kaolin and other	63,883	73,078	United Kingdom 49,919; Czechoslovakia 9,716; West Germany 6,678.
Products:			
Refractory (including nonclay bricks)	r 28,366	35,989	West Germany 12,233; Sweden 10,851; Austria 6,009.
Nonrefractory	r 41,908	72,292	West Germany 38,100; Japan 10,394; Sweden 10,151.
Diamond, gem not set or strung value, thousands	$1,015	$876	Belgium-Luxembourg $400; Switzerland $143; Israel $99.
Diatomite and other infusorial earths	r 4,147	4,572	United States 3,545; West Germany 378; France 252.
Feldspar	4,973	8,437	Norway 7,532; Sweden 683; United Kingdom 160.
Fertilizer materials:			
Crude:			
Nitrogenous	6,044	21,063	All from Chile.
Phosphatic	274,372	329,793	Morocco 222,440; U.S.S.R. 78,655; Tunisia 24,320.
Potassic	1,354	1,232	West Germany 1,220; East Germany 12.
Manufactured:			
Nitrogenous	295,919	213,276	Norway 180,421; West Germany 23,375; Finland 2,812.
Phosphatic:			
Thomas (basic) slag	2,175	835	All from West Germany.
Other	39,992	38,584	Netherlands 18,485; Belgium-Luxembourg 7,542; France 4,856.
Potassic	209,776	233,561	West Germany 171,350; East Germany 39,417; France 14,694.
Other including mixed	299,353	329,165	Norway 261,959; West Germany 49,084; Belgium-Luxembourg 17,856.
Ammonia	139,191	203,456	United States 131,286; Norway 53,843; Netherlands 12,805.
Fluorspar	3,627	1,728	East Germany 750; France 686; Republic of South Africa 292.
Graphite, natural	301	401	Norway 192; West Germany 134; United Kingdom 38.
Gypsum and plasters	115,234	174,526	Poland 114,173; France 47,893; West Germany 9,862.
Lime	1,396	2,324	West Germany 1,644; Poland 325; United Kingdom 227.
Magnesite	5,194	6,376	Austria 2,825; mainland China 999; Czechoslovakia 717.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Mica:			
Crude including splittings and waste	403	352	Norway 116; United Kingdom 113; Mozambique 50.
Worked including agglomerated splittings	116	221	West Germany 184; Belgium-Luxembourg 11.
Pigments, mineral:			
Natural, crude	329	318	Cyprus 169; West Germany 101; France 37.
Iron oxides processed	3,268	3,867	West Germany 3,274; Spain 294; United Kingdom 201.
Precious and semiprecious stones, except diamond value, thousands	$1,319	$1,213	West Germany $510; India $376.
Pyrite	r 121,122	146,774	Spain 134,589; Norway 7,780; Portugal 4,400.
Salt	r 187,328	249,590	West Germany 176,503; U.S.S.R. 26,887; United Kingdom 17,573.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous (including marble)	r 8,895	8,056	Sweden 4,153; Italy 1,903; Norway 1,659.
Slate	12,854	12,050	Norway 7,208; Sweden 2,389; West Germany 1,575.
Other (granite, gneiss, etc.)	39,348	40,560	Sweden 38,879; Portugal 780; West Germany 462.
Worked, all types	r 35,082	48,090	Sweden 24,151; Portugal 14,085; Italy 1,570.
Dolomite, chiefly refractory grade	22,071	21,935	Norway 15,124; West Germany 3,333; Sweden 2,154.
Gravel and crushed rock	r 380,236	473,009	Sweden 390,929; Norway 71,038; West Germany 9,486.
Limestone (except dimension)	50,509	58,512	Sweden 48,620; Poland 9,174; Norway 392.
Quartz and quartzite	11,015	5,282	Sweden 2,568; Norway 1,903; West Germany 398.
Sand excluding metal bearing	73,149	91,796	Belgium-Luxembourg 70,977; Sweden 9,553; West Germany 6,993.
Sulfur:			
Elemental, all forms	5,995	11,632	France 4,170; Poland 3,639; Finland 2,220.
Sulfur dioxide and sulfuric acid	3,547	3,965	West Germany 3,297; East Germany 440; Netherlands 111.
Talc, steatite, soapstone, and pyrophyllite	14,377	13,393	Norway 6,652; Sweden 3,106; West Germany 1,818.
Other nonmetals n.e.s.:			
Crude	r 25,504	35,058	West Germany 26,082; Sweden 6,131; United States 2,524.
Slag, dross and similar waste, not metal bearing	r 37,716	48,222	United Kingdom 28,076; Sweden 16,727; West Germany 2,402.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	r 1,730	1,706	United States 954; West Germany 460; United Kingdom 141.
Carbon black	2,633	3,356	West Germany 1,128; United Kingdom 991; United States 633.
Coal and coke including briquets thousand tons	4,703	4,242	Poland 3,040; U.S.S.R. 506; United Kingdom 62.
Gas hydrocarbon, liquefied do	87	91	West Germany 64; Sweden 18; Belgium-Luxembourg 4.
Peat including peat briquets and litter	5,856	9,136	Sweden 7,756; Poland 698; West Germany 626.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	49,753	62,359	Kuwait 21,534; Libya 10,426; Oman 9,461.
Refinery products:			
Gasoline do	7,604	6,882	Sweden 1,531; United Kingdom 1,421; Italy 1,324.
Kerosine and jet fuel do	4,318	4,741	United Kingdom 1,555; Netherlands 1,024; Italy 676.
Distillate fuel oil do	22,850	24,445	United Kingdom 12,485; Netherlands 2,322; Trinidad and Tobago 1,449.

See footnotes at end of table.

Table 4.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum—Continued			
Refinery products—Continued			
Residual fuel oil thousand 42-gallon barrels	19,046	23,765	United Kingdom 9,174; U.S.S.R. 3,198; Belgium-Luxembourg 2,106.
Lubricants do	722	608	United Kingdom 285; Netherlands 81; Sweden 72.
Mineral jelly and wax do	81	102	West Germany 71; Indonesia 8; United States 7.
Other do	1,643	1,752	Netherlands Antilles 760; West Germany 587; Sweden 257.
Total do	56,264	62,295	

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.*—Production of iron and steel continued to be based mainly on scrap, supplemented by small quantities of iron ore and roasted pyrite. Det Danske Staalvalsevaerk (DDN) remained the principal producer, accounting for more than 90 percent of crude steel production and virtually all output of rolled products. DDN produced 465,000 tons of rolled steel in 1970, mainly sections and heavy plates.

In 1970, imports of iron and steel semimanufactures totaled 1.6 million tons, and exports totaled 293,000 tons. Slabs and heavy plate were the principal items.

Nonferrous metals.—Aggregate consumption of primary nonferrous metals in Denmark increased more than 20 percent in 1970, as indicated by the following tabulation in metric tons:

Metals	1969	1970
Aluminum, primary	8,000	9,600
Copper, refined	4,900	5,200
Lead, refined	19,800	27,100
Nickel (excluding scrap)	100	100
Tin, refined	700	700
Zinc, slab	11,800	12,800
Total	45,300	55,500

Source: World Bureau of Metal Statistics (London). V. 24, No. 7, July 1971.

Nonmetals.—*Cement.*—Activity in the construction industry remained strong during the first half of the year, but later declined. Building completions were up about 10 percent from 1969. Sales of cement totaled 2.6 million tons, about the same as in the previous year; sales of products of cement, asbestos, and glass increased. Imports and exports of building stone were nearly twice the quantities traded in 1969.

Cryolite.—Exports of Greenland cryolite totaled 33,173 tons, 27 percent less than those of 1969.

Diatomite.—Diatomaceous materials continued to be important. Sales included 8,400 tons of diatomite, 30,000 tons of moler, and an estimated 200,000 tons of moler brick. Exports of moler rose to 92,000 tons.

Fertilizers.—In 1970, production of fertilizers for the Danish market by A/S Dansk Svovlsyre—og Superphosphatfabrik (DSS) was 730,000 tons, about the same as in 1969. Domestic sales and exports of superphosphate declined to about 60 percent of 1969 levels. DSS was the principal Danish producer of fertilizers, with plants at Norresundby, Kalundborg, and Fredericia. Output of compound fertilizers at the Fredericia plant was about 400,000 tons.

Imports of the principal crude fertilizer materials in 1970 were less than those in 1969, but imports of compound fertilizers increased. Danish consumption of fertilizer in the 1969–70 agricultural year was equivalent to 270,500 tons of nitrogen, 151,700 tons of potassium, and 55,400 tons of phosphorus.

Mineral Fuels.—*Coal.*—Production of brown coal, which has declined rapidly since 1966, may have stopped altogether in 1970. Strip mining at Søby, on Aerø Island south of Fyn, was scheduled to cease in May 1970. The brown coal was mainly used for generating electric power. Remaining accessible resources of brown coal in Denmark were estimated at 14 million tons.

Imports of coal, including brown coal briquets, in 1970 dropped about 6 percent compared with 1969; imports of coke fell 35 percent. Eighty-two percent of coal imports came from Poland and 17 percent from the Soviet Union. Imports of coke were mainly from the Soviet Union and West Germany.

Petroleum.—Danish consumption of crude oil has more than doubled since 1966, and consumption of refined products rose nearly 60 percent. Imports in 1970 included 10.12 million tons of crude oil and 10.2 million tons of refined products. Provisional figures for 1970 indicated inland consumption of 10.2 million tons of crude oil and 17.3 million tons of refined products.[12] Fuel oils made up 82 percent of the consumption of petroleum products.

By yearend 1970, the three petroleum refineries in Denmark had an aggregate refining capacity of 196,000 barrels of crude oil per day. Refineries were operated at Fredericia (46,000 barrels per day) by A/S Dansk Shell; at Kalundborg (70,000 barrels per day) by Dansk Esso A/S; and at Stigsnaes (80,000 barrels per day) by Gulf Oil Refinery A/S.

In 1970, agreement was reached between Danish and West German authorities on delineation of offshore territorial boundaries in the North Sea. Subsequently, Dansk Undergrunds Consortium (DUC) announced that four discoveries of oil and two discoveries of gas had been made since 1966. All of the discoveries were made near the western limit of the Danish sector, in an area approximately 60 miles southeast of Norway's Ekofisk field and 75 miles north of the Tenneco discovery in the Netherlands sector. DUC planned to produce about 10,000 barrels of oil per day from one of its fields, starting in 1972. DUC participants included Gulf Oil Co. (operator), 30 percent; the Royal Dutch-Shell Group, 30 percent; the A. P. Moller Group, 25 percent; Texaco, Inc., 7.5 percent; and Standard Oil Co. of California 7.5 percent.

Greenland.—Vestgron Mines Ltd., 67-percent owned by Cominco Ltd. of Canada, was granted a mining concession in the Marmorilik area of west Greenland. Other shareholders include Westfield Minerals Ltd. and Northgate Exploration Ltd. Through Greenex, S.A., a Danish subsidiary, Vestgron will conduct a $3.5 million program of exploration and development during 1971 and 1972. The concession area, which covers 37,000 acres, includes two zones of lead-zinc-silver mineralization about 5,000 feet apart that were estimated by Cominco Ltd. to contain reserves of at least 2.5 million tons of ore averaging 4.3 percent lead, 18.3 percent zinc, and 0.8 ounces of silver per ton.

Other mineral explorations, largely backed by Canadian companies, were being carried out or planned for nickel, copper, chromite, molybdenum, iron ore, uranium, and other metals. Fernico A/S reported drilling a nickel ore occurrence on Disko Island and finding interesting showings of chalcopyrite on Arveprinsens Ejland (lat. 72° N.). Farther south, the Oresund Cryolite Co. continued prospecting in the area between Godthaab and Egedesminde. The company is reported to have found large deposits of iron ore containing about 39 percent iron. The Danish Atomic Energy Commission continued investigations of low-grade uranium ore in the vicinity of Julianehaab. Offshore mineral exploration in the Davis Straits area was begun by Marine Resource Consultants, Inc., of Santa Monica, Calif. The vessel used for this project was leased from the Iceland State Research Council, which will participate in the investigations. In East Greenland, prospecting was continued by A/S Nordisk Mineselskab.

By the beginning of 1970, applications for oil and gas concessions in Greenland had been received from about 40 companies by the Greenland Ministry in Copenhagen. Preliminary reconnaissance concessions (without drilling rights) had been granted to Compagnie Française des Pétroles and to Ponderay Polar A/S. By the end of the year, about 10 other companies had been granted 2-year prospecting licenses. Particular interest was shown in the shelf areas between Greenland and the Canadian arctic archipelago and near Disko Island. Seismic surveys were carried out by at least five groups of companies during the year.

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[12] Organization for Economic Cooperation and Development (OECD) (Paris). Provisional Oil Statistics by Quarters: Fourth Quarter, 1970. 1971, 21 pp.

ICELAND [13]

In 1970, Iceland recorded a substantial increase in the value of mineral industry production as the result of new mineral developments and general improvement in the nation's economy. The major increment was the production of aluminum in the smelter at Straumsvik, which completed its first full year of operation. Output was also up sharply at the 3-year-old Lake Myvatn diatomite plant. Recovery of the economy from the drastic depression of 1967–69 stimulated construction activity and increased the demand for building materials, especially sand and gravel and all types of stone.

Government Policies and Programs.—Booming economic conditions and an expensive wage settlement in midyear caused Iceland's chronic inflation problem to reappear. Consequently, a general price freeze was announced by the government as of November 1, and price control legislation was under consideration by the Althing (Parliament).

On March 1, Iceland joined the European Free Trade Association (EFTA). As a condition of membership, many import tariffs were lowered as of that date, and a general tariff revision went into effect on January 1, 1971. What effect these provisions will have on mining for domestic consumption cannot yet be determined.

PRODUCTION

The Straumsvik smelter of Swiss Aluminum, Ltd., turned out 37,956 metric tons of primary aluminum during 1970. its first full year of operation. This production, practically all of which is exported, contributed nearly $22 million to the national economy and represented 4.5 percent of the gross national product (GNP). Additional growth in mineral output came from the diatomite plant at Lake Myvatn, operated by Johns-Manville Corp., which nearly doubled its previous year's production and gave Iceland a further $1.5 million in export income. Other mineral and mineral-related industries showing expansion were building materials, especially crushed and dimension stone and metal scrap.

TRADE

In 1970, exports of aluminum and diatomite helped to reduce Iceland's historically unfavorable balance of mineral trade. These two products together earned for the country $21 million in foreign exchange. Import data are not yet available, but past trends indicate that an estimate of between $33 million and $34 million in mineral imports would be reasonable when allowance is made for increased receipts of alumina. Exports of mineral products are forecast to approach $27 million in 1971, and this would mean only a relatively slight deficit in mineral trade when the fact that exports are valued f.o.b. and imports are valued c.i.f. is taken into account. The trend in mineral and total commodity trade is shown in the following tabulation, in million dollars;

	Mineral commodity trade	Total commodity trade	Mineral commodities share of total (percent)
Exports (f. o. b.): [1]			
1965	0.1	129.4	0.1
1966	.2	140.8	.1
1967	.2	97.0	.2
1968	.3	81.7	.4
1969	6.9	100.6	6.9
Imports (c.i.f.): [1]			
1965	22.9	137.0	16.7
1966	22.9	159.0	14.4
1967	23.8	163.4	14.6
1968	26.7	137.6	19.4
1969	27.7	123.2	22.5

[1] Export and import figures are not directly comparable, because exports are valued f.o.b. (cost, only) while imports are valued c,i.f. (cost, insurance, freight). A rule of thumb is that cost represents 90 percent of import value.

Imports of mineral commodities rose 3.5 percent in value in 1969, the last year for which data is available. The entire increase consisted of imports of bauxite for the aluminum smelter. Smaller values of other minerals were imported, particularly petroleum products, probably reflecting the lower average level of economic activity.

COMMODITY REVIEW

Aluminum.—Expansion continued at the Alusuisse aluminum plant at Straumsvik in 1970. Capacity was rated at 44,000 metric

[13] Prepared by David G. Willard.

Table 5.—Iceland: Mineral commodity trade
(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Iron and steel scrap	2,978	3,625
NONMETALS		
Diatomite	2,138	7,444
IMPORTS		
METALS		
Aluminum and alloys unwrought and semimanufactures	831	3,713
Copper and alloys unwrought and semimanufactures	r 138	110
Iron and steel semimanufactures	r 28,729	24,254
Lead and alloys unwrought and semimanufactures	112	177
Magnesium including alloys, all forms	1,001	--
Silver and platinum, all forms ... value, thousands	r $91	$81
NONMETALS		
Cement	17,071	22,794
Clay products:		
Refractory	1,637	629
Nonrefractory	864	795
Cryolite and chiolite	--	2,193
Fertilizers manufactured	r 36,214	35,026
Gypsum and plaster	6,940	6,291
Lime	1,218	22,724
Pigments, titanium oxides	275	289
Salt	57,230	47,770
Stone, dimension, worked	98	--
Other, building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals n.e.s	627	727
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	2,749	2,058
Carbon black	426	489
Coal, anthracite and bituminous	r 3,012	2,332
Coke	1,183	--
Petroleum refinery products:		
Gasoline, motor ... thousand 42-gallon barrels	478	445
Kerosine and white spirit ... do	3	298
Distillate fuel oil ... do	2,524	1,878
Residual fuel oil ... do	710	602
Lubricants ... do	32	35
Other:		
Nonlubricating oils, n.e.s ... do	--	4
Bituminous mixtures, n.e.s ... do	17	11
Liquefied petroleum gas ... do	5	6
Total ... do	3,769	3,279

r Revised.

tons per year by midyear and is scheduled to reach 60,000 tons by 1972.[14]

Petroleum.—A bill was introduced in the Althing (and passed early in 1971) for the planning, engineering, and (if feasible) construction of a petroleum refinery. Iceland currently has no refinery, and petroleum products constitute about half of its mineral imports. Refinery plans have been considered previously and have always been declared infeasible because of the small local market and limited range of product demands, but growth of the market may now justify the installation.

Majority ownership will be held by the Icelandic Government and local private interests and the minority ownership, by a foreign investor. An American oil operator was considered most likely to be selected for the minority foreign ownership.[15]

Sea Chemicals.—A drilling survey completed in 1969 indicated the possibility of producing a variety of chemicals from sea water and geothermal brines, using energy obtained from Iceland's plentiful geothermal steam. The likely location would be Reykjanes at the southwestern tip of the island. Among the possible products are sodium chloride, magnesium chloride, calcium chloride, potassium chloride, bromine, and lithium. A total investment cost of $26 million has been estimated for the

[14] U.S. Embassy, Reykjavik. State Department Airgram A-149, Aug. 13, 1970, p. 2.
[15] U.S. Embassy, Reykjavik. State Department Airgram A-85, Apr. 30, 1970, p. 1.

project. Further studies were in progress, and, if they indicate feasibility, it is expected that bids from foreign investors will be solicited.[16]

SWITZERLAND [17]

Metal consumption in Switzerland is very high, and expansion has been particularly marked in nonferrous metals, although iron and steel still lead the list of metals consumed to produce semifinished and finished products.

A modest output of several nonmetallic mineral commodities such as cement, lime, and gypsum continued to be sustained by indigenous mineral resources; output rose 5 percent in 1970. Switzerland's aluminum refining industry, based entirely upon imported raw materials, met Swiss consumption requirements and provided a small excess that was exported as aluminum ingots and semifabricated products. The Swiss petroleum refining, electric steel, and nonferrous metals industries, also based on imported raw materials, supplied a substantial portion of the nation's requirements of these processed mineral commodities.

Three distinct groups of Swiss factories use nonferrous metals to produce semifinished and finished products.[18]

1. The "Metallwerke" (Metal Works) group used primary metal and scrap to produce semifinished sheet, strips, rods, wire, profiles, and tube products of copper, brass, cupronickel, argentan, and bronze. These semimanufactured products were sold to the following Swiss industries in the percentages indicated:

Machinery and apparatus	18
Watch industry	16
Electrical industry	14
Exports	14
Consumer goods	12
Construction industry	10
Transportation, ammunition, coins	9
Fittings	7

2. Wire and cable factories produce copper wire and cables from imported primary metal for electrical conductors with protective coatings.

3. Over 60 metal foundries produce fittings, taps, valves, toys, etc., mainly from nonferrous metal scrap.

The Swiss gross national product (GNP) measured in terms of 1970 market prices increased to 9.1 percent; the real growth of GNP was only 4.3 percent. This reflected the slowdown in the Swiss economic boom as evidenced by the decrease in the rate of expansion of industry, a decline in 1970 global demand, an increasing reliance on imports and high prices from abroad, and a labor market in which positions exceeded workers.

The Swiss labor market remained extraordinarily stable during the year and reflected the full employment situation. The major problem continued to be that of reducing the number of foreign nationals in the working force. In 1970, the Swiss Federal Council tightened controls over these workers by establishing a quota system to limit and stabilize the number of foreign laborers.

In 1970, petroleum, the nation's main primary energy source, supplied 78.4 percent of the total energy consumed. Petroleum product consumption increased 12 percent and totaled 95.1 million barrels. Imports of crude oil increased 11 percent in 1970 to 41.6 million barrels. About 60 percent of the crude imports was obtained from Libya with Algeria supplying 14 percent, the Middle East supplying 23 percent, and Tunisia supplying 3 percent. Refinery product imports increased by 27 percent and totaled 60.3 million barrels, of which 92 percent was obtained from sources in the European Economic Community (EEC), primarily West Germany (29 percent), Italy (25 percent), France (23 percent), the Netherlands (11 percent), and Belgium-Luxembourg (4 percent).[19] In addition, Communist Bloc countries supplied 7 percent of the total refinery product imports in 1970.

Hydroelectric and nuclear power accounted for 15.3 percent of total energy consumption, coal provided 4.4 percent, fuel wood provided 1.6 percent, and imported gas supplied the remainder.

[16] International Minerals. Minerals From Sea Water No. 38, November 1970, p. 29.

[17] Prepared by Richard F. Stevens, Jr.

[18] Meister, Max. Swiss Industry Needs Non-Ferrous Metals. Foreign Trade, v. 135, No. 1, Jan. 2, 1971, Ottawa, Canada, pp. 26–28.

[19] Pétrole Informations (Paris, France). Les Activités Pétrolières de la Suisse en 1970 (Petroleum Activities in Switzerland in 1970). No. 1196, Sept. 3, 1971, pp. 15–17.

Because of its landlocked location and the absence of significant indigenous mineral resources, the Swiss economy continued to be highly dependent upon trade to obtain raw and semiprocessed materials. The relationship between mineral commodity trade and total trade is shown in the following tabulations.

	Value (million dollars)		Mineral commodities share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1967	207.9	3,470.9	6.0
1968	233.9	3,950.6	6,0
1969	295.7	4,609.5	6.4
Imports:			
1967	769.5	4,099.1	18.8
1968	853.8	4,494.4	19.0
1969	991.3	5,266.4	18.8
Trade balance:			
1967	−561.6	−628.2	XX
1968	−619.9	−543.8	XX
1969	−695.6	−656.9	XX

XX Not applicable.

A breakdown of Swiss foreign trade in chemicals and chemical products, as reported by the Swiss Association for Chemical Industry, is given in the following tabulation which indicates a 10-percent increase in exports and a 19-percent increase in imports in 1970 over 1969.

	(Million dollars)	
	1969	1970
Chemical exports:		
Organic chemical products	349.2	389.3
Dye stuffs, paints, ink, colors, tannic acid	204.4	231.1
Pharmaceuticals	200.8	212.3
Plastics, cellulose others, esters	92.5	104.0
Fragrances and cosmetics	44.9	49.9
Soaps, waxes, cleaning products	24.8	24.9
Other chemical products	92.5	98.3
Total	1,009.1	1,109.8
Chemical imports:		
Organic chemicals	195.6	252.6
Plastics	115.1	131.2
Other chemicals	291.4	332.8
Total	602.1	716.6

In 1969, nonferrous metal exports (excluding ores, concentrate, and scrap) constituted about 30.4 percent of the total mineral exports by value or $89.8 million. Precious and semiprecious stones contributed about 28.5 percent or almost $84.4 million to total mineral exports. Countries of the EEC and the European Free Trade Association (EFTA) remained the principal recipients of Swiss mineral exports during 1969.

Iron and steel, the largest major group of mineral commodity imports in 1969 contributed 32.1 percent or $318 million to total Swiss mineral imports. Mineral fuels imports valued at $302 million contributed 30.5 percent and nonferrous imports totaled $192 million and represented 19.3 percent of the total. In 1969, imports of gems and semiprecious stones were valued at $101 million or 10.2 percent of the total. The EEC continued to account for the major portion of Swiss mineral imports in 1969.

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, 1969." [20] Consumption of refined petroleum products in Switzerland, approximately 40 percent of which was domestically refined from imported crude oils and the remainder of which was imported as products is indicated in the following tabulation in million barrels.

Product	1969	1970
Motor and aviation gasoline	16.4	18.1
Kerosine and jet fuel	3.7	4.5
Distillate fuel oil	43.5	48.2
Residual fuel oil	13.7	15.3
Lubricants (including greases)	.6	.6
Other refined products	4.4	5.1
Refinery fuel and loss	2.2	3.3
Total	84.5	95.1

Sources: Bulletin International Petrole (Paris, France), BIP No. 1634, July 28, 1970; Bureau of Mines International Petroleum Annual (1969), March 1971; and Bureau of Mines International Petroleum Annual (1970), March 1972.

COMMODITY REVIEW

Metals.—*Aluminum.*—During 1970, an 18,000-ton expansion of Swiss Aluminium Ltd.'s (Alusuisse) smelter at Steg, in the canton of Valois, increased the total Swiss aluminum processing capacity to about 93,000 tons per year.

Copper.—Copper consumption in 1968, the most recent year for which data are

[20] Bureau of Mines. International Petroleum Annual, 1969. March 1971, 39 pp.

Table 6.—Switzerland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Oxide and hydroxide	88	126	West Germany 36.
Metal including alloys:			
Unwrought	24,212	18,277	West Germany 9,990; Italy 2,350; United Kingdom 2,187.
Semimanufactures	27,007	28,779	Denmark 3,445; Austria 2,632; 2,615.
Columbium and tantalum, tantalum including alloys, all forms	5	13	West Germany 11.
Copper:			
Matte	162	210	Netherlands 102; France 80.
Metal including alloys:			
Scrap	12,782	17,945	West Germany 11,002; Italy 1,778; France 1,566.
Unwrought	6,347	3,959	West Germany 2,340; Italy 1,388.
Semimanufactures	9,911	9,494	United States 1,210; Italy 1,500.
Gold unworked or partly worked thousand troy ounces	1,789	843	West Germany 599; France 65; Austria 44.
Iron and steel:			
Ore and concentrate	r 10,469	13,246	West Germany 13,240.
Scrap	39,335	27,251	Italy 15,238; West Germany 7,673.
Pig iron, ferroalloys and similar materials	9,409	11,701	West Germany 6,957; Italy 2,885.
Steel, primary forms	r 3,901	4,403	West Germany 2,763; Italy 1,595.
Semimanufactures	r 85,041	104,637	Italy 18,574; West Germany 18,462; Austria 15,287.
Lead including alloys:			
Scrap	5,407	8,367	Italy 6,908; Austria 850.
Unwrought and semimanufactures	r 636	486	Austria 210.
Magnesium including alloys, all forms	r 124	150	West Germany 89.
Mercury 76-pound flasks	r 145	61	West Germany 32; France 10.
Nickel:			
Matte, speiss and similar materials	7	46	West Germany 41.
Metal including alloys unwrought and semimanufactures	1,300	1,454	United Kingdom 235; West Germany 196; Spain 176.
Platinum group and silver including alloys:			
Platinum group thousand troy ounces	131	146	Italy 43; United Kingdom 29; West Germany 21.
Silver do	4,989	8,324	Italy 3,033; West Germany 1,921; France 742.
Tin including alloys:			
Scrap long tons	r 87	98	West Germany 89.
Unwrought and semimanufactures do	r 83	64	Austria 34; United Kingdom 22.
Titanium oxides	85	92	NA.
Zinc scrap	1,526	1,452	Italy 1,209.
Other:			
Ore and concentrate of molybdenum, tantalum, vanadium, and zirconium	338	86	Yugoslavia 70; West Germany 15.
Ash and residue containing nonferrous metals	17,145	20,233	West Germany 7,308; Italy 6,645; Belgium-Luxembourg 3,882.
Oxides, hydroxides and peroxides of metals n.e.s.	83	82	West Germany 21; Japan 5.
Metals including alloys, all forms:			
Metalloids	6,312	7,678	West Germany 4,054; Japan 1,400.
Base metals, including alloys, all forms, n.e.s.	26	66	West Germany 26; Netherlands 22.
NONMETALS			
Abrasives, natural, n.e.s.:			
Dust and powder of precious and semiprecious stones	19	12	West Germany 3.
Grinding and polishing wheels and stones	656	708	West Germany 188; United Kingdom 121.
Asbestos	32	50	NA.
Cement	103,868	101,219	West Germany 64,982; Italy 16,955.
Clays and products (including all refractory brick):			
Refractory (including nonclay bricks)	1,548	1,341	NA.
Nonrefractory	59,032	61,482	West Germany 25,819; France 19,901; Austria 11,515.

See footnotes at end of table.

Table 6.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Diamond:			
Gem not set or strung----value, thousands--	r $14,268	$14,954	West Germany $3,962; France $3,145; Belgium-Luxembourg $1,955.
Industrial------do----	$1,791	$998	Belgium-Luxembourg $243; West Germany $182; Yugolslavia $176.
Diatomite	82	136	Austria 81; West Germany 12.
Fertilizer materials manufactured, nitrogenous	21,721	9,522	United Kingdom 6,337; France 3,141.
Gypsum and plasters	2,226	2,392	NA.
Lime	2,167	2,232	NA.
Magnesite	43	42	NA.
Mica:			
Crude including splittings and waste	107	93	West Germany 29; Sweden 17; Ireland 11.
Worked including agglomerated splittings	185	216	Sweden 38; Netherlands 33; Austria 21; Belgium-Luxembourg 21.
Precious and semiprecious stones, except diamond:			
Natural------thousand carats--	79,505	40,390	France 7,580; United Kingdom 6,805; West Germany 6,705.
Manufactured------do----	226,950	179,365	West Germany 60,565; Italy 18,190; Pakistan 16,020.
Salt and brines	6	1,186	West Germany 1,182.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	8,886	16,987	Austria 5,507; Hungary 4,500; Czechoslovakia 3,647.
Caustic potash, sodic and potassic peroxides	32	1	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	39,462	38,398	West Germany 27,823; Italy 3,838.
Worked	6,963	9,006	West Germany 8,272.
Dolomite	120	78	Austria 27.
Gravel and crushed rock	37,045	48,198	West Germany 40,130.
Limestone (except dimension)	33	1,000	All to Italy.
Quartz and quartzite	r 18,096	23,585	Italy 18,751.
Sand excluding metal bearing	19,598	13,524	NA.
Sulfur:			
Elemental	r 207	236	West Germany 230.
Sulfur dioxide	669	125	West Germany 92.
Sulfuric acid	r 7,823	12,748	West Germany 11,948.
Talc, steatite, soapstone, and pyrophyllite	2,059	1,739	Italy 1,706.
Other n.e.s.:			
Slag, dross and similar waste, not metal bearing	9,484	NA	
Bromine, iodine and fluorine	21,363	22,577	West Germany 21,516.
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals n.e.s	6,346	5,493	West Germany 3,930; Italy 775.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	782	8	France 1.
Carbon black	201	310	Italy 121; Netherlands 81; U.S.S.R. 27.
Coal including briquets, all grades	r 2,689	3,974	Italy 2,925; Belgium-Luxembourg 1,048.
Coke and semicoke	35,558	52,886	Austria 21,201; West Germany 17,091.
Peat including peat briquets and litter	412	112	France 34; West Germany 28.
Petroleum refinery products:			
Gasoline, motor--thousand 42-gallon barrels--	105	240	Austria 210.
Distillate fuels------do----	21	196	All to Austria.
Residual fuels------do----	1,221	1,280	Do.
Lubricants------do----	43	11	Italy 8.
Other:			
Petroleum coke------do----	56	6	All to Austria.
Bituminous mixtures n.e.s------do----	3	3	NA.
Total------do----	1,449	1,736	
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r 1,468	2,066	West Germany 1,515; France 261; Italy 245.

r Revised. NA Not available.

Table 7.—Switzerland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	335	296	France 172; United Kingdom 101.
Oxide and hydroxide	161,899	149,437	France 123,447; Jamaica 16,152.
Metal including alloys:			
Unwrought	15,577	19,122	Norway 12,714; Austria 2,539.
Semimanufactures	8,067	10,654	West Germany 4,533; Sweden 1,633.
Antimony including alloys, all forms	737	816	Republic of South Africa 216; Japan 113; mainland China 103.
Arsenic trioxide, pentoxide, and acids	122	95	France 43; Sweden 16; United States 16.
Beryllium including alloys, all forms	[r] 11	19	West Germany 14.
Chromium:			
Chromite	2,644	4,055	Republic of South Africa 3,829.
Oxide and hydroxide	528	634	West Germany 463; Italy 70.
Cobalt oxide and hydroxide	6	10	Belgium-Luxembourg 9.
Copper including alloys:			
Scrap	638	511	Israel 246.
Unwrought	38,667	41,338	Belgium-Luxembourg 11,263; West Germany 9,607; Zambia 9,331.
Semimanufactures	22,324	27,266	United Kingdom 11,376; West Germany 4,270.
Gold unworked and partly worked thousand troy ounces	413	373	West Germany 294; Belgium-Luxembourg 23; France 22.
Iron and steel:			
Ore and concentrate including roasted pyrite	[r] 24,072	38,255	Mauritania 33,763.
Scrap	26,896	21,714	West Germany 18,833.
Pig iron including cast iron, sponge iron, spiegeleisen, powder and shot	[r] 61,500	64,264	West Germany 47,673.
Ferroalloys	17,974	17,150	West Germany 4,232; France 2,462; Norway 2,250.
Steel, primary forms	[r] 185,083	203,905	France 67,478; West Germany 64,614.
Semimanufactures:			
Bars, rods, angles, shapes and sections:			
Wire rod thousand tons	61	76	France 31; West Germany 22.
Other bars and rods do	144	193	West Germany 82; France 51; Austria 21.
Angles, shapes and sections do	332	243	West Germany 82; France 77; Belgium-Luxembourg 61.
Universals, plates and sheets do	495	695	West Germany 260; France 168; Netherlands 52.
Hoop and strip do	24	189	West Germany 56; Belgium-Luxembourg 54; Austria 34.
Rails and accessories do	48	45	West Germany 12; Austria 10; Belgium-Luxembourg 8.
Wire do	22	29	Austria 9; West Germany 9.
Tubes, pipes, and fittings do	122	156	West Germany 72; France 28; Austria 12.
Castings and forgings, rough do	2	2	Mainly from West Germany.
Total do	1,250	1,628	
Lead:			
Oxides	203	379	West Germany 147.
Metal including alloys:			
Unwrought including scrap	20,223	25,965	West Germany 5,126; France 4,161; Belgium-Luxembourg 3,202.
Semimanufactures	616	782	West Germany 714.
Magnesium including alloys, all forms	[r] 786	1,139	Norway 990.
Manganese oxides	632	780	Japan 480.
Mercury 76-pound flasks	[r] 783	754	Mexico 232; Yugoslavia 203.
Molybdenum including alloys, all forms	8	11	Austria 6.
Nickel:			
Metal including alloys:			
Scrap	73	119	United Kingdom 94.
Unwrought	1,519	2,109	United Kingdom 698; Belgium-Luxembourg 474; Norway 397.
Semimanufactures	962	1,278	United Kingdom 453; West Germany 324; United States 125.
Platinum group including alloys, all forms thousand troy ounces	[r] 143	123	United States 40; U.S.S.R. 29; France 21.
Silicon including alloys, all forms	243	151	Italy 100; Norway 50.

See footnotes at end of table.

Table 7.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS—Continued			
Silver including alloys, all forms thousand troy ounces	18,671	7,468	West Germany 2,238; Peru 935; Arabian Peninsula 797.
Tin:			
Oxides	26	24	NA.
Metal including alloys, all forms:			
Unwrought	r 883	928	Netherlands 368; United Kingdom 190; Malaysia 187.
Semimanufactures	r 112	156	West Germany 76; Netherlands 42.
Titanium oxides	8,970	8,918	West Germany 3,352; United Kingdom 2,568.
Tungsten:			
Ore and concentrate	40	20	All from Portugal.
Metal including alloys, all forms	r 107	105	West Germany 93.
Zinc:			
Oxide	1,145	1,414	West Germany 594; France 239; Netherlands 233.
Metal including alloys:			
Blue powder	3,026	3,531	Belgium-Luxembourg 2,305; United Kingdom 540; West Germany 392.
Unwrought	25,809	31,057	Belgium-Luxembourg 6,511; West Germany 5,067; North Korea 4,875.
Semimanufactures	1,555	1,742	Belgium-Luxembourg 938; West Germany 416.
Other:			
Ore and concentrate of molybdenum, tantalum, vanadium, and zirconium	2,543	3,197	Australia 2,835.
Ash and residue containing nonferrous metals	1,386	NA	
Oxides, hydroxides and peroxides of metals n.e.s	1,075	1,208	West Germany 932.
Metals, including alloys, all forms:			
Metalloids	1,971	2,414	West Germany 1,068; France 997.
Alkali, alkaline earths and rare earth metals	338	393	West Germany 361.
Pyrophoric alloys	11	11	NA.
Base metals including alloys, all forms n.e.s	737	816	Republic of South Africa 216; Belgium-Luxembourg 116; Japan 113.
NONMETALS			
Abrasives, natural n.e.s.:			
Pumice, emery, natural corundum, etc	1,302	2,117	NA.
Grinding and polishing wheels and stones	1,326	1,515	West Germany 743.
Asbestos	14,999	15,713	Canada 8,026; Republic of South Africa 2,713; U.S.S.R. 2,331.
Barite and witherite	1,826	1,769	West Germany 1,325.
Boron materials:			
Crude natural borates	757	1,247	United States 1,246.
Oxide and acid	483	3,907	Yugoslavia 2,900; France 757.
Cement	33,470	34,957	France 15,062; West Germany 12,031.
Chalk	14,530	15,397	France 14,086.
Clays and products (including all refractory brick):			
Crude n.e.s	172,610	176,206	West Germany 81,427; United Kingdom 53,116.
Cryolite and chiolite	651	550	All from Denmark.
Diamond:			
Gem not set or strung ---- value, thousands	$28,133	$34,486	Belgium-Luxembourg $10,609; Israel $5,354; United States $4,719.
Industrial ---- do	$2,160	$2,313	Belgium-Luxembourg $658; Republic of South Africa $547.
Diatomite and other infusorial earths	2,029	2,601	United States 1,063.
Feldspar and fluorspar	17,325	17,216	France 8,099; West Germany 5,468.
Fertilizer materials:			
Crude:			
Nitrogenous	401	543	All from West Germany.
Phosphatic	21,957	21,679	Morocco 14,375; United States 2,765.
Potassic	87,091	86,296	France 61,254; West Germany 14,317.
Other	20,665	18,152	France 17,648.

See footnotes at end of table.

Table 7.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Fertilizer materials—Continued			
Manufactured:			
Nitrogenous	2,552	3,136	France 1,047; West Germany 769.
Phosphatic:			
Thomas (basic) slag	r 216,669	193,654	France 125,819; Belgium-Luxembourg 67,737.
Other	17,885	17,132	Belgium-Luxembourg 5,733; France 5,528.
Potassic	18,169	22,176	West Germany 11,389; France 6,119.
Other including mixed	31,528	38,418	West Germany 14,796; France 10,759.
Ammonia	5,155	15,693	Austria 14,680.
Graphite, natural	508	353	NA.
Gypsum and plasters	63,332	80,035	West Germany 46,225; Austria 23,126; Italy 9,169.
Lime	r 33,470	20,337	Italy 14,128; West Germany 5,215.
Magnesite	3,350	3,785	Austria 3,623.
Mica:			
Crude including splittings and waste	638	756	West Germany 331; India 88.
Worked including agglomerated splittings	r 189	126	France 98.
Pigments, mineral:			
Natural crude	475	NA	
Iron oxides processed	2,200	780	Japan 480.
Precious and semiprecious stones, except diamond:			
Natural thousand carats	177,565	176,200	Brazil 62,415; United States 53,275; West Germany 23,955.
Manufactured do	100,425	121,435	France 117,800.
Pyrite (gross weight)	42,217	32,359	Italy 32,346.
Salt and brines	1,600	1,119	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	7,169	8,954	West Germany 3,077; France 2,966; Italy 1,642.
Caustic potash, sodic and potassic peroxides	2,927	3,689	France 1,123; West Germany 1,006.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	41,986	47,471	Italy 19,004; Austria 17,893.
Other	34,253	39,964	Italy 15,858; France 11,035.
Worked:			
Slate	1,382	1,440	Italy 1,230.
Paving and flagstone	21,212	31,394	Italy 21,474; Austria 9,264.
Other	8,406	9,527	Italy 6,737; West Germany 1,345.
Dolomite	12,629	13,181	Italy 7,568; France 3,536.
Gravel and crushed rock thousand tons	3,824	4,086	France 2,397; West Germany 1,018.
Limestone (except dimension)	53,913	47,822	France 43,620.
Quartz and quartzite	19,923	23,859	Italy 17,520; West Germany 2,812.
Sand excluding metal bearing	906,846	828,432	Italy 366,611; Belgium-Luxembourg 159,597; West Germany 152,033.
Sulfur:			
Elemental:			
Other than colloidal	35,241	55,123	United States 33,006; France 12,811.
Collidal	336	210	West Germany 162.
Sulfur dioxide	25	23	France 19.
Sulfuric acid	1,148	860	West Germany 565; France 226.
Talc, steatite, soapstone, and pyrophyllite	12,361	11,384	Austria 4,950; France 4,567.
Other nonmetals n.e.s.:			
Crude	r 27,502	25,273	West Germany 13,492; Netherlands 2,165.
Slag, dross and similar waste, not metal bearing	r 30,596	23,577	France 12,835; West Germany 7,921.
Oxides and hydroxides of magnesium, strontium, and barium	272	441	West Germany 232.
Bromine, iodine and fluorine	r 1,226	1,535	France 1,205; Japan 72.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	944	2,054	Trinidad and Tobago 1,085.
Carbon black	7,556	8,345	France 2,605; Netherlands 1,672; Italy 1,637.

See footnotes at end of table.

Table 7.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coal and briquets:			
Anthracite and bituminous coal thousand tons	570	517	West Germany 379; Czechoslovakia 50.
Briquets of anthracite and bituminous coal do	22	28	West Germany 18; France 6.
Lignite and lignite briquets do	98	94	West Germany 88.
Coke and semicoke do	296	233	West Germany 157; France 31.
Hydrogen, helium and rare gases	r 189	239	West Germany 127; United States 10.
Peat and peat briquets and litter	41,298	45,027	West Germany 39,008; Poland 5,612.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	34,407	37,442	Libya 16,715; Algeria 9,875.
Refinery products:			
Gasoline, motor do	10,447	11,492	West Germany 3,689; Italy 3,594; France 2,469.
Kerosine and white spirit do	597	549	Italy 295; France 132.
Distillate fuel oil do	29,683	30,810	Italy 7,328; France 6,628; West Germany 6,419.
Residual fuel oil do	3,685	3,988	West Germany 1,629; France 1,597.
Lubricants do	562	563	Italy 154; Netherlands 107.
Mineral jelly and wax do	69	79	West Germany 41; France 10.
Other:			
Petroleum coke	300	279	United States 128; West Germany 124.
Bitumen and other residues	1,406	1,335	West Germany 546; France 391.
Bituminous mixtures, n.e.s	30	32	West Germany 13; United States 7.
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r 14,004	16,491	France 8,598; West Germany 5,127.

r Revised. NA Not available.

available, was estimated to be about 35,200 metric tons or roughly 22 pounds per capita. The largest consumers were the metal and wire works in Thun, Cossonay, Dornach, and Reconvilier. In addition to smelter copper, these works use large quantities of scrap from their own operations and from those of their customers.

Nonmetals.—*Concrete.*—One of the largest Swiss producers of building materials, A.G. Hunziker & Cie, operates a large factory near Brugg, about 30 miles northwest of Zurich, which makes concrete pipes and prefabricated concrete building elements such as beams, slabs, and wall panels. The high degree of automatic control built into the plant allows the entire operation to be controlled by two men located in a separate concrete building that houses the office and control room.

Mineral Fuels.—*Petroleum.*—Work was conducted on a large expansion of pipeline facilities for the transport of crude oil from Mediterranean ports (Fos, France and Genoa and Trieste, Italy) to the consuming area of Central France, Southwestern Germany, and Switzerland. The present pipeline facilities have a combined capacity of about 516 million barrels per year. To meet the area's projected crude oil requirements, which are expected to more than double by the end of the current decade, additional pipelines will be constructed. Present plans envisage the construction of two completely new pipelines parrallel to the one already in existence. The Swiss petroleum refineries supply less than half of the country's requirements. The balance is supplied by imports of refined petroleum products.

The Swiss petroleum refinery at Collombey-Muraz, Valais, Reffinerie du Sud-ouest SA, which reportedly had a capacity of some 60,000 barrels per day, (3 million metric tons per year), announced plans for a $5 million expansion which would go onstream in 1972. The second Swiss refinery, Raffinerie de Cressier SA, at Cressier treated about 56,780 barrels per day (2,383,700 tons per year) of crude oil during 1970.

As a result of a technical feasability study conducted during the year to determine optimum methods of transporting refined petroleum products the construction of a special pipeline was started in November 1970.

Seismic studies were conducted in the cantons of Berne and Lucerne in an attempt to find oilfields within Switzerland which would allow the country to be less dependent upon foreign sources for its mineral fuel requirements. To date the seismic studies have not indicated the presence of any oilfields.

The Mineral Industry of Other Areas of Africa

By Staff, Bureau of Mines

CONTENTS

BOTSWANA [1]

Development of copper-nickel deposits at Selebi and Pikwe, construction of a diamond mine at Orapa, and intensified minerals exploration highlighted activity in the mineral industry of Botswana. Anglo-American Corp. of South Africa Ltd. was prospecting in the Tati Concession, while United States Steel Corp., Anglo Transvaal Consolidated Investment Co. Ltd., and Middle Witswatersand Ltd. were prospecting in the vicinity of Lake Ngami, northwestern Botswana. Concession rights to large areas of the eastern section of the country were held by Botswana Roan Selection Trust (BRST). In April BRST signed an agreement with the Government on taxes and royalties. It called for an income tax of from 40 to 65 percent of profits and royalty of 7.5 percent of profits. The Botswana Government received 15 percent of the shares of Bamangwato Concessions Ltd., which owns the mineral rights to the Selebi and Pikwe deposits. De Beers Consolidated Mines Ltd. and the Government signed a tax agreement providing for a royalty on the sale of diamond by De Beers and establishing income tax rates. The Government of Botswana also would receive 15 percent of all shares issued by the De Beers subsidiary.

In May the Canadian Government agreed to loan Can$18 million to Botswana for construction of an electric power station. The Government was negotiating with the World Bank for a Can$25 million loan to finance in part development of the Shashi Complex.

Production of mineral commodities in

[1] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

1970 was estimated at $70,000, compared with $516,887 in 1969. Although Botswana is poised on the threshold of a considerable mining boom, mining and quarrying activity in 1967–68 employed only 814 persons out of a total industrial employment of 28,148. Statistics on production are shown in table 1.

Reserves at the Selebi deposit of BRST were reported as 10.5 million tons proven ore containing 0.66 percent nickel and 1.57 percent copper, and 3.0 million tons probable ore containing 0.92 percent nickel and 1.32 percent copper. The deposit at Pikwe was said to contain 21.3 million tons proven ore containing 1.54 percent nickel and 1.20 percent copper. Probable reserves were placed at 10.9 million tons of ore having 1.11 percent nickel and 1.05 percent copper.[2]

Reportedly, mining at a rate of 2.16 million tons of ore per year—1.5 million tons per year from Pikwe and 660,000 tons per year from Selebi—would be the optimum rate for developing the deposits. Ore will be concentrated at Pikwe in a 6,000-ton-per-day plant yielding 1,400 tons of 3.9 percent copper and 3.5 percent nickel concentrate. A flash smelting and sulfur reduction method will be used to produce a 42-percent copper, 35-percent nickel, and 20-percent sulfur matte. About 50,000 tons per year of matte will be refined at Braithwaite, Louisiana. Development costs for mines and plant facilities were estimated at $100 million. The cost of infrastructure to service mining operations has been placed at an additional $50 million. These include a 60-kilowatt electric plant at Pikwe, which will be powered by coal from a mine at Morupule, a dam on the Shashi river to supply water, and roads, railways, a hospital, and a township.

Traces of copper were discovered 25 miles south of Lake Ngami.[3] The Theta Mining and Prospecting Co. of the Anglo Vaal Group expected to prospect in the area for a year.

Anglo-American Corp. was prospecting in the Tati area where copper and nickel indications have been found.[4]

[2] Standard Bank Group (London). Annual Economic Review, Botswana, Lesotho, Swaziland. October 1970, p. 6.
[3] Standard Bank Review (Johannesburg). Botswana. No. 615, June 1970, p. 27.
[4] World Mining. Botswana, V. 7, No. 1, January 1971, p. 51.

Table 1.—Other African Areas: Production of mineral commodities

Country and commodity [1]	1968	1969	1970 [p]
BOTSWANA [2]			
Gem stones, semiprecious, rough, not further described ---- kilograms	1,835	6,044	11,224
Manganese ore and concentrate, gross weight ---- metric tons	[r] 9,998	22,470	40,841
Talc ---- do	125	51	41
BURUNDI [3]			
Columbium and tantalum, columbite concentrates, gross weight ---- do	8	--	NA
Gold mine output, metal content ---- troy ounces	643	--	NA
Lime ---- metric tons	795	800	120
Rare-earth metals, bastnaesite concentrates, gross weight ---- do	525	600	300
Tin ore and concentrate:			
Gross weight ---- long tons	148	108	130
Metal content ---- do	116	83	98
CAMEROON [4]			
Aluminum metal, primary ---- metric tons	45,391	46,737	52,372
Cement, hydraulic ---- do	--	--	30,000
Gold mine output, metal content ---- troy ounces	[r] 465	177	154
Tin ore and concentrate:			
Gross weight ---- long tons	49	44	59
Metal content ---- do	34	31	44
CENTRAL AFRICAN REPUBLIC [4]			
Diamond:			
Gem [e] ---- carats	304,680	267,658	241,000
Industrial [e] ---- do	304,680	267,659	241,000
Total ---- do	609,360	[r] 535,317	482,000
CHAD [4]			
Natron:			
Slabs ---- metric tons	4,540	3,200	[e] 3,200
Broken ---- do	NA	3,500	[e] 3,500
CONGO (BRAZZAVILLE) [4]			
Copper mine output, metal content ---- do	783	11	135
Gold mine output, metal content ---- do	4,790	3,922	2,669

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country and commodity [1]	1968	1969	1970 p
CONGO (BRAZZAVILLE)—Continued [4]			
Lead mine output, metal content e ... metric tons	r 1,000	500	80
Petroleum, crude ... thousand 42-gallon barrels	342	173	137
Potash, crude, K_2O equivalent ... metric tons	--	80,778	250,177
Tin mine output, metal content ... long tons	r 26	20	20
Zinc mine output, metal content e ... metric tons	r 1,000	500	80
ETHIOPIA [4]			
Cement, hydraulic ... thousand metric tons	174	166	181
Clays, kaolin ... metric tons	13,000	12,497	10,453
Feldspar ... do	7,130	11,643	--
Gold mine output, metal content ... troy ounces	38,828	42,400	27,282
Gypsum and anhydrite, crude ... metric tons	360	5,191	4,650
Lime ... do	22,735	17,980	17,590
Limestone ... do	147,155	106,121	152,960
Petroleum refinery products:			
Motor gasoline ... thousand 42-gallon barrels	603	r 585	583
Kerosine and jet fuel ... do	119	r 219	239
Distillate fuel oil ... do	929	r 1,011	1,191
Residual fuel oil ... do	1,251	r 1,365	1,550
Liquefied petroleum gas ... do	23	29	27
Asphalt ... do	90	r 50	98
Refinery fuel and losses ... do	412	429	509
Total ... do	r 3,427	r 3,688	4,197
Platinum mine output, metal content ... troy ounces	349	343	273
Pumice ... metric tons	NA	NA	8
Salt:			
Rock ... do	NA	4,000	10,000
Marine ... do	NA	r 230,000	250,000
Total ... do	233,000	r 234,000	260,000
GUINEA [4]			
Aluminum:			
Bauxite ... thousand metric tons	r 2,117	2,459	e 2,600
Alumina ... metric tons	530,861	572,460	599,387
Diamond:			
Gem e ... carats	21,000	22,000	22,000
Industrial e ... do	49,000	50,000	52,000
Total e ... do	70,000	72,000	74,000
Gold mine output, metal content ... troy ounces	--	3,922	e 4,000
IVORY COAST [4]			
Cement, hydraulic ... thousand metric tons	330	r 338	e 400
Columbium and tantalum ore and concentrate, tantalite, gross weight kilograms	632	211	NA
Diamond:			
Gem e ... carats	r 77,004	r 80,965	85,123
Industrial e ... do	r 110,005	r 121,448	127,685
Total ... do	187,009	202,413	212,808
Gold mine output, metal content ... troy ounces	84	--	--
Manganese ore and concentrate, gross weight ... metric tons	116,741	r 127,050	23,060
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	1,358	1,354	1,435
Jet fuel ... do	412	319	317
Kerosine ... do	213	306	375
Distillate fuel oil ... do	1,470	1,613	1,469
Residual fuel oil ... do	1,544	1,730	1,474
Liquefied petroleum gas ... do	r 126	r 121	116
Refinery fuel and losses ... do	149	248	224
Total ... do	r 5,272	r 5,691	5,410
LESOTHO [4]			
Diamond:			
Gem ... carats	1,604	p 5,000	3,502
Industrial ... do	10,310	p 24,000	13,037
Total ... do	11,914	p 29,000	16,539
MALAGASY REPUBLIC [4]			
Abrasives, natural:			
Corundum ... kilograms	1,100	800	1,900
Garnet (industrial only) ... do	50,400	2,082	40,100
Beryllium, beryl concentrate industrial, gross weight ... metric tons	r 85	r 83	52

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country and commodity [1]	1968	1969	1970 [p]
MALAGASY REPUBLIC [4]—Continued			
Bismuth concentrate:			
Gross weight ---- kilograms	40	--	--
Metal content ---- do	[e] 10	--	--
Cement, hydraulic ---- thousand metric tons	68	75	75
Chromium, chromite concentrate, gross weight ---- metric tons	--	[p] 80,000	141,000
Clays, kaolin ---- do	620	[e] 800	989
Columbium and tantalum ore and concentrate, gross weight ---- kilograms	1,354	--	--
Feldspar ---- metric tons	(5)	--	1
Gem and ornamental stones:			
Agate ---- do	2,400	1,800	2,700
Amazonite ---- do	8,600	2,300	10,500
Amethyst:			
Gem ---- do	11	10	13
Geodes ---- do	4,500	5,200	6,900
Apatite (ornamental only) ---- do	1,420	--	1,500
Aragonite ---- do	470	488	829
Beryl:			
Gem ---- kilograms	1	1	1
In quartz ---- do	--	550	453
Calcite (ornamental only) ---- do	7,200	4,800	19,600
Celestine ---- do	2,900	6,100	7,700
Cipoline ---- metric tons	NA	1,147	1,429
Citrine, gem ---- kilograms	26	39	19
Cordierite, gem ---- do	204	150	100
Diopside, gem ---- do	2	700	750
Garnet:			
Gem ---- do	91	200	33
Other ornamental ---- do	4,300	6,800	3,600
Jasper ---- do	402	140	38,900
Labradorite ---- do	1,400	7,083	45,100
Quartz:			
Rose quartz ---- do	6,100	6,900	19,800
Geodes ---- do	3,800	1,300	8,900
Other ornamental ---- do	7,700	15,700	15,100
Rhodonite ---- do	--	--	33,200
Tourmaline, black ---- do	--	1,400	1,800
Tourmaline, in quartz ---- do	1,300	--	700
Gold mine output, metal content ---- troy ounces	543	646	534
Graphite, all grades ---- metric tons	[r] 16,429	[r] 16,868	18,197
Mica, phlogopite:			
Block ---- do	78	62	39
Splittings ---- do	725	1,006	878
Scrap ---- do	103	114	19
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	865	[r] 727	859
Jet fuel ---- do	103	94	478
Kerosine ---- do	265	178	--
Distillate fuel oil ---- do	809	731	1,136
Residual fuel oil ---- do	[e] 1,004	[e] 1,553	1,393
Lubricants ---- do	--	47	--
Liquefied petroleum gas ---- do	70	30	98
Other ---- do	4	39	
Refinery fuel and losses ---- do	[e] 267	[e] 233	345
Total ---- do	[r] 3,387	[r] 3,632	4,309
Quartz, piezoelectric ---- kilograms	3,300	1,600	2,900
Rare-earth metals:			
Bastnaesite concentrate, gross weight ---- metric tons	254	(5)	97
Betafite ore, gross weight ---- kilograms	1,088	261	100
Euxenite ore, gross weight ---- do	--	22	6
Monazite concentrate, gross weight ---- metric tons	2	2	--
Salt, marine ---- do	17,000	22,000	21,700
Stone:			
Calcite (industrial) ---- do	NA	NA	655
Quartz (metallurgical) ---- do	49	98	75
Uranium and thorium, uranothorianite concentrate, gross weight ---- do	95	--	--
Zirconium concentrate, gross weight ---- kilograms	--	--	2,500
MALAWI [4]			
Abrasives, natural, corundum ---- do	NA	NA	11
Cement, hydraulic ---- thousand metric tons	56	76	70
Kyanite ---- metric tons	NA	NA	1,371
Lime ---- do	NA	NA	249
Sodalite ---- do	NA	NA	2,386
Stone, sand and gravel:			
Limestone ---- do	NA	NA	92,000
Shale ---- do	NA	NA	90,000
Other stone ---- thousand cubic meters	NA	NA	270
Sand ---- do	NA	NA	170

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country and commodity [1]	1968	1969	1970 p
MALI [4]			
Gold mine output, metal content____troy ounces__	--	32	NA
Salt____metric tons__	3,000	e 3,000	e 3,000
Stone:			
Limestone____do____	NA	2,500	NA
Marble____do____	2,500	2,500	NA
MAURITANIA [4]			
Iron ore and concentrate____thousand metric tons__	r 8,045	r 8,678	6 9,218
Rare-earth metals, monazite concentrate, gross weight____metric tons__	r 586	r 104	e 100
Salt, marine (including evaporated)____do____	600	r 900	1,000
MAURITIUS [4]			
Salt, marine____do____	4,166	4,064	4,000
NIGER [4]			
Cement, hydraulic____do____	23,000	25,000	35,000
Gold mine output, metal content____troy ounces__	170	161	235
Gypsum____metric tons__	1,957	r e 2,000	e 2,000
Salt e____do____	4,000	4,000	4,000
Sand____do____	e 3,000	2,000	NA
Stone, limestone, not further described____do____	29,665	30,000	NA
Tin mine output, metal content____long tons__	r 72	r 87	74
Tungsten mine output, metal content____metric tons__	--	--	e 1
Uranium concentrate____do____	--	--	54
RWANDA [4]			
Beryllium, beryl ore and concentrate, gross weight____do____	r 149	r 267	e 270
Columbium and tantalum ore and concentrate, gross weight____do____	28	r 22	NA
Tin mine output, metal content____long tons__	r 1,396	r 1,323	1,320
Tungsten mine output, metal content____metric tons__	r 321	170	e 180
SENEGAL [4]			
Attapulgite (fuller's earth)____do____	4,480	3,940	3,050
Cement, hydraulic____do____	r 202,300	206,900	241,000
Fertilizer materials, phosphatic:			
Crude:			
Aluminum phosphate____do____	r 160,398	r 164,445	130,388
Calcium phosphate____thousand metric tons__	r 1,100	r 1,035	998
Manufactured:			
Aluminum phosphate, dehydrated____metric tons__	r 43,638	36,666	36,477
Other [7]____do____	7,898	3,322	6,915
Petroleum refinery products:			
Gasoline, motor____thousand 42-gallon barrels__	785	r 806	634
Kerosine and jet fuel____do____	607	r 642	577
Distillate fuel oil____do____	945	925	906
Residual fuel oil____do____	1,506	r 1,754	1,478
Liquefied petroleum gas____do____	r 69	r 81	106
Refinery fuel and losses____do____	330	250	542
Total____do____	r 4,242	r 4,458	4,243
Salt e____metric tons__	83,558	r 79,900	e 120,000
Stone:			
Basalt____cubic meters__	NA	30,000	15,635
Marble____do____	NA	r 336	212
SOMALI REPUBLIC [4]			
Salt, marine e____metric tons__	1,000	2,000	2,000
SOUTHERN RHODESIA [8]			
Abrasives, natural, corundum e____do____	1,800	1,800	1,800
Asbestos e____do____	86,000	80,000	80,000
Beryllium, beryl, gross weight____do____	9 88	e 90	e 90
Cement, hydraulic____thousand metric tons__	339	382	e 390
Chromium, chromite, gross weight e____metric tons__	380,000	365,000	365,000
Coal, bituminous____thousand metric tons__	3,273	3,332	e 3,400
Coke, metallurgical____do____	221	243	e 245
Copper:			
Mine output, metal content____metric tons__	e 19,500	e 19,100	10 24,065
Smelter e____do____	17,000	19,000	20,000
Fertilizer materials, crude, phosphate rock____do____	9,000	11,000	11,000
Fluorspar e____do____	150	150	150
Gold mine output, metal content____troy ounces__	499,943	e 480,000	e 500,000
Iron and steel: e			
Iron ore____thousand metric tons__	700	500	500
Pig iron and ferroalloys____do____	260	r 270	280
Crude steel____do____	140	150	160
Lithium minerals, gross weight e 11____metric tons__	61,000	61,000	61,000
Magnesite____do____	18,000	18,000	18,000
Nickel mine output, metal content____do____	1,000	4,000	5,000
Pyrite:			
Gross weight e____do____	73,000	72,000	73,000
Sulfur content e____do____	30,000	29,000	30,000
Silver mine output, metal content____thousand troy ounces__	NA	NA	12 71

See footnotes at end of table.

Table 1.—Other African Areas: Production of mineral commodities—Continued

Country and commodity [1]	1968	1969	1970 p
SOUTHERN RHODESIA [8]—Continued			
Stone, industrial limestone e ... thousand metric tons	590	640	640
Tantalum minerals, gross weight e ... metric tons	65	45	45
Tin:			
Mine output, metal content ... long tons	600	600	600
Smelter ... do	600	600	600
SUDAN [4]			
Cement, hydraulic ... metric tons	145,000	175,000	210,144
Chromium, chromite concentrate, gross weight ... do	22,086	26,213	26,665
Gold mine output, metal content ... troy ounces	29	--	--
Gypsum and anhydrite, crude ... metric tons	10,226	e 5,000	1,637
Magnesite, crude ... do	6,500	r 499	100
Manganese ore and concentrate, gross weight ... do	5,000	r 853	1,160
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	524	747	767
Jet fuel ... do	273	465	491
Kerosine ... do	160	151	158
Distillate fuel oil ... do	1,230	1,786	1,746
Residual fuel oil ... do	1,645	1,803	1,593
Other ... do	230	26	1,178
Refinery fuel and losses ... do	260	619	281
Total ... do	r 4,322	r 5,597	6,214
Salt ... metric tons	49,626	50,847	52,366
SWAZILAND [4]			
Asbestos, chrysotile ... do	r 38,960	r 39,079	33,057
Barite ... do	888	571	338
Clays, kaolin ... do	2,145	1,657	1,620
Coal, bituminous ... do	96,789	r 104,232	122,946
Iron ore, direct shipping, gross weight ... thousand metric tons	2,050	r 2,302	2,296
Pyrophyllite ... metric tons	581	599	254
Stone, quarry product ... thousand cubic meters	37,140	40,240	32,678
TOGO [4]			
Phosphate rock:			
Run-of-mine ... thousand metric tons	2,632	2,968	e 3,040
Beneficiated product ... do	1,375	1,473	1,508
Stone, marble ... metric tons	--	e 2,500	3,801

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, Spanish Sahara and Upper Volta, all covered textually in this chapter, presumably produce quantities of crude construction materials such as clays, stone, and sand and gravel and may produce 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, diamond is known to have been produced and production of a variety of crude construction materials may be assumed to have occurred, but no production data are reported, and available information is inadequate to make reliable estimates of output levels.

[3] In addition to the commodities listed, tungsten minerals, columbium-tantalum minerals and a variety of crude construction materials all may be assumed to have been produced, but no production data are reported, and available information is inadequate to make reliable estimates of output levels.

[4] In addition to the commodities listed, a variety of crude construction materials may be assumed to have been produced, but no production data are reported, and available information is inadequate to make reliable estimates of output levels.

[5] Less than ½ unit.

[6] Exports.

[7] Products marketed under the trade names baylifos and phosphal.

[8] In addition to the commodities listed, graphite, mica, phosphate rock, tungsten, and a variety of crude construction materials may have been produced, but little data on output (if any) is available and general information is inadequate to make reliable estimates of output levels.

[9] U.S. imports.

[10] Output of Alaska, Gwai River, Inyati, Mangula, and Umkondo mines.

[11] Data presented is 1964 total recorded production rounded. Eycryptite, lepidolite, petalite and spodumene ore produced but there is no reliable basis for estimating year-to-year variations in output for 1965–70.

[12] Output of Inyati mine only.

Reportedly a large low-grade deposit, which is considered an extension of the Selebi-Pikwe occurrence, has been located.

Production from the Orapa diamond mine of De Beers Botswana Mining Co. (Pty.) Ltd. was expected to begin by June 1971.[5] The recovery plant was scheduled to process 7,250 tons per day of kimberlite rock yielding 2 million carats of diamond per year. Water for the mine and ancillary facilities will be piped from an 18,000-million-gallon dam on the Botletle River. An all-weather gravel road has been constructed by the Government from Francistown to Orapa.

Makgadikgadi Soda Ltd., a subsidiary of BRST, was building a pilot plant to test commercial production of salt, soda ash,

[5] World Mining. Botswana. V. 6, No. 13, December 1970, p. 50.

and sodium sulfate from brine of the Makgadikgadi Pan, west of Francistown.[6] If pilot plant operations are successful, BRST plans to start commercial production in 1974. About 85 percent of output would be exported to the Republic of South Africa and 10 to 15 percent would go to Zambia.

Limestone, fire clay, and ceramic materials also occur in Botswana. However, they are used only for local construction.

BURUNDI [7]

Burundi's mineral industry remained of minor significance in the country's economy. Export earnings from minerals totaled only $254,860,[8] compared with $329,140 in 1969, and comprised only 1.2 percent of total exports of $21.7 million. The gross national product (at current prices) was an estimated $207.4 million, a 16.6-percent increase over the 1969 rate. According to the Department of Geology and Mines, Ministry of the Economy, mineral production was limited to bastnaesite (rare-earth mineral containing 68 to 70 percent rare-earth oxides), cassiterite (tin ore containing about 75 percent tin), small quantities of gold recovered from artisanal panning of alluvial deposits in the northwest, lime, and miscellaneous construction materials such as clays and sand and gravel. Production of bastnaesite concentrate by Société Minerale de Karonge (SOMIKA), a Belgian firm, at Karonge in Bujumbura Province was estimated at about one-half the rate of the previous year. The mining rate was curtailed because of a decrease in the world price. SOMIKA estimated reserves of tin concentrate at 500 tons, valued at $1 million, at its Mulehe mine in the Lake Rweru region, Muyinga Province. The mine was operated at only 30 to 40 percent of capacity, owing to mechanical difficulties and labor problems. SOMIKA also was investigating old tungsten and columbium-tantalum mines in the same region and considered reopening them.

A Romanian technical team reportedly was scheduled to begin an oil search in the Lake Tanganyika area of Burundi. Late in the year, a shortage developed in petroleum products, particularly gasoline, kerosine, and diesel fuel. This problem apparently was due to difficulties at the refinery at Dar-es-Salaam, Tanzania, which supplies the Burundi market, and a shortage of rail tank cars.

Imports into landlocked Burundi arrived mainly by rail through Tanzania to Kigoma, a port on Lake Tanganyika, and then by boat to the Bujumbura port. Petroleum refinery products, particularly lubricants, continued as the principal imports from the United States. In addition to petroleum products from Tanzania, other significant mineral commodity imports were salt and cement.

Although an attractive investment code was enacted in 1967, foreign private investment remained small. The National Bank of Economic Development continued efforts to attract foreign investment.

Burundi remained dependent on foreign technical and financial assistance for its major development projects. European Economic Community (Common Market) aid to Burundi through the European Development Fund totaled $1.5 million in 1969 and $2.2 million in 1970. U.S. assistance increased steadily since 1965, reaching $3 million in 1970, and was expected to expand further during the next 5-year period. A $1 million, 3-year United Nations Development Program (UNDP) mineral survey started in 1969, fell behind schedule in 1970, owing to difficulties in acquiring technical personnel and delivery of equipment. A contract for a photogeological survey, scheduled to start in early 1971, was awarded to Lockwood of Canada. The area to be covered comprised 11,000 square kilometers in the northwest. Radiometric and magnetometric surveys also were planned. The first stage, scheduled to terminate at yearend 1971, was extended to early 1972, and a 3- to 4-year second stage was in planning. Evidence of a number of economic minerals was discovered, and drilling and geochemical studies were underway.

Late in the year, another proposed

[6] U.S. Embassy, Gaborone, Botswana. State Department Airgram A–85, Dec. 31, 1970, 2 pp.
[7] Walter C. Woodmansee, physical scientist, Division of Nonferrous Metals.
[8] Where necessary, values have been converted from Burundi Francs (RBF) to U.S. dollars at the rate of RBF87.5=US$1.00.

UNDP project was the development of the Kagera River basin in conjunction with Rwanda and Tanzania. ELC Electroconsult, Milan, Italy, was working on UNDP-financed preliminary study for a hydroelectric power plant near Bujumbura.

Table 2.—Burundi: Apparent foreign trade in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
Diamond, gem .... value, thousands	$4,335	$1,693
Tin ore and concentrate .... long tons	67	94
Tungsten ore and concentrate	NA	10
Unspecified crude nonmetals	257	150
IMPORTS		
Iron and steel semimanufactures	3,626	1,930
Petroleum refinery products, lubricants	282	NA

NA Not available.

[1] Compiled from trade returns of 24 trading partner countries given in Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

CAMEROON [9]

The mineral industry of the Federal Republic of Cameroon consisted mainly of cement and aluminum production and output of small quantities of gold and tin.

Société d'Études des Bauxites du Cameroun, incorporated at Yaounde, is continuing its financial and technical evaluation for developing the bauxite deposits at Minim-Martap. Bauxite reserves of the Minim-Martap deposits were estimated to be between 500 to 1,000 million tons. Participants in the Société are the Société Camerounaise d'Investissements, Compagnie Péchiney, Ugine-Kuhlmann, Bureau de Récherches Géologiques et Minières, and Vereinigte Aluminium Werke.

The construction of a dam at M'Bakaou on the upper reaches of the Sanaga River has been completed. The dam will permit regulation of the river's flow throughout the year. Prior to the building of the dam, there was seasonal irregularity of the flow of the Sanaga River, and the Edea hydroelectric power station did not receive sufficient water to produce electricity at its rated capacity. With the completion of the dam, additional generators are being installed at the Edea power station. Compagnie Camerounaise de l'Aluminium is expanding its smelter capacity at Edea from 50,000 to 60,000 tons per year. Completion date for the smelter expansion is for 1971. The increase in smelter capacity was made possible by assured hydroelectric power from the newly constructed dam at M'Bakaou.

Cameroon's aluminum industry is by far the country's most important manufacturing activity. However, it is based on imported alumina from Guinea, which is shipped by rail from Douala to Edea. If the bauxite reserves at Minim-Martap prove economically feasible to exploit, the proposed railway from Douala to Chad may be diverted to include the area of the deposits.

Marine exploration for crude petroleum has intensified, but no commercially exploitable reserves have been discovered. Six unsuccessful offshore exploration tests were drilled in Cameroon during 1970; only one was drilled in 1969. Four tests were conducted in the Rio del Rey area, and one each in the Sanaga North and the Lokele areas. Three exploration tests are planned for 1971, and additional seismic work planned in the Rio del Rey, Lokele, and Douala areas.

An agreement was signed between Kenting Limited and the Canadian International Development Agency which are jointly sponsoring a 2-year $250,000 geological mapping project in Cameroon. The project will include about 7,000 aerial photographs to be interpreted by Kenting geologists in Toronto. This work will be sup-

[9] E. Chin, chemist, Division of Nonferrous Metals.

ported by on-site geological checks of rock formations during the second year of the program. Base of operation for the field work will be in the city of Yaounde where Kenting personnel will work with resident French geological teams. The final report will make recommendations on the mineral potential of the areas concerned.

The World Bank granted a loan of $5.2 million to Cameroon to help finance a railway rehabilitation and modernization project, which is designed to maintain present railroad capacity by undertaking overdue relaying of track and to meet future growth in traffic following the opening of the Trans-Cameroon Railway. The project includes purchase of locomotives and rolling stock, and an economic study of a proposed realignment of the central line between Yaounde, the capital, and the port of Douala, the country's major commercial center in the coastal southwest. Additionally the World Bank and its affiliate, the International Development Association, granted a $19 million loan to Cameroon for a highway project. Two of the roads involved will contribute toward the completion of the trans-Cameroon road-rail route, which will extend from the Chad border to the coast. Two others radiate from Douala, the main port—one to link with Victoria, a commercial center, and the other to link with the densely populated Bamileke region.

Table 3.—Cameroon: Apparent foreign trade in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Aluminum metal:		
Unwrought	34,419	45,201
Semimanufactures	--	360
Copper and copper alloys scrap	42	146
Iron and steel scrap	982	1,131
Tin ore and concentrate ... long tons	r 48	40
Metal scrap n.e.s	[2] 63	48
IMPORTS		
METALS		
Aluminum metal and alloys unwrought and semimanufactures	r 1,348	186
Copper metal and alloys unwrought and semimanufactures	r 44	49
Iron and steel:		
Pig iron and ferroalloys	--	285
Steel, primary forms	601	559
Semimanufactures	r 40,951	36,851
Lead metal and alloys unwrought and semimanufactures ... value, thousands	--	$28
Magnesium metal and alloys unwrought and semimanufactures	40	130
Other:		
Oxides of titanium, lead, zinc, and other metals for paint	98	89
Metals and alloys not reported separately	25	60
NONMETALS		
Barite and witherite	r 2,100	10,370
Cement, hydraulic	r 78,714	79,405
Clays and products:		
Crude n.e.s	454	1,364
Products:		
Nonrefractory	1,410	1,217
Refractory	2,128	1,754
Cryolite and chiolite, natural [3]	875	1,473
Diatomite and other infusorial earths	276	225
Fertilizer materials manufactured:		
Nitrogenous	33,042	28,937
Potassic	5,720	5,910
Mixed	10,770	12,296
Lime	1,246	684
Salt	17,963	12,880
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products: [4]		
Gasoline:		
Aviation ... thousand 42-gallon barrels	70	80
Other ... do	610	656
Jet fuel ... do	19	390
Kerosine ... do	370	44
Distillate fuel oil ... do	641	516
Residual fuel oil ... do	123	171
Lubricants ... do	42	49
Other ... do	2	68
Total ... do	1,877	1,974
Tar, pitch, and other crude chemicals from coal, oil and gas distillation	r 525	564

r Revised.

[1] Except as noted, compiled from trade returns of 24 trading partner countries given in Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), pubished by Walker and Co., New York, 1970 and 1971.

[2] Erroneously reported as nonferrous metal ore and concentrates, n.e.s., in the 1969 edition of this chapter.

[3] Excludes unspecified tonnages from Denmark, which assuming a unit value equal to that of the reported tonnages from other countries, would total 411 tons in 1968 and 766 tons in 1969.

[4] Source: Bureau of Mines International Petroleum Annual 1968 and 1969 editions.

CENTRAL AFRICAN REPUBLIC [10]

Mining activity in the Central African Republic in 1970 was dominated by the year-long dispute between the Government and several diamond mining and buying companies. Production of diamond, the only significant mineral resource presently exploited in the country, declined in 1970. These companies' mines and buying offices remained closed throughout the year, but output was maintained by individual diggers. Recent reports indicate that the dispute has been resolved, and company

[10] David G. Willard, economist, Division of Nonmetallic Minerals.

mining operations will probably resume in 1972.

Work continued on development of a uranium mine, and plans for a cement plant were under study.

PRODUCTION

Production of diamond declined approximately 10 percent in 1970 from the 1969 level. The second consecutive annual reduction in output was again caused by a dispute between the Government and several diamond mining and buying companies. The dispute has forced the operations to remain closed since late in 1969. Individual diggers accounted for the entire output in 1970.

The only other known mineral production in the country was an unrecorded quantity of the common building materials —stone, gravel, and clays—which was consumed entirely in local construction use.

Mineral production statistics for the Central African Republic are included in table 1.

TRADE

Declining production of diamond, which normally accounts for 50 percent of total exports, had a negative effect on the nation's mineral trade in 1969, the latest year for which statistics are available. A 17-percent decrease in the quantity of diamond exported and a 16-percent decrease in value reduced the level of total exports. A larger overall trade deficit was avoided because of a rise in nonmineral exports.

The continuing slump in diamond output during 1970 probably resulted in a further decrease of total exports in that year. Diamond shipments were estimated to be down 10 percent from the 1969 level.

Balances of mineral and total trade in 1967–69 follow:

	Value		Mineral commodities share of total (percent)
	Mineral commodities (million dollars)	Total trade (million dollars)	
Exports:			
1967	13.6	29.3	46
1968	19.0	36.0	53
1969	16.1	38.2	42
Imports:			
1967	4.3	44.5	10
1968	2.6	40.1	6
1969	3.8	44.4	9
Trade balance:			
1967	9.3	−15.2	XX
1968	16.4	−4.1	XX
1969	12.3	−6.2	XX

XX Not applicable.

The value of mineral exports declined 15 percent in 1969. Small quantities of several mineral commodities other than diamond were shipped out, but these amounted to a total of only $156,000 in 1969. The nation's total exports would have fallen below the 1968 level if offsetting gains had not occurred in sales of agricultural products.

Mineral commodity imports were composed mainly of refined petroleum products, iron and steel semimanufacturers, fertilizers, salt, cement, and other building materials. Most imports decreased in 1969, resulting in a drop in the favorable balance of mineral trade from $16.4 million to $12.3 million.

Table 4 gives statistics on exports and imports of selected mineral commodities in 1968 and 1969.

Table 4.—Central African Republic: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Iron and steel semimanufactures	--	46
Zinc oxide	1	NA
NONMETALS		
Clay products, nonrefractory	--	2
Diamond, gem and industrial ... value, thousands	$18,964	$15,974
Fertilizer materials crude and manufactured:		
Nitrogenous	--	672
Phosphatic	--	96
Potassic	--	41
Ammonia ... value, thousands	--	$1
Salt	--	73
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	4	2
Kerosine ... do	(1)	NA
Liquefied petroleum gas ... do	--	(1)
Lubricants ... do	--	1
IMPORTS		
METALS		
Aluminum and alloys semimanufactures	r 103	17
Copper and alloys semimanufactures	9	4
Iron and steel:		
Pig iron and ferroalloys	--	2
Semimanufactures	r 2,599	3,588
Lead:		
Oxide	--	5
Metal including alloys, semimanufactures	4	4
Tin and alloys semimanufactures ... long tons	1	1
Titanium oxide	22	3
Zinc:		
Oxide	2	2
Metal including alloys, semimanufactures	--	14
Nonferrous metal ores and concentrates n.e.s ... value, thousands	--	$1
NONMETALS		
Abrasives:		
Natural, powder of precious and semiprecious stones ... value, thousands	$6	$5
Grindstones	3	2
Barite and witherite	60	49
Cement, hydraulic	r 17,843	2,962
Chalk	78	28
Clay products:		
Refractory	5	3
Nonrefractory	162	87
Dolomite	39	60
Fertilizer materials:		
Manufactured:		
Nitrogenous	1,066	954
Phosphatic	2,682	228
Potassic	207	564
Mixed	11	1,245
Ammonia	2	3
Gypsum	--	1
Lime	80	110
Salt	5,375	4,732
Sand and gravel	31	30
Sodium and potassium compounds n.e.s	718	520
Stone, dimension	--	1
Talc and related materials	36	19
Nonmetallic minerals, crude n.e.s	r 19	387
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	18	30
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	109	36
Kerosine ... do	44	8
Distillate fuel oil ... do	100	19
Residual fuel oil ... do	--	(1)
Lubricants ... do	8	6
Liquefied petroleum gas ... do	3	1
Other products n.e.s ... do	1	2

r Revised. NA Not available.

[1] Less than ½ unit.

COMMODITY REVIEW

Diamond.—Negotiations were carried on throughout 1970 in an effort to resolve the dispute between the Central African Republic Government and two diamond mining companies owned by Diamond Distributors, Inc. (DDI). The dispute arose in late 1969 over the companies' refusal to pay certain taxes and fees demanded by the Government. All mines and diamond buying offices of DDI remained closed during the year.[11] It is reported that a solution has recently been reached that will permit resumption of diamond mining by the company, probably in 1972. The additional production will give a needed boost to the nation's economy and trade.

Uranium.—Work continued on the development of a uranium mine at Bakouma by Compagnie des Mines d'Uranium de Bakouma.

Other Minerals.—A project for a cement factory based on local limestone deposits was under study.[12]

CHAD [13]

Natron (hydrous sodium carbonate) from the Lake Chad area continued to be the only mineral whose production is reported in Chad. The value of natron output for 1970 was not reported, but exports, totaling 3,500 tons (chiefly slabs) were valued at about $58,680.[14] SONACOT, a Government organization, controls purchases and sales of natron. Some salt and various construction minerals were produced for domestic use, but figures on outputs were not available.

Natron is recovered after the rainy season of June to September when Lake Chad begins to dry up. Laborers dig into the still-wet shores to a depth of about 1½ meters for the mineral. The products (slab and crushed natron) are sun dried and marketed.

The Abeche Oil Works was dedicated in August 1969. The 2,000-ton-per-year-capacity refinery will treat crude.[15]

Continental Oil Co.'s (CONOCO) concession to explore more than 233,000 square miles in the Lake Chad Syncline and Chari Depression for oil and gas continued in force. The permit, approved in September 1969, extends for 5 years. CONOCO agreed to spend in research at least $320,000 during the first year, $237,000 during the second year, $1.34 million during the third year, $1.29 million during the fourth year, and $2.48 million during the fifth year, totaling $5.67 million. The permit is renewable for two 5-year periods.

[11] U.S. Embassy, Bangui, Central African Republic. State Department Airgram A-31, Diamond Production Still Suffering. Mar. 2, 1971, pp. 5–6.

[12] Economic Commission for Africa. Summaries of Economic Data. Central African Republic. Second year, No. 28, September 1970, p. 8.

[13] Donald E. Eilertsen, physical scientist, Division of Nonmetallic Minerals.

[14] Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF277=US$1.00.

[15] Economic Commission for Africa. Summaries of Economic Data—Chad, 1969. September 1970, 24 pp.

Table 5.—Chad: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968 r	1969
EXPORTS		
METALS		
Copper and alloys semimanufactures ..... value, thousands ..	$1	NA
Iron and steel scrap	--	25
NONMETALS		
Abrasives, natural ..... value, thousands ..	--	$1
Clay products, nonrefractory	--	60
Nonmetallic minerals, crude n.e.s	740	2,994
MINERAL FUELS AND RELATED PRODUCTS		
Petroleum refinery products, lubricants ..... 42-gallon barrels ..	7	35
IMPORTS		
METALS		
Aluminum and alloys semimanufactures	7	155
Copper and alloys semimanufactures	7	10
Iron and steel:		
Pig iron and ferroalloys	9	3
Semimanufactures	4,538	3,734
Lead and alloys semimanufactures	5	9
Tin and alloys semimanufactures ..... long tons ..	1	2
Zinc and alloys semimanufactures	1	NA
Nonferrous metal ores and concentrates, n.e.s	--	90
NONMETALS		
Abrasives:		
Natural	8	9
Grindstones	19	24
Cement, hydraulic	20,319	12,703
Clay products:		
Refractory	2	3
Nonrefractory	165	187
Diatomite	--	1
Fertilizer materials:		
Manufactured:		
Nitrogenous	1,936	23
Phosphatic	--	16
Potassic	15	449
Ammonia	2	2
Lime, ordinary and hydraulic	135	176
Salt	3,068	3,178
Sand and gravel	6	3
Sodium and potassium compounds n.e.s	246	369
Stone, dimension	152	6
Talc and related materials	10	1
MINERAL FUELS AND RELATED PRODUCTS		
Asphalt and bitumen, natural	10	6
Petroleum refinery products:		
Gasoline ..... thousand 42-gallon barrels ..	150	179
Kerosine ..... do	86	116
Distillate fuel oil ..... do	120	154
Liquefied petroleum gas ..... do	2	3
Lubricants ..... do	6	12
Residual fuel oil ..... do	3	28
Other products n.e.s ..... do	3	20

r Revised. NA Not available.

CONGO (BRAZZAVILLE)[16]

The output of the mineral industry of Congo (Brazzaville) consisting of crude petroleum, potash, and small quantities of nonferrous metals accounted for only 1 percent of the country's gross domestic product. Trade statistics for 1970 are not available, but in 1969 the value of gross imports, including wood products and minerals, etc., exceeded exports by $30 million. The overall payments balance created by the trade deficit is offset by net earnings on invisible accounts, transportation services, and by foreign aid.

Congo's rivers, particularly the Kouilou, provide a vast hydroelectric power potential. There are plans to build hydroelectric plants on the Kouilou and Bouenza Rivers. Currently about 70 percent of the electric power is supplied by a hydrostation at Brazzaville and 30 percent by two thermal plants at Pointe Noire and Dolisie.

[16] Herbert R. Babitzke, physical scientist, Division of Nonferrous Metals.

Small quantities of copper, tin, gold, lead, and zinc were produced during the year. Iron ore deposits that have high iron content have been reported near Souanke and Zanago. Other minerals that have been reported include indications of diamond in the extreme northwestern portion of the country. A large potash deposit on the Congo River will become a major industrial project. Drillings showed that the deposits extend from Gabon, through the Congo and Cabinda, into Angola in a strip running parallel to the Coast. A mine and refinery have been designed to have an annual capacity of 500,000 tons of K_2O equivalent.[17] The bed, which is an average of about 3 feet thick, consists of both high-grade sylvanite (30 percent K_2O) and carnallite, and lies between 980 and 1,300 feet below the surface. Mining began in mid-1969 with the actual extraction being carried out by three continuous mining operations. The operations have so far been below capacity, but once difficulties are overcome, Congolese potash will be supplied from either Pointe Noire or Antwerp, Belgium.

Petroleum at Pointe Indienne, Northwest of Pointe Noire, is the only mineral produced in quantity and exported. These reserves are being depleted gradually, thus the petroleum and natural gas production has been falling as the reserves are nearing exhaustion. Discovery of offshore oil deposits in 1970 is expected to raise crude production substantially. Two deep offshore wells were drilled by AGIP/ELF-CONGO.[18] No technical data have been released, but the two wells, Djeno 1 and Madingo 1, together total 20,621 feet of hole.

[17] Industrial Minerals. No. 42, March 1971, pp. 17–19.

[18] American Association of Petroleum Geologists Bulletin. V. 55, No. 9, September 1971, pp. 1568–1569.

Table 6.—Republic of Congo (Brazzaville): Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968 [r]	1969
METALS		
Aluminum and alloys scrap	54	52
Copper:		
Ore and concentrate	2,115	579
Matte	27	83
Iron and steel:		
Scrap	2,122	1,217
Semimanufactures	410	148
Lead metal and alloys unwrought and semimanufactures	33	--
Tin ore and concentrate ... long tons	32	--
Tungsten ore and concentrate	12	--
Zinc ore and concentrate	2,655	5
NONMETALS		
Cement, hydraulic	--	31
Diamond, gem ... value, thousand	$15,532	$6,515
Fertilizer materials, crude potassic	--	44,713
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude ... thousand 42-gallon barrels	414	238
Refinery products:		
Gasoline ... do	3	3
Kerosine and jet fuel ... do	89	18
Lubricants ... do	(1)	(1)

[r] Revised.
[1] Less than ½ unit.

Table 7.—Republic of Congo (Brazzaville): Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal and alloys, all forms	r 117	72
Copper:		
Matte, speiss and similar materials	r 1	9
Metal and alloys unwrought and semimanufactures	r 44	35
Iron and steel:		
Roasted iron pyrite	140	--
Scrap	110	--
Pig iron ferroalloys and crude steel	150	154
Semimanufactures	r 18,403	16,199
Lead:		
Oxide	31	20
Metal and alloys, all forms	21	21
Silver unworked and partly worked ... value, thousands	$1	$4
Tin metal and alloys, all forms ... long tons	6	2
Titanium oxide	21	28
Zinc:		
Oxide	12	--
Metal and alloys, all forms	12	6
Other, alkali, alkaline earth and rare-earth metals	59	15
NONMETALS		
Barite	65	10
Boron materials:		
Borates, crude natural	11	--
Boric oxide and acid	--	26
Cement, hydraulic	r 27,022	1,760
Chalk	137	49
Clays and products:		
Clays, crude	88	41
Products:		
Nonrefractory	613	349
Refractory	467	179
Diatomaceous earth	86	40
Fertilizer materials:		
Natural, crude, potassic	--	24
Manufactured:		
Nitrogenous	1,620	4,138
Phosphatic	29	36
Potassic	2,616	3,953
Mixed	30	56
Ammonia	10	14
Gypsum	2,422	1,992
Lime	1,086	763
Magnesite, crude	59	92
Pigments, mineral:		
Natural n.e.s	7	8
Iron oxides manufactured	5	--
Salt	3,747	2,116
Sodium and potassium hydroxides and peroxides	721	751
Stone, sand and gravel:		
Dimension stone	49	--
Dolomite	--	20
Crushed and broken stone and gravel n.e.s	80	15
Sand	4	59
Talc and related materials	40	49
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	642	11
Carbon black and gas carbon	10	--
Coal	102	76
Coke	44	45
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	42	28
Kerosine and jet fuel ... do	43	19
Distillate fuel oil ... do	189	267
Residual fuel oil ... do	5	--
Lubricants ... do	30	51
Other ... do	14	12
Total ... do	323	377
Crude chemicals from distillation of coal, oil or petroleum	5	8

r Revised.

DAHOMEY [19]

Activity in the mineral industry of Dahomey consisted primarily of exploration for petroleum offshore in the southeastern section of the Continental Shelf. The Government of Dahomey and United Nations Development Program (UNDP) initiated a project to strengthen the National Geological and Mining Service by providing field training for Dahomey geologists and mining technicians. Indications of mineral deposits, discovered in previous years, will be studied intensively under a 2½-year project conducted by the Government and UNDP.[20]

The UNDP and the Government also planned to draft a mining code that would attract minerals exploration and development capital as well as regulate minerals production.

There was virtually no production of mineral commodities in 1970 except for the quarrying of sand and gravel and stone for local construction. Statistics on foreign trade in mineral commodities are shown in table 8.

Essex Steel Co., a subsidiary of United States Steel Corp., conducted an aerial magnetic survey for minerals in northern Dahomey. Results of the survey have not been reported.

In August the cornerstone of a future cement factory was laid. The factory will be located near a limestone deposit 50 miles north of Porto Novo. Cofei, a Spanish company, will build the plant estimated to cost over $20 million. Production reportedly would be 300,000 tons per year. Inasmuch as Dahomey's cement consumption was less than 100,000 tons per year, a large part of output would be exported.

Union Oil Co. of Dahomey shut down its drilling operation located offshore, 8 miles southeast of Cotonou.[21] Four of the seven wells drilled found petroleum, but were not considered to be commercially economic.

Shell Oil Co. obtained a concession in western Dahomey lying along the Togalese border and extending out to sea. The area covered by the concession consisted of about 25 percent of the Union Oil Co. concession, which was relinquished in April.

[19] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[20] Mining Engineering. UN Seeks to Build Up Geology and Mining Expertise in Dahomey. V. 22, No. 11, November 1970, p. 34.

[21] World Petroleum Report. Dahomey. V. 17, 1971, p. 54.

Table 8.—Dahomey: Apparent trade in mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
Diamond, industrial .... value, thousands	$912	$1,045
Iron and steel scrap	--	906
IMPORTS		
Aluminum and alloys semimanufactures	113	73
Cement, hydraulic	18,159	28,630
Clay products, nonrefractory	296	746
Copper and alloys semimanufactures	--	20
Fertilizer materials manufactured:		
Nitrogenous	2,807	NA
Potassic	4,680	4,652
Mixed	NA	1,444
Iron and steel semimanufactures	6,706	9,590
Petroleum refinery products:		
Gasoline .... thousand 42-gallon barrels	105	41
Kerosine and jet fuel .... do	54	84
Distillate fuel oils .... do	72	38
Lubricants .... do	8	9
Salt	--	932
Sodium compounds n.e.s., caustic soda	425	369
Other:		
Crude nonmetals n.e.s	--	887
Nonferrous metals unwrought and semimanufactures .... value, thousands	$39	$21

NA Not available.

[1] Compiled from trade data of selected trading partner countries.

Source: Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

EQUATORIAL GUINEA AND FERNANDO PO[22]

Exploration for petroleum continued to be virtually the only mineral activity in Equatorial Guinea and Fernando Po. Probably unrecorded quantities of stone and sand and gravel were produced for local use.

Continental Oil Co. of Equatorial Guinea (CONOCO) conducted seismic surveys offshore from Equatorial Guinea. CONOCO has a 50-percent interest in a 772-square-mile concession offshore and a 1,081-square-mile concession onshore in the province of Rio Muni, owned by Spanish Gulf Oil Co. and Compania Española de Petróleos, S.A. (CEPSA). CONOCO planned to drill its first well in late 1970; however, operations were suspended pending settlement of a border dispute between Equatorial Guinea and Gabon.

Spanish Gulf Oil Co. of Equatorial Guinea relinquished its concession rights on offshore block No. 9.[23] The company drilled its second dry well in 2 years. In June the Government approved Mobil Producing Spain, Inc., renunciation of its concession by Decree 9/1970. Chevron Oil Co. of Equatorial Guinea was drilling a well in its concession area offshore from Fernando Po.

ETHIOPIA[24]

The minerals industry of Ethiopia contributed only marginally to the gross national product estimated at $1,769 million in 1970 (1967 prices). Activity during the year was centered mainly on exploration for platinum, copper, and petroleum deposits by private industrial firms and the Ethiopian Geological Survey. An Ethiopian and United Nations survey team in the Sidamo and Wollega Provinces was engaged in preparing a photogeological map series and conducting airborne magnetic and radiometric surveys in a 10,422-square-mile area. The Geological Survey and United Nations Development Program (UNDP) conducted a survey of the Rift System for areas where electricity could be produced from geothermal steam. Reportedly prospects were good for future use of this natural resource.

Evaluation of potash deposits in the Danakil area by private industrial firms continued; however, by yearend it was apparent that further development of the deposits would be halted until potash prices and economic conditions in world markets improved.

Production and foreign trade in mineral commodities are shown in tables 1, 9, and 10.

A Japanese firm, Nippon Mining Co., contracted with the Government to assume control of a 1,081-square-mile mining copper concession located in the Asmara area.[25] Nippon Mining will continue mineral exploration of the deposit by diamond drilling to determine its size and the grade of ore. Several other occurrences in the Asmara area also will be investigated.

The Duval Corp., a subsidiary of Pennzoil United Inc., relinquished its platinum concession in the vicinity of Gambela, Ilubabor Province, and its copper concession at Ambe Derho, near Asmara. The concessions were terminated at the end of March.

The Ethiopian Potash Co., owned jointly by Kaiser Aluminum & Chemical Corp. and Seatraders Inc. of the United States, terminated its potash concession located in the Danakil area. Low prices for potash in world markets and the low grade of potash ore reportedly were cited as the main reasons for not developing the deposit.

Reportedly India was offered a potash concession in the Danakil area that was formerly held by the Ralph Parsons Co. of the United States. A team of technicians from India's Geological Survey, National Minerals Development Corp., and Department of Mines and Metals was scheduled to prepare a technical and economic feasibility study of the potash deposit.

Two fertilizer plants with a combined capacity of 10,000 tons per year of mixed compounds, based upon imported raw ma-

[22] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[23] Petroleum Legislative Report. Equatorial Guinea (Fernando Po). February 22—June 1, 1970, p. 19.

[24] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[25] U.S. Embassy, Addis Ababa, Ethiopia. Mineral Exploration Developments. State Department Airgram A-325, Dec. 2, 1970, p. 1.

terials, were scheduled for construction at Massawa and Assab.[26] Cost of the two plants was placed at $560,000.

The Mobil-Esso consortium abandoned its gas well located in the Red Sea, about 75 miles north of Massawa.[27] The well blew out of control in November 1969 and was permanently capped early in 1970. Tenneco Ethiopia Inc. completed an aeromagnetic survey and planned to drill several stratigraphic holes.

[26] United Nations Industrial Development Organization. Second African Meeting for the Promotion of Specific Industrial Projects in African Countries. Project Information Sheet, ETH-006-70, 7 pp.

[27] World Petroleum Report. Ethiopia. V. 17, 1971, pp. 55-56.

Table 9.—Ethiopia: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal unwrought and semimanufactures	--	27
Copper scrap	25	93
Iron and steel:		
Metal:		
Scrap	74	233
Semimanufactures	--	10
Other nonferrous metal scrap	88	122
Platinum troy ounces	643	--
NONMETALS		
Cement	22,692	22,621
Lime	30	30
Salt	159,524	178,301
Stone and sand:		
Dimension crude and worked	11	502
Other	10	10
Sands, natural, all kinds	--	36
Sulfur, crude	--	2
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	1,234

[1] Reexports not included because only value data are available.

Table 10.—Ethiopia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	--	8
Metal including alloys, all forms	r 1,011	641
Arsenic oxides and acid	--	9
Copper including alloys, all forms	121	34
Iron and steel:		
Metal:		
Scrap and waste	1,770	678
Pig iron including cast iron	2	--
Steel, primary forms	7,000	5,730
Semimanufactures	r 36,289	33,094
Lead including alloys, all forms	13	20
Manganese oxide	--	15
Mercury 76-pound flasks	--	3
Nickel including alloys, all forms	293	15
Platinum-group metals including alloys, all forms troy ounces	450	--
Silver including alloys do	--	193
Tin including alloys, all forms long tons	34	30
Zinc including alloys, all forms	r 632	380
Other:		
Oxides, hydroxides and peroxides of metals n.e.s	--	51
Base metals including alloys, all forms n.e.s	5	--
NONMETALS		
Abrasives, natural, n.e.s.:		
Dust and powder of precious and semiprecious stones	4	(1)
Grinding and polishing wheels and stones	153	121

See footnotes at end of table.

Table 10.—Ethiopia: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Asbestos	40	95
Barite and witherite	250	915
Borates, crude natural	150	--
Cement	1,876	804
Chalk	219	184
Clays and products:		
Crude clays n.e.s	5	276
Products:		
Refractory (including nonclay bricks)	r 1,163	639
Nonrefractory	r 1,364	1,278
Cryolite and chiolite	--	16
Diamond, industrial thousand carats	--	240
Fertilizer materials:		
Crude	120	(1)
Manufactured:		
Nitrogenous	1,994	558
Phosphatic	277	1,129
Potassic	20	320
Mixed	906	6,193
Ammonia	--	8
Graphite, natural	30	(1)
Lime	30	32
Mica, crude and worked including splittings and waste	2	36
Pigments, mineral:		
Natural, crude	443	138
Iron oxides	--	12
Precious and semiprecious stones except diamond kilograms	--	42,500
Salt	76	145
Sodium and potassium compounds n.e.s.:		
Caustic soda	2,048	1,760
Caustic potash	12	3
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	215	68
Worked	68	3
Gravel and crushed stone	25	15
Sands, natural, all kinds	110	(1)
Sulfur:		
Elemental:		
Other than colloidal	215	--
Colloidal	--	567
Sulfuric acid	153	174
Other nonmetals n.e.s.:		
Crude:		
Meerschaum, amber	216	89
Strontianite, mineral substances n.e.s	105	231
Slag and ash n.e.s	942	750
Oxides and hydroxides of magnesium, strontium, and barium	--	30
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals n.e.s	2,139	971
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	392	58
Carbon black	--	1
Coal, coke and briquets	4,823	9,897
Petroleum:		
Crude thousand 42-gallon barrels	r 4,466	3,570
Refinery products:		
Gasoline, aviation do	104	133
Gasoline, motor do	34	15
Jet fuel do	23	7
Kerosine do	25	19
Distillate fuel oil do	168	179
Residual fuel oil do	6	(1)
Lubricants (including grease) do	52	30
Mineral jelly and wax do	24	25
Other:		
White spirit do	1	(1)
Nonlubricating oils n.e.s do	5	4
Liquefied petroleum gas do	2	(1)
Bituminous mixtures and petroleum bitumen do	7	4
Total do	r 451	416
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r 432	44

r Revised.

1 Less than ½ unit.

THE FRENCH TERRITORY OF THE AFARS AND ISSAS [28]

Data on foreign trade appear in the following table.

Table 11.—French Territory of the Afars and Issas: Apparent imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
IMPORTS		
METALS		
Aluminum and alloys semimanufactures	--	101
Iron and steel semimanufactures	815	4,691
Nonferrous metals and alloys n.e.s. ____ value, thousands	$33	$26
NONMETALS		
Cement, hydraulic	4,272	5,662
Fertilizer materials manufactured, phosphatic	--	450
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, lubricants ____ thousand 42-gallon barrels	3	3

[1] Compiled from trade statistics for selected trading partner countries, in the absence of official French Territory of the Afars and Issas trade returns.

Source: Statistical Office of the United Nations, 1968 and 1969 editions of the Supplement to the World Trade Annual. V. 3 (Africa) published by Walker and Co., New York, 1970 and 1971.

GAMBIA [29]

Activity in the mineral industry consisted mainly of exploration for petroleum and other mineral deposits and trade in mineral commodities. The Government of Gambia initiated a campaign to encourage the inhabitants to search for mineral deposits. A staff member of the Government Division of Physical Planning-Lands was designated to take training in Geology and Mineralogy.

There was no recorded production of mineral commodities. Statistics on foreign trade are shown in table 12.

A steady demand for building materials, particularly cement, was attributed to an increase in construction activity.

The deposit of kaolin discovered near Kundam Village in the Upper River area was studied by a geologist from the United Nations Development Program. His report to the Government indicated that the deposit was of sufficient size and grade to establish a ceramic factory in Gambia.

A seismic survey was conducted offshore by Western Geophysical Co. for BP Petroleum Development Ltd. and Enterprise de Recherches et d'Activities Pétrolières.[30]

Table 12.—Gambia: Apparent imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
Cement, hydraulic	15,092	5,581
Fertilizers manufactured	3,134	1,560
Iron and steel semimanufactures	1,157	320
Petroleum refinery products:		
Lubricants ____ thousand 42-gallon barrels	2	2
Asphalt and bitumen ____ do	9	7

[1] Compiled from trade returns of 24 trading partner countries given in Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

GUINEA [31]

Bauxite, alumina, diamond, and gold were mineral commodities produced in Guinea.

Total bauxite production includes about 1,950,000 tons mined by Compagnie International pour la Production de l'Alumine

[28] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[29] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[30] World Oil. Africa. V. 171, No. 3, Aug. 15, 1970, p. 156.

[31] E. Chin, chemist, Division of Nonferrous Metals.

(FRIA) at Kimbo and about 650,000 tons mined by Harvey Aluminum, Inc., at Tamara Island. As in past years, FRIA's bauxite production was converted to alumina, and Harvey's production was exported to its alumina plant in the Virgin Islands.

FRIA continued the $10 million expansion program of its alumina plant located 90 miles northeast of Conakry, the capital. By yearend, it expected to boost the annual rate of alumina production from 530,000 metric tons to 700,000 tons. FRIA was owned by Olin Corp. and by French, British, Swiss, and German firms.

In the Boké region, Halco (Mining) Inc. continued a $182.5 million program to develop bauxite reserves at Sangaredi, 175 miles north of Conakry. The Boké Bauxite Program was a joint venture between Halco and the Government. Stockholders in Halco included Harvey Aluminum, Inc., Aluminum Co. of America, as well as Canadian, French, German, and Italian companies. The Boké project was scheduled to begin bauxite production in mid-1972 at an initial rate of 6.6 million tons per year. A major component of the Boké project included building and equipping a railroad from Sangaredi to the port of Kamsar, 85 miles to the west.

Guinea currently ranks seventh in world bauxite output. When the Boké project is completed, the country is expected to be among the world's largest producers.

Japan Aluminium Smelters' Association, representing Showa Denko Co. Ltd., Sumitomo Chemical Co. Ltd., Mitsubishi Chemical Industries, Ltd., Nippon Light Metal Co. Ltd., and Mitsui Aluminum Industry Co. is negotiating with the Government of Guinea to develop the bauxite resources at Tougue, which were estimated to be 3.6 billion tons. In midyear, the association submitted a formal request to the Government to develop the Tougue bauxite deposits and was conducting a feasibility study for developing the deposit and for building an alumina plant at the site.

The Spanish-controlled Instituto Nacional de Industria is negotiating with government authorities to obtain a bauxite mining concession in Guinea. Spain possesses no proven commercially exploitable bauxite deposits, but owns an alumina plant that has an annual capacity of 70,000 tons.

Table 13.—Guinea: Apparent foreign trade in selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Aluminum:		
Bauxite	r 85,946	150,449
Oxide and hydroxide	368,686	366,693
Copper metal and alloys scrap	--	33
Iron and steel scrap	r 4,414	1,425
Nonferrous metal scrap n.e.s. value, thousands	$26	--
NONMETALS		
Diamond do	$209	$195
IMPORTS		
METALS		
Aluminum and alloys semimanufactures	873	1,049
Copper and alloys semimanufactures value, thousands	--	$43
Iron and steel semimanufactures	1,484	7,018
NONMETALS		
Cement, hydraulic	6,005	9,875
Fertilizer materials manufactured	2,954	1,556
Lime	18,442	16,343
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Kerosine thousand 42-gallon barrels	22	17
Residual fuel oils do	r 420	178
Lubricants do	7	14
Other do	10	15

r Revised.
[1] Compiled from trade statistics for selected trading partner countries, in the absence of official Guinean trade returns.
Source: Official trade returns of the U.S.S.R. for 1968 and 1969, and Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

During 1969–70, Guinea's entire continental shelf area was under license to the Shell Oil Co. In mid-1970, Shell completed a marine seismic survey. Shell's license was not renewed at yearend and the area was opened for filing.

IVORY COAST [32]

The mining industry's contribution to the Ivory Coast economy declined in 1970 as a result of closing the nation's one manganese mine. However, prospects are good that the mineral sector will make an increasing contribution to the nation's growth in coming years with the development of a large iron mine and greater diamond production.

Closure of the manganese mine at Grand Lahou caused a sharp drop in the total value of mineral production in 1970. Mineral exports were also affected although accumulated stocks of manganese were drawn upon. Investigation of the iron ore deposits near Man continued to indicate the possibility of large-scale production. Another event during the year was the signing of a convention for offshore oil exploration. The Government's Mineral Development Corporation concentrated its attention on some promising signs of copper and molybdenum mineralization in various parts of the country.

PRODUCTION

Total mineral production in the country declined about 25 percent in value from $5.5 million in 1969 to $4.0 million in 1970.[33] The drop was brought about by closure of the manganese mine in March. Output of diamond was slightly higher, with gains occurring in both the gem and industrial categories.

In 1970 diamond production increased, maintaining the gradual uptrend of the previous 2 years. Total 1970 output was 212,808 carats, 5 percent greater than the 1969 total of 202,413 carats. Gem diamonds are believed to represent about 40 percent of the total quantity. Three companies—Société Anonyme de Recherches et d'Exploitation Minières en Côte d'Ivoire (SAREMCI), Société Diamantifere de Côte d'Ivoire (SODIAMCI), and Société Minière des Bandamas (SMB)—again accounted for the entire output. Statistics on their 1970 operations are as follows:

Company	Volume of ore treated (cubic meters)	Ore grade (carats/cubic meter)	Total diamond recovered [1] (carats)
SAREMCI	546,070	0.36	193,968
SODIAMCI	100,253	.16	16,284
SMB	9,315	.26	2,438

[1] Data differ from figures shown on table 1 and in text because of source.

The manganese mine at Grand Lahou was closed in March 1970, and total production was only a fraction of that in previous years.

Total refinery output was marginally lower as increases in motor gasoline and kerosine were offset by declines in jet fuel, distillate and residual fuel oil, and liquified petroleum gas.

Mineral production statistics for the Ivory Coast in 1968–70 are included in table 1.

TRADE

Exports of the principal mineral products declined in total value in 1969, the latest year for which data are available. Income from manganese sales fell to around half of the 1968 figure because of the reduced volume of shipments. An increase of 9 percent in the value of diamond exports was insufficient to overcome the deficit. Value of these two exports in 1968–69 are shown below in thousand dollars.

	1968	1969
Diamond	3,816	4,155
Manganese	e 1,900	e 900
Other mineral exports	NA	NA

e Estimate. NA Not available.

Value data were not available for other mineral exports or for mineral imports, precluding an estimate of the mineral trade balance. Figures from previous years indicate that the country regularly runs an unfavorable mineral trade balance because of the relatively small mining industry and the lack of sufficient domestic sources of mineral products. Among the principal mineral imports are crude oil, semimanu-

[32] David G. Willard, economist, division of Nonmetallic Minerals.

[33] U.S. Embassy, Abidjan. Ivory Coast. Mineral Production Statistical Questionnaire. State Department Airgram A-61, May 12, 1971. Enc. 1, p. 1.

factured metals, cement, and fertilizer materials.

A rise in exports of forest and agricultural products offset the reduction in mineral exports, resulting in a higher overall trade surplus for the country in 1969.

Statistics on trade in mineral commodities for 1968–69 appear in tables 14 and 15.

Table 14.—Ivory Coast: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Metal and alloys, all forms	392	589
Oxides	1	--
Antimony metal and alloys, all forms	(1)	(1)
Copper:		
Scrap	r 774	1,129
Metal and alloys unwrought and semimanufactures	2	8
Iron and steel:		
Scrap	r 9,698	5,006
Pig iron	18	(1)
Primary forms	(1)	2
Semimanufactures	r 534	631
Lead:		
Ore and concentrate	1	--
Oxide	--	7
Metal and alloys, all forms	r 300	144
Manganese ore and concentrate	132,990	53,910
Nickel and alloys, all forms	2	--
Tin and alloys ... long tons	(1)	50
Zinc:		
Oxides	1	2
Metal and alloys, all forms	25	5
Other, metalloids n.e.s	32	8
NONMETALS		
Abrasives, crude, natural	1	(1)
Cement, hydraulic	15,640	24,781
Diamond ... carats	189,753	197,275
Clays, crude	--	10
Fertilizer materials:		
Crude	679	30
Manufactured:		
Nitrogenous	69	26
Phosphatic	37	25
Potassic	r 295	200
Other and mixed	16	11
Ammonia	5	1
Gypsum and plaster	32	51
Lime	62	95
Pigments, mineral	6	8
Salt	1,905	672
Sand and gravel	(1)	2
Sodium and potassium compounds n.e.s	195	387
Sulfur:		
Elemental	(1)	1
Sulfuric acid	(1)	12
Talc and related materials	4	(1)
Other crude nonmetals n.e.s	2	1
MINERAL FUELS AND RELATED MATERIALS		
Coke	--	16
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	357	203
Kerosine ... do	236	124
Distillate fuel oil ... do	399	161
Residual fuel oil ... do	863	990
Liquefied petroleum gas ... do	36	9
Bitumen ... do	156	54
Other ... do	20	10
Total ... do	r 2,067	1,551
Other crude chemicals from oil coal and gas distillation	1	(1)

r Revised.
1 Less than ½ unit.

Table 15.—Ivory Coast: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxides	3	2
Metal and alloys, all forms	r 502	2,944
Antimony metal and alloys, all forms	(1)	2
Arsenic oxides	2	--
Chromium oxides	6	3
Cobalt oxides	2	(1)
Copper metal and alloys, all forms	178	185
Gold metal unworked and partly worked troy ounces	14,210	5,466
Iron and steel:		
Roasted pyrite	(1)	--
Pig iron	4	6
Ferroalloys scrap	26	56
Primary forms	6	286
Semimanufactures	66,761	69,906
Lead:		
Ore and concentrate	3	2
Oxide	74	98
Metal and alloys, all forms	98	120
Manganese oxide	1	--
Molybdenum including alloys, all forms	16	--
Nickel including alloys, all forms	1	2
Platinum metal including alloys troy ounces	578	--
Silver metal including alloys do	5,176	6,237
Tin:		
Ore and concentrates long tons	--	(1)
Metal including alloys, all forms do	19	17
Titanium oxides	211	215
Zinc:		
Oxides	108	89
Metal and alloys, all forms	r 35	49
Other sands, metal bearing	17	92
NONMETALS		
Abrasives, natural, crude	6	17
Asbestos	2	2
Barite and witherite	98	131
Boron materials, crude natural borates	1	2
Cement, hydraulic	r 338,455	355,976
Chalk	558	770
Clays:		
Kaolin	12	39
Bentonite	79	7
Refractory	14	13
Diamond carats	175,000	130,000
Diatomite	47	39
Fertilizer materials:		
Crude:		
Phosphatic	75	(1)
Other	7,624	4,534
Manufactured:		
Nitrogenous	6,807	3,498
Phosphatic	5,641	3,874
Potassic	8,886	12,277
Other mixed	2,736	9,436
Ammonia	44	36
Graphite, natural	(1)	3
Gypsum and anhydrate plasters	13,055	18,303
Lime	r 2,809	2,957
Magnesite	3	1
Mica	4	4
Pigments, mineral, natural	110	189
Precious and semiprecious stones except diamond kilograms	17	128
Quartz	--	31
Salt	r 23,106	18,596
Sand and gravel	r 2,420	2,152
Sodium and potassium compounds n.e.s	3,458	3,498
Stone:		
Crushed and broken	r 3,030	3,881
Dimension	r 175	233
Sulfur:		
Elemental	8	9
Sulfuric acid	197	199

See footnotes at end of table.

Table 15.—Ivory Coast: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Talc and related materials	594	490
Other:		
Crude minerals n.e.s	585	803
Metalloids n.e.s	4	1
Meerschaum, amber and jet	--	250
Metallurgical residues not containing metals	--	16
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	4	12
Carbon black	110	78
Coal	r 17	34
Coke	r 283	205
Fuel briquets	r 29	28
Petroleum:		
Crude thousand 42-gallon barrels	r 5,352	6,250
Refinery products:		
Gasoline do	705	46
Kerosine do	217	14
Distillate fuel oil do	799	105
Residual fuel oil do	--	3
Lubricants do	87	87
Liquefied petroleum gases do	38	33
Bitumen do	51	49
Other do	13	13
Total do	r 1,910	350
Crude chemicals from coal, oil and gas distillation	760	840

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

Diamond.—A new concentration plant with a capacity for treating 300,000 metric tons of ore per year went into operation in December 1970 at the Tortiya mine of SAREMCI. It is expected to increase in annual production of approximately 15 percent. Renovation of the digging plant and a new sampling station are other expansion projects that were completed during the year. At Séguéla, the Société West African Selection Trust and Harry Winston Inc. (WASTON) combine instituted detailed investigations of its deposit and made plans to begin production in 1971. Annual output is expected to reach 70,000 carats when the mine is fully operational. These two developments should raise total diamond production in the Ivory Coast about 30 to 50 percent in 1971, and an annual level of about 325,000 carats should be achieved by 1972.

The mine operated by SMB near Tortiya closed in October 1970 because its reserves were depleted. Some hope was held for reopening the mine, based on exploration by SAREMCI in the same area.[34]

Iron Ore.—Pickands Mather & Co. continued investigations at its iron ore concession area near Man in western Ivory Coast. Results so far remain encouraging, and the company is planning to spend several times the amount that is required in its concession agreement on exploration costs in 1971. A large-scale investigation program is slated to continue into 1972 in the 4,000-square-mile concession area. Depending on feasibility, construction would begin shortly after, but no target dates for construction or operation have been determined. Financing for the project is being sought from various international banking sources and from potential major customers in Europe and Japan. It is reported that two Japanese companies have agreed to participate in the investment. Opening of a mining operation on this scale would make a major contribution to the country's income and exports, and would be particularly important to the relatively undeveloped western region.[35]

Manganese.—In March 1970 Compagnie de Mokta closed its manganese mine, the only one in the country. Increasing sales difficulty and declining prices in the last several years had foreshadowed the termination of operations. A surplus of low-grade manganese, the type produced by Mokta, continued to plague the world market and was the reason for the closure.

[34] Mining Journal (London). Mining Annual Review, 1970. June 1971, pp. 361, 364.
[35] Engineering and Mining Journal. Huge Iron Mine Planned for Ivory Coast. V. 172, No. 7, July 1971, p. 39.

A small stock remained to be sold at the end of the year.[36]

Petroleum.—An exploration convention was signed between the Ivory Coast Government and the consortium consisting of Esso, Royal Dutch/Shell, and Enterprise de Recherches et d'Activites Pétrolières (ERAP). Esso will have a 50-percent interest in the consortium, and 25 percent will be held by each of the other two partners. A program of seismic research in the offshore concession area began in December 1970.[37]

Other Minerals.—Investigation in the Zeitouo region of southwestern Ivory Coast by Bureau de Recherches Geologiques et Minieres (BRGM) confirmed the existence of a copper deposit, but further study is needed to determine its commercial possibility. Other exploration in that area revealed a promising indication of molybdenum at Monogaga.

Société pour le Développement Minier (SODEMI), a government corporation that had established exploration missions in five regions of the country, diverted most of its efforts to the western region in 1970 to study indications of copper and molybdenum in the area of Man. One other office remained open for investigation of deposits of the same minerals in the Bouake region.[38]

LESOTHO [39]

Exploitation of diamond deposits continued to be the only significant mining activity in Lesotho during 1970. Diamond output fell far below the record achieved in the previous year, probably as a result of the civil strife that occurred at one of the principal diamond digging areas. Two mining concerns, Rio Tinto-Zinc Corp. and Lonrho, Ltd., carried on prospecting activities in order to determine the feasibility of commercial production in their concession areas.

Lesotho's economy was disrupted by two crises during the year. In January, political tension and the Government's subsequent suspension of the constitution caused the United Kingdom to terminate its aid agreement, Lesotho's principal source of outside funds. A new agreement was signed late in the year. Concurrently, subsistence agricultural production was hard hit by drought and frost, resulting in a famine which required assistance from international relief agencies. On the positive side, a new customs agreement between Lesotho, South Africa, Botswana, and Swaziland was signed in December 1969 under the terms of which Lesotho will receive a considerably more generous share of the pooled customs collections. Negotiations also continued on the Malibamatso River Project, formerly called the Oxbow Scheme, a plan to divert part of the country's ample water supply to neighboring areas of South Africa. If developed, this project will provide another large increment of outside income.

PRODUCTION AND TRADE

Diamond production in 1970 attained only 57 percent of the previous year's level in both quantity and value. Civil strife, which occurred at the Kao field in April among diggers who had been relocated from Letseng-la-Terai, was probably responsible for most of the decline. The proportion of gem quality diamond to the total remained at about 20 percent, but their value of $618,000 accounted for 68 percent of the total diamond value of $913,000. Statistics on Lesotho's mineral production in 1968–70 are included in table 1.

An unrecorded output of crushed stone, precast concrete, and cement bricks from the plant of Lesotho Crushers, Ltd., was the only other known mineral production in the country. These materials were used entirely for local construction.

Lesotho's balance of mineral trade improved considerably in 1969, the latest year for which data are available, as a result of the larger-than-usual diamond output in that year. Diamonds constitute the country's sole mineral export, and the entire production is sold abroad. Lesotho's total trade has always been highly unbalanced because of its low productivity and dependence on foreign supplies. Imports of mineral commodities consist largely of re-

[36] Page 364 of work cited in footnote 34.
[37] Work cited in footnote 33; and Petroleum Intelligence Weekly. Ivory Coast. V. 9, No. 15, Apr. 13, 1970, p. 8.
[38] Page 364 of work cited in footnote 34.
[39] David G. Willard, economist, Division of Nonmetallic Minerals.

fined petroleum products, and these have maintained a steady uptrend. This normal gain in mineral imports, when combined with the drop in diamond production in 1970, will undoubtedly push the balance of mineral trade further into the red. Total trade and mineral trade values in 1967, 1968, and 1969 are shown in the following tabulation in thousand dollars.

	1967	1968	1969
Total commodity trade:			
Exports	5,835	4,732	5,697
Imports	33,320	33,513	33,470
Balance	−27,485	−28,781	−27,773
Mineral commodity trade:			
Exports	1,425	527	1,643
Imports	NA	2,157	2,431
Balance	NA	−1,630	−788

NA Not available.

Source: Standard Bank. Annual Economic Review, Botswana, Lesotho, Swaziland. Nov. 1971, p. 17.

COMMODITY REVIEW

Diamond.—A violent clash occurred between native diamond diggers and the police at the Kao diamond field in April 1970. The diggers were embittered at being forced to leave their former plots at Letseng-la-Terai to accommodate the Rio Tinto exploration program. The resulting disorder and property damage set back the Government's attempt to organize digging operations at Kao and contributed to the sharp drop in diamond production.[40]

At their Letseng-la-Terai and Mothae concessions Rio Tinto and Lonrho continued prospecting activities aimed at determining economic feasibility of large-scale mining of those pipes. No further word was announced on their findings. Several other mining companies have expressed interest in diamond exploration, and it is expected that additional concession contracts will be signed in the near future.[41]

A survey of the diamond mining potential of an 1,800-square-mile area in northern Lesotho is to begin soon under the auspices of the United Nations Development Program (UNDP). Modern aerial and ground survey techniques will be used to assess the resources in known diamond pipes and to locate additional pipes. Lesotho will contribute $150,000 toward the cost of the survey; the personnel and remaining funds will be provided by UNDP.[42]

Petroleum.—Southern Oil Exploration Corp. (SOEKOR), which is acting as technical advisor to the Government has invited bids for oil exploration in Lesotho. It is expected that a country-wide lease will be granted to the Lesotho National Development Corp. (LNDC), which will in turn authorize prospecting concessions to private interests.[43]

MALAGASY REPUBLIC[44]

Mineral deposits in the Malagasy Republic continued to attract the attention of international mining companies in 1970. Several million dollars was invested in searches for petroleum, bauxite, nickel, and other ores. No new commercial resources were discovered during the year, but the pace of exploration activity showed no sign of slackening.

Mineral production recorded a gain over the 1969 level, boosted primarily by the first full year's output from the Andriamena chromite mine. Production of graphite rose but mica output declined. Greater growth of mineral imports in 1969 aggravated the country's perennially unfavorable balance of trade in that year.

Government Policies and Programs.—The Malagasy Government continued to encourage foreign private investment during the year in order to maintain the flow of capital into the country. In regard to trade, however, a system of quotas and licenses has been put into effect which favors imports from the Franc Zone, the European Common Market, and countries having bilateral trade agreements with the Malagasy Republic. Expansion of this system to include those Common Market members not in the Franc Zone has tended to reduce the trade opportunities for nations such as the United States, which are not in one of the favored groups.

PRODUCTION

Production increases were reported for most of the leading mineral commodities

[40] U.S. Embassy, United Kingdom. State Department Airgram A-786, May 7, 1970, pp. 1–3.

[41] Mining Journal (London). Mining Annual Review, 1970. June 1971, p. 339–340; Mining Magazine. Lesotho Diamond Output. V. 122, No. 4, April 1970, p. 304.

[42] Mining Journal (London). Diamond Survey. V. 276, No. 7083, May 21, 1971, p. 407.

[43] American Association of Petroleum Geologists Bulletin. Lesotho. V. 55, No. 9, September 1971.

[44] David G. Willard, economist, Division of Nonmetallic Minerals.

of the Malagasy Republic in 1970. The new chromite mine of the Comina combine at Andriamena produced 141,000 metric tons of concentrates during its first full year of operation. Output of graphite was up 8 percent, extending the growth trend to a third consecutive year. Recorded production of mica showed a drop from 1,182 tons to 936 tons, but an excess of exports over production that has continued for a number of years indicates the likelihood that not all production is being reported. The cement plant at Amboania turned out about the same quantity of product as the year before.

Output of the country's many minor minerals exhibited both increases and decreases. Beryl production slipped to 52 tons from 83 tons the year before. Mining of piezoelectric quartz and most types of ornamental quartz increased sharply. Feldspar, industrial garnet, and nearly all ornamental stones showed higher production levels, but output of gold and rare-earth minerals, decreased.

Mineral production statistics for the Malagasy Republic in 1970 are included in table 1.

TRADE

Statistics on the Malagasy Republic's external trade for 1969, the latest complete data, indicated a worsening of the country's unfavorable balance of mineral trade, with exports totaling about $9.7 million and imports at $29.1 million. Exports of mineral commodities rose 28 percent, while imported minerals and mineral materials showed an increase of only 23 percent. However, the increase of over $1.9 million in mineral exports failed to compensate for the $5.5 million growth in imports. Shipments of chromite valued at $830,000 from the new mine at Andreamina provided the majority of the export gain, but exports of mica, graphite and petroleum products also contributed to the increase. Imports of iron and steel, chiefly semimanufactures, were up 33 percent to over $10.4 million. Other major groups of imports were crude oil, up 20 percent to $7.8 million and refined petroleum products, which rose 18 percent to nearly $4.5 million.

The increase in the mineral trade deficit contributed to the nation's poorer overall trade balance in 1969. Total exports rose by a meager 2 percent, but total imports grew at a 10-percent rate. The gain in exports was small because production of key agricultural commodities was hampered by extensive cyclone damage.

Significant improvement in the balance of mineral trade is anticipated for 1970, primarily stemming from increased chromite exports. Exports of graphite also increased, but shipments of mica slipped below the 1969 level.

Statistics on exports and imports of selected mineral commodities appear in tables 16 and 17.

COMMODITY REVIEW

Bauxite.—Investigation continued into the feasibility of developing the bauxite deposits at Manantenina, which are estimated by the Péchiney Company to contain about 100 million tons of commercial-grade ore. The principal problem is the need to construct a new port because there is no existing port close enough to the site.[45]

Cement.—An engineering study commissioned by the Malagasy Government has proposed that a new cement plant be built in an industrial zone that would be developed as part of a contemplated port and drydock project at Narinda Bay.[46]

Nickel.—An exploration program was also underway in an area of nickeliferous laterite deposits near Moramanga. A joint venture consisting of Société Le Nickel, Anglo-American Corporation of South Africa, Ltd., Ugine, and the Malagasy Government will perform beneficiation and metallurgical tests to determine the quantity and grade of the ore. If found feasible, a mine producing at least 35,000 tons of nickel per year will be developed.[47]

Petroleum.—Eight companies continued searching for petroleum in the Malagasy Republic through 1970. Drilling was in progress on several offshore concessions on both sides of the island, but no discoveries had yet been made. No new concessions were granted during the year.

Other Minerals.—A Japanese engineering team was studying a proposed hydroelectric power project on the Namorona River

[45] Metal Bulletin. Malagasy Bauxite. Mar. 17, 1970, p. 19.

[46] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A-010. Jan. 21, 1971, p. 1.

[47] World Mining. What's Going On in World Mining? V. 5, No. 13, December 1970, p. 51.

Table 16.—Malagasy Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Bauxite and concentrate	--	102
Beryl ore and concentrate	57	76
Chromite	--	32,980
Copper metal and alloys:		
Unwrought and scrap	181	259
Semimanufactures	1	1
Iron and steel:		
Iron ore	3	--
Scrap	131	3,305
Semimanufactures	r 899	994
Lead metal and alloys, all forms	3	9
Manganese ore and concentrate	10	7
Uranium and thorium ore and concentrate including rare-earth metals	81	--
Zinc metal and alloys, all forms	2	10
Other ore and concentrate	307	25
NONMETALS		
Abrasives, natural, garnet	25	(1)
Cement, hydraulic	3	6
Clays and products	14	(1)
Graphite, natural	15,886	18,514
Lime	1	18
Mica, all forms	1,415	2,319
Precious and semiprecious stones including quartz crystal, except diamond kilograms	r 90,302	76,683
Salt and brine	r 2,642	1,870
Stone, sand and gravel	111	79
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke including briquets	--	20
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	r 213	292
Kerosine do	r 93	117
Distillate fuel oil do	r 263	204
Residual fuel oil do	820	1,026
Lubricants do	1	(1)
Other do	1	1
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	--	5

r Revised.
[1] Less than ½ unit.

Table 17.—Malagasy Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	(1)	1
Metal and alloys, all forms	r 1,093	795
Chromium oxide and hydroxide	1	1
Copper metal and alloys, all forms	r 177	541
Gold metal unworked or partly worked troy ounces	2,900	10,288
Iron and steel:		
Ore and concentrate	10	8
Metal:		
Scrap	r 41	83
Pig iron, ferroalloys, and similar materials	21	7
Steel, primary forms	r 1	(1)
Semimanufactures	r 44,810	56,043
Lead metal and alloys, all forms	r 318	337
Mercury 76-pound flasks	3	2
Nickel and alloys, all forms	6	(1)
Silver metal and alloys troy ounces	r 17,908	4,147
Tin metal and alloys, all forms long tons	r 11	11
Titanium oxides	62	84
Zinc:		
Oxide and hydroxide	r 20	40
Metal and alloys, all forms	r 107	95
Other metals and alloys, all forms	r 20	16
NONMETALS		
Abrasives:		
Emery, corundum and other crude natural	20	21
Grinding wheels and stones	r 25	57
Asbestos	5	17
Cement	60,678	63,545
Chalk	462	598

See footnotes at end of table.

Table 17.—Malagasy Republic: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS—Continued		
Clays and products (including all refractory brick):		
Crude n.e.s	376	802
Products	r 139	1,114
Diamond, all grades thousand carats	r 55	25
Diatomaceous earth	6	5
Fertilizer materials:		
Crude and manufactured:		
Nitrogenous	4,937	5,908
Phosphatic	3,772	1,015
Potassic	4,891	6,791
Other including mixed	9,238	10,508
Ammonia	23	36
Gypsum and plaster	4,105	3,156
Lime	1,357	926
Magnesite	14	72
Mica crude and worked	--	10
Pigments mineral including iron oxide	r 144	229
Salt and brine	r 672	908
Sodium and potassium compounds, caustic soda	r 398	1,125
Stone, sand and gravel:		
Dimension stone	(1)	53
Dolomite	39	72
Gravel and crushed rock	5	6
Sand excluding metal bearing	5	17
Sulfur:		
Elemental, all forms	r 27	22
Sulfur dioxide	6	3
Sulfuric acid	101	89
Talc, steatite, soapstone and pyrophyllite	59	84
Other:		
Crude nonmetals n.e.s	7,653	242
Oxides and hydroxides of magnesium, strontium, and barium	30	2
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	3,007	998
Coal including briquets, all grades	21,136	18,643
Coke and semicoke	168	75
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	3,129	3,633
Refinery products:		
Gasoline do	r 120	125
Kerosine and jet fuel do	20	6
Distillate fuel oil do	57	115
Residual fuel oil do	6	1
Liquefied petroleum gas do	1	1
Lubricants do	r 50	67
Mineral jelly and wax do	30	21
Other:		
Petroleum coke do	2	8
Bitumen and other residues do	59	62
Bituminous mixtures do	10	1
Total do	r 355	407
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r 66	358

r Revised.
1 Less than ½ unit.

near Fianarantsoa. If feasible, the project would provide power for smelters utilizing presently undeveloped metal deposits in the area. Another Japanese team examined deposits of iron sands in the southern part of the island.[48]

MALAWI [49]

Malawi's mineral industry consisted mainly of gem corundum and kyanite production and the quarrying of limestone for cement and stone for building, railroad ballast, and aggregates. However, the mineral potential of the country was being reexamined in the light of recent industrial and transportation developments. The second stage of the Malawi Geological Survey's program for detailed mineralogical investigation of areas determined by a regional geochemical survey was started in

[48] U.S. Embassy, Tananarive, Malagasy Republic. State Department Airgram A-146. Dec. 4, 1970, p. 1.

[49] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

1970. Several anomalies that indicated possible nickel, copper, and tin-molybdenum deposits were considered for detailed examination. A phosphate deposit associated with carbonatite rocks was drilled by the survey to determine its economic potential. Although the mineral industry employed only about 550 persons, many Malawi citizens were employed by mines in the Republic of South Africa and Zambia. The remittance of salary by these workers constituted a significant source of foreign exchange for Malawi.

A deposit of high-quality sand became accessible with the opening of the railroad line to Nacala, Mozambique. Gem corundum was mined from a deposit in the Chimwadzulu Hills. Kyanite was produced at the Kupiridimba deposit.

Production of mineral commodities in 1970 was valued at about $3 million,[50] compared with an estimated $2.5 million in 1969. Mineral commodity production and foreign trade are shown in tables 1 and 18.

A feasibility study of bauxite deposits on Mount Mlanje by a consortium consisting of the London and Rhodesian Mining and Land Co., the Champalimaud Group, and the Government of Malawi, indicated that an aluminum smelting industry utilizing Mlanje bauxite would be economically viable.[51] Several recent developments such as the Cabora Bassa project and consequent navigability of the Zambezi River, the construction of a railway from Malawi to the port of Nacala, Mozambique, and the construction of an electric powerplant on the Shire River in Malawi have enhanced the economic potential of the Mlanje bauxite deposits. Reportedly, an integrated plant to produce alumina at a rate of 250,000 tons per year and aluminum metal at a rate of 125,000 tons per year was being considered. Cost of the plant was placed at about $204 million. Reserves of bauxite on Mount Mlanje total about 60 million tons and average 42.65 percent aluminum oxide (Al_2O_3), and 1.18 percent combined silica (SiO_2).

Columbite (pyrochlore) deposits occur at Ilomba Hill, northwest Malawi, Chilwa Island, and Tundulu. At Ilomba Hill inferred reserves of 100,000 tons of ore contain 6 pounds per ton of columbium oxide and 1.15 pounds per ton of uranium oxide.

A factory to mix, granulate, and bag fertilizer was scheduled to begin operating in April 1971, at a rate of 30,000 tons per year.[52] The plant was constructed for Optichem (Malawi) Ltd.

Monazite and strontianite occur at Kangankunde Hill disseminated in carbonatites and carbonatized feldspathic rocks. Indicated reserves in three separate areas are 4,000 tons per 100-foot depth of 4.5 percent monazite; 14,000 tons per 100-foot depth of 6 percent monazite; and 4,700 tons per 100-foot depth of 3.6 percent monazite. From 10- to 70-percent strontianite is contained in the ore as disseminated grains and veinlets. Underground exploration of the Kangankunde Hill deposit was being carried out in order to obtain bulk samples and to determine the size of the ore body.[53]

A study of the quantity of rutile in beach sand along the southwest shore of Lake Malawi was being conducted. An exclusive prospecting license was granted recently to explore for ilmenite, rutile, monazite, and zircon in a 7,100-square-mile area near Salima, southwest Malawi.

Oil Company of Malawi, Ltd. (OILCOM), a petroleum distribution company, planned to construct a number of service stations throughout the country.[54] The program, which will cost about $240,000, will be completed in 18 months.

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[50] Where necessary, values have been converted from Malawi Pounds (M£) to U.S. dollars at the rate of M£1=US$2.38.
[51] U.S. Embassy, Johannesburg, Republic of South Africa. State Department Airgram A-124, Dec. 1, 1970, pp. 5-7.
[52] Fertilizer and Chemical Development Council. Malawi. V. 10, No. 8, August 1970, p. 19.
[53] World Mining. Malawi. V. 6, No. 7, June 25, 1970, pp. 126-127.
[54] Petroleum Press Service. News in Brief. V. 37, No. 2, February 1970, p. 73.

Table 18.—Malawi: Foreign trade in selected mineral commodities [1]
(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Iron and steel, pig iron and ferroalloys	--	459
NONMETALS		
Asbestos	--	363
Fertilizer materials, natural, phosphatic	2,481	NA
IMPORTS		
METALS		
Aluminum and alloys semimanufactures	58	255
Copper and alloys semimanufactures	39	NA
Iron and steel semimanufactures	2,523	3,893
Nonferrous metals n.e.s. ... value, thousands	$8	$31
NONMETALS		
Clay products:		
Refractory	--	100
Nonrefractory	252	221
Fertilizer materials manufactured:		
Nitrogenous	9,790	4,963
Other n.e.s	950	1,289
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products, lubricants ... thousand 42-gallon barrels	--	1

NA Not available.
[1] Compiled from trade statistics for selected trading partner countries, in the absence of official Malawi trade returns.

Source: Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa) published by Walker and Co., New York, 1970 and 1971.

MALI [55]

The mineral industry of the Republic of Mali consisted mainly of marble, limestone, salt, and gold production. Exploration for mineral deposits was conducted by the National Society for Research and Mineral Exploration (SONAREM). Studies were in progress on phosphate rocks at Bourem and their potential utilization in producing fertilizers. Texaco Inc., a U.S. petroleum firm, made plans to have an aerial survey conducted on its concession area in northern Mali.

Statistics on production and foreign trade of mineral commodities are shown in tables 1 and 19. Marble was quarried at Bafoulabe and limestone for cement manufacture near Diamou. Gold was recovered at Yanfolila.

Studies of possible uranium occurrences in an area north of Kita was being conducted by a group from Hamburg University, West Germany.

The cement plant at Diamou near Kayes began operating in October 1969 and was inaugurated June 1970. Annual capacity of the plant is 50,000 tons, which exceeds Malian requirements, which were estimated at 40,000 tons per year. The Soviet Union, which built the plant, was providing about 50 technicians for its operation.

Salt is produced in the Taoudenni Basin of northern Mali and transported by camel train to Gao, where it is exchanged for goods.

In May, Texaco Inc. was granted a concession to explore for petroleum in a 200,000-square-mile area of the Taoudenni Basin of northern Mali, for a period of 5 years. Texaco agreed to invest $3.3 million in exploration. Terms of the agreement contained a 50–50 profit-sharing arrangement, and a 50-percent income tax based on realized prices. Taxes included a 12.5-percent royalty on oil and a 5-percent royalty on natural gas.[56]

[55] Henry E. Stipp, physical scientist, Division of Ferrous Metals.
[56] Petroleum Intelligence Weekly. Mali. V. 9, No. 22, June 1, 1970, p. 8.

Table 19.—Mali: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
NONMETALS		
Salt	434	590
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	1,285	4,677
IMPORTS		
METALS		
Aluminum and alloys, all forms	r 134	103
Copper and alloys, all forms	51	54
Iron and steel including alloys, metal, semimanufactures	r 13,299	5,677
Lead and alloys, all forms	r 32	16
Nickel and alloys, all forms	r 3	--
Tin and alloys, all forms ... long tons	1	4
Zinc and alloys, all forms	--	6
NONMETALS		
Cement, hydraulic	26,008	22,600
Fertilizers manufactured	3,260	NA
Salt	12,535	17,510
Stone, sand and gravel	40	233
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	14	NA
Petroleum refinery products	r 67,688	69,645

r Revised. NA Not available.

MAURITANIA [57]

Mineral Industry activity in the Islamic Republic of Mauritania consisted mainly of iron ore production and local output of salt, sand and gravel, and construction stone. Development of Société de Minière de Mauritanie's copper mine, plant, and ancillary facilities at Akjoujt was progressing satisfactorily, and output of concentrates was expected to begin by yearend.

Government and private industry teams explored for copper, iron ore, and petroleum. The United Nations and the Government of Mauritania initiated a mineral prospecting project covering 38,600 square miles in the northeastern section of the country. Cost of the 2½-year project was placed at $453,711.[58] Prospecting and an aerial geological survey also will be conducted in the northern part of the country to determine its minerals potential.

In 1970 employment by the mining sector totaled 4,601 persons, 3,462 of whom were Mauritanian citizens. Government income from mining activity was about $9 million, which represented 25 percent of the national budget.

Production and trade of mineral commodities are shown in tables 1 and 20. Shipments of iron ore by Société des Mines de Fer de Mauritanie (MIFERMA) from the port of Nauadhibou (Port Etienne) reached 9.22 million tons in 1970, compared with 8.6 million tons in 1969. Exports went mainly to France (1.99 million tons), the United Kingdom (1.72 million tons), and Italy (1.47 million tons). Reportedly low-grade magnetite deposits at Kedia d'Idjil were to be mined in 1971 and would contribute to an increase in total output.

MIFERMA and Japanese steel producers negotiated a contract for exporting to Japan 19.8 million tons of iron ore over a 9-year period.[59] Annual shipments will total 200,000 tons of lump ore averaging 66 percent iron and 2 million tons of fine ore containing an average 51- to 58-percent iron.

Important indications of copper were found near Guimimaka and Oum Kadnar.[60] The Mauritanian Government and Bureau de Recherches Géologiques et Minières (BRGM) prospected in the Oum Kadnar area, south-central Mauritania, with encouraging results. Ore containing 28- to 30-percent copper has been found, but no indication of the size of the deposit was available. Reportedly, copper and

[57] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[58] Where necessary values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF277.71=US$1.00.

[59] Japan Metal Bulletin. Steel Firms to Import 19.8 Million Tons of Iron Ore From Mauritania. No. 2550, June 2, 1970, p. 7.

[60] World Mining. What's Going On In World Mining? V. 6, No. 7, June 25, 1970, p. 128.

nickel anomalies also have been found in the Atar Region, about 250 miles northeast of Nouakchott.

Six deposits of ilmenite were found at Cap d'Arguin, Cap Sainte Anne, Pointe Jerome, Pointe Minou, Tacheleche, and Cap el Sass by Bureau Minièr de la France d'Outremer. Reserves of the six deposits were estimated to be 120,000 tons.

A deposit of rare-earth minerals at Bou Naga was worked for 2 years; however, mining was halted in 1970 because of the drop in price of yttrium. Reserves were incompletely estimated at 1,167 tons per meter of depth averaging 4.4 percent yttrium oxide. Reportedly, the ore proved difficult to refine.

A deposit of gypsum located about 35 miles northeast of Nouakchott was estimated to contain reserves of 4 billion tons of ore.[61] Two types of gypsum were noted—friable dunes and compact gypsum. The gypsum in dunes consisted of 14 million tons of fine-grained ore containing 96 percent calcium sulfate ($CaSO_4 \cdot 2H_2O$). Costs of mining this type of deposit was estimated to be low. The compact gypsum occurs in a deposit extending for a distance of about 58 miles. It consists of ore averaging 92.5 percent $CaSO_4 \cdot 2H_2O$.

Phosphate deposits occur along the bank of the Senegal River between Matam, Kaedi, and Boghe. Two types of ore have been distinguished; white or pink layers of phosphate and clay-schist, in a clay-sandstone formation 5 to 6 meters thick, and nodular phosphate in a limestone formation. Reserves of the white or pink type were estimated at 100,000 tons, averaging 55 percent tricalcium phosphate $Ca_3(PO_4)_2$. Reserves and grade of the other type of phosphate are not known; however, a hole drilled near Aleg indicated a significant deposit.

The two most important deposits of salt in Mauritania are the Sebkha d'Idjil, 19 miles northwest of F'Derik and the N'Terert deposit, 75 miles south of Nouakchott. Sebkha d'Idjil, which is 10 miles long and 3 miles wide contains proved reserves of 11.5 million tons. Proved reserves of the N'Terert deposit are 150,000 tons of salt. Both deposits are located near good roads.

Sulfur occurs near Cuprit; however, prospecting conducted in 1966 failed to uncover a significant deposit.

Petroleum exploration continued with Amoco Mauritania Petroleum Co., which drilled three wells offshore from Cape Timiris.[62] The wells were drilled to an average depth of 9,700 feet and abandoned. Esso Exploration and Production Mauritania conducted seismic surveys and began drilling a well in its concession area of 17,190 square kilometers located offshore, extending from about 62 miles north of Nouakchott to the Senegal border.

Texaco Oil Co. Inc. was given an authorization to prospect for petroleum in the Taoudeni Basin of east-central Mauritania.

MAURITIUS[63]

The mineral industry of Mauritius, a small island about 500 miles east of the Malagasy Republic, contributed a negligible amount to the gross domestic product estimated at $169 million[64] in 1970.

The Government passed several laws and regulations designed to permit prospecting and mining of petroleum and associated substances within or incidental to Mauritius. This legislation is titled the Continental Shelf Act, the Petroleum Act, No. 6 and regulations section 10, and the Minerals Act, No. 7, of 1970.

Production of mineral commodities in 1969 consisted of the recovery by solar evaporation of 4,242 tons of salt. In previous years about 6,000 tons per year of coral was quarried for use in the manufacture of lime and for road construction. Large quantities of lime are consumed by the sugar industry. In addition, unrecorded quantities of basalt are quarried for use in local construction.

Foreign trade in mineral commodities is shown in table 21.

A plant to mix imported fertilizer materials was scheduled to be constructed in Mauritius. The plant will have a capacity

[61] U.S. Embassy, Nouakchott, Mauritania. State Department Airgram A-23, Apr. 22, 1971, p. 12.
[62] World Oil. Africa. V. 171, No. 3, Aug. 15, 1970, p. 154.
[63] Henry E. Stipp, physical scientist, Division of Ferrous Metals.
[64] Where necessary, values have been converted from Mauritius Rupees (MR) to U.S. dollars at the rate of MR5.6=US$1.00.

Table 20.—Mauritania: Apparent foreign trade in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Iron and steel:		
Ore and concentrate ... thousand tons	7,487	8,238
Roasted iron pyrites	--	[2] 20,689
Scrap	1,783	2,115
NONMETALS		
Fertilizer materials, crude and phosphatic	--	10,520
Nonmetallic mineral, crude n.e.s	286	270
IMPORTS		
METALS		
Aluminum and alloys semimanufactures ... value, thousands	$29	--
Copper and alloys semimanufactures	--	14
Iron and steel semimanufactures	14,826	5,974
Tin and alloys unwrought ... long tons	--	12
NONMETALS		
Abrasives, grindstones	23	--
Cement, hydraulic	5,634	3,285
Clay products:		
Refractory	--	609
Nonrefractory	201	523
Fertilizer materials manufactured:		
Nitrogenous	731	2,841
Other n.e.s	2,400	--
Salt	5,275	4,800
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	18	17
Kerosine ... do	--	9
Distillate fuel oil ... do	169	264
Lubricants ... do	18	20

[1] Compiled from trade statistics for selected trading partner countries, in the absence of official Mauritanian trade returns.
[2] Reported in Spanish import statistics; no output of roasted pyrite is credited to Mauritania.
Source: Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

Table 21.—Mauritius: Apparent foreign trade in mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
Copper and alloy scrap	209	340
Other nonferrous metal scrap	74	48
IMPORTS		
Aluminum metal and alloys unwrought and semimanufactures	35	29
Cement, hydraulic	5,475	--
Clay products:		
Nonrefractory ... value, thousands	$35	--
Refractory	1,177	368
Copper metal and alloys unwrought and semimanufactures ... value, thousands	$51	$37
Fertilizer materials manufactured:		
Nitrogenous	9,988	1,427
Phosphatic	710	--
Potassic	3,215	3,569
Mixed	26,154	25,776
Iron and steel:		
Steel, primary forms	--	296
Semimanufactures	8,784	4,320
Nonferrous metals and alloys, unwrought and semimanufactures n.e.s ... value, thousands	$50	$25
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	8	9
Kerosine ... do	--	40
Distillate fuel oil ... do	19	32
Lubricants ... do	30	1
Precious and semiprecious stones, except diamond ... value, thousands	$69	$83

[1] Compiled from trade statistics of selected trading partner countries.
Source: Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

of 300 tons per day of compound fertilizer and 180 tons per day of nitric acid. Mauritius Chemical and Fertilizer Industry, Ltd., composed of 50-percent Mauritian business firms and 50-percent International Development Investment Corp. of Nassau, Bahamas, will own the plant.

In early 1970, Texaco Mauritius, Inc., was granted petroleum exploration rights to 57,000 square miles of the territorial seas and Continental Shelf of Mauritius for an initial period of 8 years.

NIGER [65]

The mineral industry of the Republic of Niger again was limited essentially to small production of gold, cassiterite (tin) concentrate, tungsten ore, cement, salt, and various crude construction materials such as gypsum, limestone, sand and gravel, and clays. Development continued at the Arlit open pit uranium mine, and the first uranium oxide (U_3O_8) was produced in late 1970. Large sections of the country were leased as petroleum concessions to U.S. oil companies, and the first large-scale search for oil was begun. Total value of mineral production was not reported but apparently was of minor significance relative to industrial production, which was estimated at $20 million to $25 million.[66]

The small gold production resulted from artisanal panning of alluvial deposits along rivers. Output of tin concentrate, containing about 70 percent tin, and tungsten by Société Minière du Niger, from deposits near Agadès was shipped to smelters in Nigeria and Belgium. Niger's one cement plant, with capacity of 45,000 tons per year, was operated at nearly 80 percent of capacity during 1970 and reached the highest rate of production since opening in 1966. Traditional production of salt and construction materials was mainly for local use. Only the gold, tin, and tungsten were exported. Principal mineral commodity imports were petroleum refinery products, various chemical products, and cement.

Société des Mines de L'Air (SOMAIR) continued mine development and mill construction at its Arlit uranium mine. Interests in this company are held by the Government of Niger, the French Commissariat à L'Energie Atomique (CEA), Péchiney-Mokta Mining Co. (France), Urangesellscheft (West Germany), and Agip Nucleare (Italy). The latter two companies each acquired 8.125-percent interests. First-stage mill construction, with annual capacity of 750 tons U_3O_8, was scheduled for completion in 1971, and expansion to 1,500 tons per year was planned by 1974. The concentrate will be hauled over a new paved road to an existing southbound road and then by rail in Dahomey to the Coutonou port.[67] France, West Germany, and the European Development Fund provided financial assistance for haulage of road construction.

A tripartite agreement (Niger Government, CEA, and Japanese interests) was signed for exploring and developing a uranium deposit at Akokan, about 20 kilometers south of Arlit and apparently along the same geological trend. Two years are planned for exploration and feasibility studies, followed by 3 years for underground mine development before production. An operation of the same magnitude as that at Arlit (1,500 tons U_3O_8 per year) was envisioned. A preliminary estimate of reserves at Akokan was 30,000 tons U_3O_8.[68] Exploration costs will be shared by the CEA (70 percent) and by Japanese interests (30 percent), which are represented by Overseas Uranium Resources Development Co., an agency formed by Japan's Atomic Energy Industry Council and that represents about 20 private Japanese firms. If the operation proves economic, the three parties will share the development phase as follows: Japanese, 25 percent; Niger Government 30 to 40 percent; and the CEA, the remainder.[69]

A third uranium deposit was reported at Imouraren, 50 kilometers south of Arlit, where uranium ore was intersected by drilling at depths of 150 to 400 meters.

Geophoto Inc., a subsidiary of Texas Instruments Inc., was hired by CEA to con-

[65] Walter C. Woodmansee, physical scientist, Division of Nonferrous Metals.

[66] U.S. Embassy, Niamey, Niger. Economic Trends Report. State Department Airgram A-005. Feb. 5, 1971, 7 pp.

Where necessary, values have been converted from Communauté Financiere Africiane Francs (CFAF) to U.S. dollars at the rate of CFAF275=US$1.00.

[67] Engineering and Mining Journal. V. 171, No. 6, June 1970, p. 257.

[68] Journal of Commerce. V. 304, No.'s 22, 211, June 15, 1970, p. 11.

[69] American Metal Market. V. 77, No. 64, Apr. 6, 1970, p. 16.

duct an aerial survey for uranium on the Djado Plateau in northeast Niger.

In the petroleum sector, U.S. oil companies holding concessions in Niger planned preliminary geological and geophysical activities. Continental Overseas Oil Co. (CONOCO) made an aerial survey in its concession area, which comprises 290,000 square kilometers and extends across the southern part of the country from the border with Mali in the west to Chad in the east.[70] CONOCO agreed to spend $5,990,000 during a 5-year period, renewable for an additional 5 years. Texaco Niger Inc. contracted with Mandrel Industries for a seismic program in its 245,000-square kilometer concession in eastern Niger, where Texaco will spend $3,285,000 in exploration during a 5-year period. Global Energy Co., another U.S. company, was originally granted a 65,000-square-kilometer concession and subsequently acquired an additional 90,480 square kilometers in western Niger, near Niamey. Global was committed to a $2.25 million, 5-year exploration program. In addition, Bishop Oil and Refining Co., Phoenix, Arizona, received two exploration permits in March, totaling 195,000 square kilometers.[71]

Geophoto Inc. conducted an aerial magnetic survey for Essex Iron Co., a subsidiary of United States Steel Corp., in the Liptako (western area of Niger, near Niamey and the borders with Mali and upper Volta).

A 4-year United Nations Development Program (UNDP) mineral survey project, which started in 1967, continued in central and western Niger. An airborne magnetic survey and ground geochemical work were conducted in the Liptako of western Niger. A copper-molybdenum anomaly reportedly was drilled in the Kourki area. In central Niger, a preliminary photogeologic survey and regional exploration were carried out in a 12,000-square-kilometer tract of the Aïr Mountains area. A tin occurrence near El Mecki and coal near Agadès were investigated further. Drilling was planned for the area.

Watts, Griffis, and McOuat Ltd., Toronto, Canada, conducted a $225,000 geological mapping project and economic evaluation of phosphate deposits in Niger as part of Canada's foreign assistance program. The objective was to locate economic phosphate deposits for a domestic fertilizer industry.

[70] Skillings Mining Review. V. 59, No. 5, Jan. 31, 1970, p. 33.
[71] Petroleum Press Service. V. 37, No. 2, February 1970, p. 68.

Table 22.—Niger: Foreign trade in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Aluminum, bauxite	--	[2] 15,935
Tin ore and concentrate ... long tons	89	115
IMPORTS		
METALS		
Iron and steel semimanufactures	r 3,347	4,910
Nonferrous metals n.e.s. ... value, thousands	--	$28
NONMETALS		
Cement	503	NA
Clay products nonrefractory	228	167
Fertilizer materials manufactured:		
Nitrogenous	r 322	NA
Other n.e.s.	r 163	NA
Nonmetallic mineral manufactures n.e.s.	15	16
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	--	52
Kerosine ... do	--	46
Distillate fuel oil ... do	--	28
Residual fuel oil ... do	--	90
Lubricants ... do	6	7

r Revised. NA Not available.
[1] Compiled from trade statistics for selected trading partner countries, in the absence of official Niger trade returns.
[2] Reported in Italian import statistics; no output of bauxite is credited to Niger.
Source: Statistical Office of the United Nations, 1968 and 1969 editions of the Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

RWANDA[72]

No major mineral developments were reported in Rwanda in 1970. A project to evaluate the country's mineral potential began in 1970 under the Special Fund of the United Nations. The Woods Hole Oceanographic Institute, Woods Hole, Massachusetts, initiated a study of the geology, biology, and ecology of Lake Kivu for possible exploitation of methane, petroleum, and mineral resources from the lake.

Minerals are Rwanda's second most important source of foreign exchange after agricultural products. In 1969, mineral exports were valued at about $6.1 million, compared with a total of about $15 million for all exports.

Cassiterite continued to be the chief mineral produced and exported, but the industry continued to be plagued by smuggling. Cassiterite production in 1970 was valued at an estimated $4.1 million, from $3.8 million in 1969. Tungsten production was valued at an estimated $1.6 million in 1970, compared with $1 million in 1969.

La Société Minétain-Rwanda (MINETAIN), the major tin mining company, reported that its alluvial mineral deposits were exhausted.

Table 23.—Rwanda: Apparent foreign trade in selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
Tin ore and concentrate .... long tons..	r 1,131	1,044
Tungsten ore and concentrate	260	309
IMPORTS		
Iron and steel semimanufactures	r 2,900	2,198
Petroleum refinery products	122	180

r Revised.

[1] Compiled from trade returns of 24 trading partner countries given in Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

SENEGAL[73]

The principal mineral industries of the Republic of Senegal are the production of phosphate rock and fertilizer materials, the manufacture of cement, and petroleum refinery products. Small quantities of salt, building stone, and attapulgite (fuller's earth) were produced for domestic consumption and export. The discovery of oil in the offshore waters of southern Senegal has not produced commercially exploitable quantities. Compagnie des Petroles Total Afrique de l'Quest (COPETAO) and Texas Gulf Sulphur Co. have had negative results from all four wells drilled to date. Esso Exploration Senegal reduced its Dakar Marine concession and the SAP-Subibotane Exploitation license was not renewed. Shell has recently acquired concessions including two onshore and one offshore.

In addition to the oil prospecting activity noted, the French Bureau de Recherches Géologiques et Minières (BRGM) and a United Nations Special Fund team are conducting mineral research. Diamonds, gold, iron, traces of chromite, and copper have been found; however, further studies will be required to ascertain the value of the deposits.

The two large phosphate deposits in Senegal are mined by different companies. Compagnie Sénégalaise des Phosphates Taiba (CSPT) produces calcium phosphate at Taiba. This operation started in 1960 with a plant capacity of 600,000 tons per year. It was increased to 1.1 million tons in 1969. Production in 1969 increased to 1,035 million tons and declined in 1970 to 998 million tons. Most of this product was exported in 1970 to the Netherlands (211,764 tons), United States (173,430 tons), France (188,936 tons), and Japan (143,747 tons). Lesser quantities were

[72] V. Anthony Cammarota, Jr., physical scientist, Division of Nonferrous Metals.

[73] William F. Stowasser, physical scientist, Division of Nonmetallic Minerals.

Table 24.—Senegal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Copper metal and alloys unwrought and semimanufactures	r 330	721
Iron and steel:		
Scrap	1,218	6,598
Ferroalloys	1	--
Semimanufactures	402	391
Lead metal and alloys unwrought and semimanufactures	r 153	298
Tin:		
Ore and concentrates ... long tons	--	36
Metal and alloys ... do	1	--
Zinc metal and alloys, unwrought and semimanufactures	--	17
Other, unspecified metalloids	r 2	2
NONMETALS		
Cement, hydraulic	21,736	25,608
Chalk	--	10
Clays, crude	r 20	1,172
Fertilizer materials:		
Crude, calcium phosphate	r 809,966	793,642
Manufactured:		
Nitrogenous	51	169
Phosphatic	26,316	48,456
Mixed	4,972	3,064
Ammonia	46	--
Gypsum	--	83
Salt	18,315	45,362
Sand and gravel	682	34
Sodium and potassium compounds n.e.s.	309	496
Stone, dimension, worked	--	64
Sulfur, elemental	--	65
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	--	71
Kerosine ... do	--	245
Distillate fuel oil ... do	--	249
Residual fuel oil ... do	--	421
Lubricants ... do	(1)	2
Liquefied petroleum gas ... do	(1)	14
Other ... do	(1)	(1)
Total ... do	1	1,002

r Revised.
1 Less than ½ unit.

Table 25.—Senegal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	--	2
Metal and alloys, all forms	318	650
Copper metal and alloys, all forms	r 96	101
Iron and steel:		
Scrap	23	211
Pig iron and ferroalloys	18	34
Steel, primary forms	--	4
Semimanufactures	39,456	63,905
Lead:		
Oxide	58	44
Metal and alloys, all forms	r 67	31
Mercury ... 76-pound flasks	58	116
Nickel metal and alloys, all forms	--	3
Silver metal and alloys unwrought and semimanufactures ... value, thousands	$6	$10
Tin metal and alloys, all forms ... long tons	17	15
Titanium oxide	159	175
Zinc:		
Oxide	79	76
Metal and alloys, all forms	29	26
Other:		
Metalloids n.e.s	1	11
Nonferrous metals and alloys, all forms	8	1

See footnotes at end of table.

Table 25.—Senegal: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
NONMETALS		
Abrasives, crude natural except diamond	8	--
Asbestos	r 762	474
Barite and witherite	1,139	109
Borates:		
Crude, natural	(1)	3
Boric acid and oxide	2	--
Cement, hydraulic	2,629	2,707
Chalk	697	961
Clays and products:		
Clays, crude	r 46	1,651
Products:		
Nonrefractory	r 1,519	1,411
Refractory	r 347	448
Diatomaceous earth	99	37
Fertilizer materials:		
Manufactured:		
Nitrogenous	16,668	2,518
Phosphatic	6,351	--
Potassic	7,276	1,516
Mixed	973	23
Ammonia	1,345	4,051
Gypsum	3,683	9,144
Lime	1,516	1,697
Mica crude and worked	14	53
Pigments mineral:		
Natural	104	155
Iron oxide manufactured	61	45
Salt	77	115
Sodium and potassium compounds n.e.s:		
Sodium hydroxide	4,080	4,884
Potassium hydroxide, sodium and potassium peroxide	5	24
Stone, sand and gravel:		
Dimension stone crude and worked	186	261
Dolomite, industrial	181	112
Quartz and quartzite	1	69
Crushed and broken stone and gravel n.e.s	529	229
Sand not metal bearing	--	6
Sulfur, elemental, all types	3,020	6,320
Talc and related materials	208	205
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	63	161
Carbon black	2	1
Coal and coal briquets	314	172
Coke	133	139
Petroleum:		
Crude thousand 42-gallon barrels	1,824	6,174
Refinery products:		
Gasoline do	49	17
Kerosine and jet fuel do	10	1
Distillate fuel oil do	19	4
Residual fuel oil do	7	(1)
Lubricants do	37	39
Other do	45	52
Total do	167	113
Crude chemicals from coal, oil and gas distillation	350	501

r Revised.
1 Less than ½ unit.

shipped to West Germany, Greece, and Italy. The phosphate deposit at Keur Morfal was to be abandoned in 1970 because of mining problems, and a new mine at Ndomor Diop was to start producing in 1970. The annual capacity was expected to increase to 1.5 million metric tons.

Société Sénégalaise des Phosphates de Thiès, a branch of Péchiney Saint-Gobain of France produces aluminum phosphate. The total production of aluminum phosphate rock, clinker phosphate rock, phosphal and polyfos, and baylifos was 173,780 tons in 1970, down from 204,433 tons in 1969. The production capacity is 250,000 metric tons per year.

SOMALI REPUBLIC [74]

The mineral industry of the Somali Republic consisted chiefly of salt and meerschaum production and the quarrying of stone and sand and gravel for local construction. Activity related to minerals was centered around prospecting for uranium and other minerals by teams from private industry, Government, and the United Nations. Exploration for petroleum by subsidiaries of United States, French, and German firms continued.

Early in the year the Government of Somalia and the United Nations signed an agreement for the United Nations Development Program (UNDP) to extend its mineral and groundwater survey to the central and northern areas of the country.[75]

Reportedly, the Somali Government planned to reactivate the Hafun salt works; however, there was no indication

[74] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[75] Mining Journal. Somalia Mineral Survey Extended. V. 274, No. 7012, Jan. 9, 1970, p. 31.

Table 26.—Somali Republic: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Iron and steel:		
Scrap	5	(1)
Pig iron and ferroalloys	1	NA
Semimanufactures	4,000	NA
Nonferrous metal scrap	169	(1)
NONMETALS		
Cement	10	NA
Clay products, nonrefractory	1	NA
Salt	5	71
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	6	(2) (total for gasoline, kerosine and lubricants)
Kerosine ... do	(2)	
Lubricants ... do	(2)	
IMPORTS		
METALS		
Iron and steel:		
Pig iron and ferroalloys	96	5,082 (total for iron and steel)
Steel, primary forms	19	
Semimanufactures	5,193	
Nonferrous metals unwrought and semimanufactures:		
Aluminum and alloys	80	236 (total for nonferrous metals)
Copper and alloys	5	
Lead and alloys	13	
Nickel and alloys ... kilograms	30	
Platinum and silver ... thousand troy ounces	1,122	
Zinc and alloys	35	
Other	106	
NONMETALS		
Cement, hydraulic	30,393	NA
Clays and products:		
Crude	2	NA
Clay products:		
Nonrefractory	404	NA
Refractory	638	NA
Fertilizer materials:		
Crude potassic	105	NA
Manufactured	2,954	7,315
Lime	106	NA
Salt	188	NA
Stone, sand and gravel	37	NA
Other crude nonmetals	1	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	92	e 733 (total for petroleum refinery products)
Jet fuel and kerosine ... do	43	
Distillate fuel oil ... do	173	
Residual fuel oil ... do	48	
Lubricants ... do	23	
Liquefied petroleum gas ... do	2	
Other ... do	193	
Crude chemicals from the distillation of coal gas or oil	953	2,065

e Estimate.
NA Not available.
[1] Exports of scrap iron and steel and nonferrous metal totaled 51 tons in 1969.
[2] Less than ½ unit.

when this project would begin. A national survey for bauxite uncovered low-grade and irregular deposits. Examination of a deposit containing 79-percent-grade sepiolite indicated possible industrial use for the material. A survey of ground water resources in the Bur Galan-Daimir area, Bur Acaba basin, and the Chisimaio area found large potential water resources in fissures in basement rocks, in limestones of Jurassic age, in river underflows and in surface accumulations.

Other minerals indicated but not studied thoroughly by the United Nations team were copper, silver, tin, feldspar, marble, columbium-tantalum, beryl, quartz, galena, molybdenite, bismuthinite, nepheline syenite, gypsum, and anhydrite.

The petroleum firm Elf-Scebel, which has a concession in central Somalia, conducted seismic surveys. Hammar Petroleum Co., which was drilling an anomaly, abandoned one exploration well at 3,248 feet and another well at 7,161 feet.[76] The West German firms Deutsche Erdol A.G. and Deminex applied for a concession area that had been returned to the Somali Government by Sinclair Somali Corp., Amerada Petroleum Corp. of Somalia and Marathon International of Somalia Ltd. on December 31, 1968.

Data were not available for mineral production in 1970; however, the principal output probably consisted of about 2,000 tons of salt, 4,500 tons of sepiolite (meerschaum) and unrecorded quantities of stone and sand and gravel. Foreign trade in mineral commodities is shown in table 26.

A report was published that gave a detailed description of several mineral occurrences and the ground water potential of four areas in Somalia.[77] Studies of iron ore deposits at Daimir and Bur Galen revealed about 170 million tons of ore that reportedly could not be mined profitably. An aerial survey of 3,860 square miles in the Bur area outlined 38 radioactive anomalies. A detailed study of one anomaly near Alio Ghelle revealed an ore body containing 3.30 percent thorium oxide (ThO_2), 0.12 percent uranium oxide (U_3O_8), and 0.080 percent yttrium oxide (Y_2O_3). Nucleare Somala, a subsidiary of Ente Nazionale Idrocarburi (ENI) continued its investigation of radioactive anomalies in the Bur Region. A license also was granted to Nucleare Somala covering 19,000 square miles in the Northern Region. An airborne survey was started. Western Nuclear Inc. and Uran Erzbergbau, which also had been studying areas in the Bur Region, completed their work and withdrew during the year.

SOUTHERN RHODESIA[78]

According to a senior Rhodesian mine official, the year 1970, was one of considerable achievement in the mining industry —the growth rate was fully maintained and there were encouraging pointers to the future.

According to the Minister of Mines, the mining industry took another step toward its target of $280 million, value of production increased nearly 13 percent. The outlook for the Rhodesian mineral industry was projected for a short period of leveling off, based on declared valuation, before the fruit of recent and present prospecting activity will be reaped. For security reasons, many projects now being developed are not published in advance.

No detailed production statistics have been published in Rhodesia since 1965, and almost all news of current mining development has been embargoed.

Reported value of mineral output rose to a record high of $138.1 million from $173.6 million in 1969. Value of mineral output before sanctions was $89.6 million. The greatest advance was reportedly in nonmetallic mineral products because construction continued at a high level.

During the year, 432 operating mines and 181 companies were engaged in mining. A district breakdown shows that Salisbury led with 148 mines, followed by Bulawayo with 124; Gwelo with 102; Gatooma with 31; and Victoria with 127.

Employment in the mining and quarrying industries rose from 50,400 in 1969 to 55,000 in 1970.

According to the Annual Report of the Secretary of Mines for 1969, a shift of emphasis in the structure of Rhodesia's min-

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[76] World Oil. Africa. V. 171, No. 3, Aug. 15, 1970, p. 158.

[77] United Nations Development Program. Mineral and Groundwater Survey Somalia, 1970. P. 133.

[78] John L. Morning, physical scientist, Division of Ferrous Metals.

eral industry has occurred since 1964. During that year, 504 precious metal blocks were registered; in 1969, there were only 203. In contrast, base mineral registered blocks rose to 1,468 in 1969 from 679 in 1964.

Exploration activity during the past 5 years, particularly for base metals, has grown and is being conducted over wider areas. Exclusive prospecting orders granted by the Government for this period follow:

Year	Number of orders granted	Total area in square miles
1966	23	1,727
1967	6	508
1968	44	380
1969	62	5,285
1970 [1]	49	3,891

[1] At yearend, 100 orders were in effect.

At the beginning of the year, new royalty rates, which will be based on weight instead of value, became effective.[79]

A new program of assistance to the mining industry was introduced on a trial basis in the Gwelo Mining District. The objective was to assist prospectors in opening up deposits of readily available marketable base metals. A nonrepayable grant of up to $700 per property can be authorized to help cover exploration charges. The program is directed by the Government Geologist.

Metrification was being introduced, and steps were taken to implement certain aspects of it at an early date. A metrification council was established in 1969 and subcommittees appointed for various industries. Currency was decimalized in February, and the implications of metrification in mining valuation, ventilation, surveying, assaying, and mineral processing in the minerals industry was being studied during the year. Many mining concerns have changed to the metric system.

Production of electric power in Rhodesia rose to over 6 billion kilowatt-hours for the first time. However, domestic consumption totaled 3.4 billion kilowatt-hours; the balance going into the Central African Power Corp. grid. The mining and quarrying industries generally accounts for about 20 percent of Rhodesia's requirements.

Copper production continued to be dominated by Messina (Transvaal) Development Co. Ltd. (Messina) and its subsidiary MTD (Mangula) Ltd. The Messina mill processed 1.05 million tons of ore and recovered 10,830 tons of copper. Overall recovery was 92.5 percent. Ore reserves were reported at nearly 5 million tons grading 1.31 percent copper. Ore processed at Messina's Umkondo mine totaled 7,400 tons, from which 962 tons of copper was recovered. Ore reserves were almost exhausted and at yearend totaled 11,000 tons. Performance was good at the Alaska mine; the mill processed 278,000 tons of ore and recovered 1,984 tons of copper. Ore reserves decreased during the year to 360,000 tons grading 2.08 percent.

Gwai River, Messina's new copper facility, initiated operations in May and processed 70,000 tons of ore and recovered 1,109 tons of copper. Yearend ore reserves totaled 1.2 million tons grading 2.13 percent copper. Owing to a shortage of ore, the mill only operated 91 percent of the time, thereby raising unit costs. In 1971, the designed production rate of 16,000 tons per month should be achieved. Messina continued to develop its Shackleton mine, and initial production was scheduled for October 1971.

MTD recovered 13,014 tons of copper from nearly 1.3 million tons of ore treated in the concentrator. In addition, an oxide leach plant recovered 5,387 tons of copper. Sulfide ore reserves at yearend totaled nearly 16 million tons grading 1.36 copper, and oxide ore reserves totaled 1.4 million tons grading 1.04 percent copper, of which 0.82 percent was nonsulfide copper. MTD plans to initiate operations in 1971 at its Silverside copper mine at an annual rate of 180,000 tons per year. The mine had previously been developed and then placed on standby. The fully delineated ore body contains 1 million tons of ore grading over 2 percent copper and some silver. MTD also plans to complete the development of its Norah mine and bring it into production in early 1972. Reported ore reserves total 1.8 million tons grading 1.4 percent copper.

Coronation Syndicate, a subsidiary of Lohnro Ltd., reported 1970 sales of 3,700 tons of copper and 2,200 kilograms of silver from its mine at Inyati. The mine was still under development because less than 40 percent of the ore milled came from stoping in reserves. Ore reserves increased

[79] Chamber of Mines Journal. V. 12, No. 1, 1970, pp. 36–38.

to 843,000 tons grading 2.31 percent copper during the year.

Rhodesia's developing nickel industry continued to make news. Rio Tinto Rhodesia Ltd. planned to open a new copper-nickel mine (Perservance) in 1972 at Chakari, about 85 miles southwest of Salisbury. The Perservance will be Rhodesia's fourth nickel mine, all of which have been developed since 1965. The other mines are Rio Tinto's Empress and Anglo-American Corp. Rhodesia Ltd's. Trojan and Mudziwa. Johannesburg Consolidated Investment Co. was reported to have found a nickel prospect about 15 miles north of Shangani. Rio Tinto was granted prospecting rights in the Hadley district for nickel and copper and in the Lalapanzi district for chromium. The combined ore reserves of the Trojan and Madziwa mines of Anglo-American was estimated at between 17 and 20 million tons of nickel-copper ore, and monthly output was estimated at 600 tons of refined metal. Rio Tinto's Empress mine ore reserves was estimated at 23 million tons. The firm was reported to be producing 500 tons of nickel per month.

Falcon Mines Ltd. reported a drop in profits at its Dalny mine owing to working costs rising from $7.59 in 1969 to $8.12 in 1970. As a result, ore reserves fell from 828,000 tons to 536,000, which is about a 2-year supply of ore.

Norman Levin G.M. Co. (Pvt.) Ltd. reopened the Joyce mine at Beatrice. This long-time gold producer was closed down in the 1950's. Diamond drilling produced sufficient evidence of mineralization that new facilities including housing, a new shaft, and a concentrator were constructed. The concentrator uses flotation for recovery of values.

According to Messina's annual report, the new tungsten mine at Beardmore started production in May and produced scheelite concentrate containing 102 tons of tungsten trioxide (WO_3). The target goal for the 1971 fiscal year is 310 tons of tungsten trioxide. Ore reserves were reported at 100,000 tons averaging 1.28 percent tungsten trioxide.

The Ball scheelite mine owned by Corsyn Consolidated Mines Ltd. was reported to have processed 37,000 tons of ore in 1970, compared with 42,000 tons in 1969. Operations were increased toward the end of the year and production of ore came from a low-grade surface deposit.

At Wankie Colliery Co. coal production was up 100,000 tons from 1969, the highest since 1961. To meet increased demand for coke, a 300,000-ton-annual-capacity coking plant was under construction during the year. The $9.8 million plant was scheduled for full operation in 1971. Another significant development at Wankie was the development of a small open-cast mine which allows almost 100-percent extraction of coal, compared with 40 to 50 percent by underground methods. A side benefit of this development will be recovery of non-coking coal that was not previously recovered that will be suitable for thermal purposes.

Evidence that sanctions are helping to make Rhodesia self-reliant was made when W.S. Craster Ltd. (Salisbury) completed its first year of operating a new ball foundry. Six different sizes of balls were manufactured and a seventh was planned; a larger variety than is produced in the Republic of South Africa. The organization also produces castings for the mining industry as well as manufacturing ball mills and liners.

SPANISH SAHARA [80]

During this year, the technical service department of Fisons Ltd. initiated an evaluation of the phosphate rock deposits at Bou-Craa. The deposit will be mined by Fosfatos de Bou-Craa S.A., the operating subsidiary of Empresa Nacional Minera del Sahara (ENMINSA). A 1,500-metric-ton-per-month pilot plant designed to process the rock will permit prospective customers to evaluate the product. Preliminary reports indicate that the rock is high quality and compares favorably with Moroccan deposits. Most of the work carried out at Fisons Research Station at Lexington was to establish the amenability of the rock in the manufacture of phosphoric acid and its fertilizer derivatives.

Production is scheduled for early 1973; construction work on all the major facilities is in progress. The port installation at El Aiún is essentially completed as is the 60-mile conveyor system linking the deposit

[80] William F. Stowasser, physical scientist, Division of Nonmetallic Minerals.

with the port. The plant when completed will be capable of treating 5 million metric tons of crude rock to produce 3.3 million tons of washed and screened phosphate concentrates.

The only active petroleum work in Spanish Sahara last year was the Empresa Nacional Petróles de Aragon, S.A. (ENPASA) marine seismic survey and wildcat well offshore in block 15–A drilled with Société National des Pétroles d'Aquitaine (SNPA) and operated by Zapata North Sea, Inc., from the semisubmersible, *Louisiana*. The well, Alisio 15–A–1, was drilled to 12,545 feet and abandoned in the Lower Cretaceous.

In concession changes, ENPASA was awarded four onshore permit areas, Union Carbide Corp. received five offshore licenses, and AMOCO applied for three offshore concessions. The Conoco/Gulf/Cepsa group continued to hold three onshore and three offshore permits.

SUDAN [81]

Sudan's mineral industry contributed little to the country's gross domestic product estimated at $1,674 million in 1970. Faced with a slowdown in economic growth, the Government in mid-1970 drafted a 5-year development plan, which was designed to achieve an average annual rate of growth of 7.6 percent. Although emphasis was placed on development of the agricultural sector, industrial development would receive 16.7 percent of the plan's total budget of $1.06 billion.[82] Foreign trade and capital investment by western nations decreased in 1970 as Sudan's Government became more closely aligned with neighboring states. An agreement providing for eventual economic integration and coordination of resources between the Sudan, Libya, and United Arab Republic was signed in early 1970.[83] The agreement called for eventual removal of tariffs on the products of the three states and the free interchange of labor. A technical assistance agreement also was signed with the United Kingdom, whereby British technicians would advise the Sudan on economic and social development projects, and Sudanese technicians would be trained in the United Kingdom. The Government nationalized the importation of various products used in agricultural production, especially fertilizer materials. It was estimated that during the 1969–70 fiscal year, imports of nitrogenous fertilizers would total about 32,000 tons nitrogen content.[84] In mid-year an agreement was signed between the Governments of Sudan and Czechoslovakia calling for construction of a 500- to 650-ton-per-day nitrogenous fertilizer plant at Sennar.[85]

Production and foreign trade in mineral commodities are shown in tables 1 and 27.

Geological exploration for copper, mica, gold and chromite was conducted in Darfour, Nil Bleu, Kassala, and northern provinces by technicians from the United Nations Development Program. In early 1970 a successful test run reportedly was carried out at the 100,000-ton-per-year Rabak cement factory.[86] Salt was produced at seven or eight works, the principal one is near Port Sudan. Annual production totals about 52,000 tons. Human and animal salt consumption was estimated at about 100,000 tons. Three salt crops per year are recovered from conventional concentrating and crystallizing ponds.

In early 1970, the Director of Sudan's Geological Department announced that preliminary surveys confirmed that some deposits of oil and natural gas occur in the Red Sea area.[87]

Apparently the Soviet petroleum exploration team, which conducted studies in October 1969 was inactive in 1970.[88] Continental Oil Co. was negotiating with the Government for participation in the Digna concession and reportedly was making progress. British Petroleum Sudan (BP Sudan) and the Government were negotiating for government participation in the 20,000-barrel-per-day refinery at Port Sudan. Shell Oil Co. and BP Sudan own the refinery, which began operating in 1964.

[81] Henry E. Stipp, physical scientist, Division of Ferrous Metals.
[82] Where necessary, values have been converted from Sudanese pounds (S£) to U.S. dollars at the rate of S£1=US$2.87.
[83] Barclays Overseas Review (London). Sudan. May 1970, p. 25.
[84] Nitrogen (London). Sudan. No. 64, March/April 1970, p. 8.
[85] Page 8 of work cited in footnote 84.
[86] Barclays Overseas Review (London). Sudan. March 1970, p. 24.
[87] Barclays Overseas Review (London). Sudan. January 1970, p. 23.
[88] World Petroleum Report. Sudan. V. 17, 1971, p. 62.

Table 27.—Sudan: Apparent foreign trade in mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Chromium, ore and concentrate	10,394	18,713
Copper metal including alloys scrap	483	708
Iron and steel metal scrap	NA	2,139
Platinum-group metals and silver waste and sweepings ... value, thousands	$1,111	NA
Other, ash and residue containing nonferrous metals	33	4
NONMETALS		
Fertilizer materials, crude, phosphatic	13,151	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	109	126
Residual fuel oil ... do	366	421
IMPORTS		
METALS		
Aluminum metal including alloys, all forms	r 403	374
Copper metal including alloys, all forms	r 282	62
Iron and steel:		
Pig iron, ferroalloys, and similar materials	NA	2,896
Semimanufactures:		
Bars, rods, angles, shapes, and sections	6,072	8,831
Universals, plates, and sheets	9,404	4,566
Hoop and strip	3,011	4,172
Rails and accessories	3,590	259
Wire	311	444
Tube, pipes, and fittings	15,464	8,946
Castings and forgings, rough	NA	141
Lead metal including alloys, all forms	r 479	713
Tin metal including alloys, all forms ... long tons	107	39
Zinc metal including alloys, all forms	r 165	430
NONMETALS		
Abrasives, natural, grinding and polishing wheels and stones	r 157	175
Clays and products (including all refractory brick)	r 315	NA
Fertilizer materials manufactured, nitrogenous	r 16,834	4,000
Lime ... value, thousands	NA	$28
Sodium and potassium compounds caustic soda	r 2,743	3,219
Sand excluding metal bearing	NA	1,275
Other nonmetal:		
Crude	597	NA
Building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals n.e.s	3,681	5,632
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	1,383	NA
Petroleum refinery products:		
Lubricants ... thousand 42-gallon barrels	r 117	93
Mineral jelly and wax ... do	r 1	2
Other ... do	r 3	14
Mineral tar, and other coal, petroleum, or gas derived crude chemicals	2,811	4,246

r Revised. NA Not available.
[1] Compiled from report statistics of selected trading partner countries.
Source: Supplement to the World Trade Annual. V. III (Africa), 1968 and 1969; prepared by the Statistical Office of the United Nations.

SWAZILAND [89]

Minerals activity in Swaziland was concentrated on development of a new asbestos mine in the Emlembe area and the surveying of coal deposits in the Manzini area. Production and trade of iron ore, asbestos, and coal continued to be Swaziland's principal source of foreign exchange. The repatriation of wages earned by Swazis in the Republic of South Africa mines also represented a significant source of foreign exchange. In 1970 an estimated 8,400 persons were recruited for work in South African mines. An average of 2,716 persons were employed by Swaziland's mineral industry. Interest in minerals was shown by private industry in applying for 12 mining permits and 13 prospecting rights during the year. The Government of Swaziland acquired a 20-percent interest in the Swaziland Iron Ore Development Co., as provided in an agreement signed before the start of mining operations.

The Ministry of Commerce, Industry and Mines and Japanese interests held

[89] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

talks on the feasibility of constructing a plant to make dry cell batteries.

A United Nations Development Program (UNDP) minerals survey of the Swaziland system of rocks lying along the north-western border was completed. A preliminary report was prepared and made available to private industry in limited quantity.

PRODUCTION AND TRADE

Mineral commodity production in 1970 generally increased 2 percent to $27.8 million,[90] compared with $27.2 million in 1969. Coal output increased substantially; whereas, production of asbestos, iron ore, quarry stone, kaolin, barite, and pyrophyllite decreased. The sharp decrease in output of chrysotile asbestos reportedly resulted from problems associated with bad ground conditions and a shortage of technical personnel.

Foreign trade in mineral commodities consisted primarily of the export of 33,057 tons of chrysotile asbestos, mainly to the United Kingdom (22,057 tons) and the Republic of South Africa (7,717 tons). Iron ore exports totaled 2,332,107 tons, all to Japan. Coal exports totaled 75,276 tons, mainly to Mozambique (41,397 tons) and Kenya (33,677 tons). Total export of mineral commodities in 1970 was valued at $27.5 million, compared with $27.0 million in 1969. The principal mineral exports iron ore and asbestos were valued at $19.7 million and $7.4 million respectively in 1970.

COMMODITY REVIEW

Asbestos.—Lonrho Swaziland Ltd. was conducting extensive diamond drilling of their asbestos deposit near Bulembu.[91] Underground development continued, and a new adit was started to the western part of the ore zone. The company also was constructing surface facilities, and operations were moving towards the production stage. Development of a second asbestos mine would be very important to the economy of Swaziland. At the Havelock mine, the main vertical shaft was deepened to provide access to the lower levels of ore.

Coal.—The production of coal has become the third most important mineral activity. Swaziland has deposits at Mpaka, Lukhula, and Ehlane estimated at about 200 million tons, ranging from anthracite to semianthracite. Coal located near Lukhula has coke-blending properties. Coal deposits also occur in the Lowveld area; a special investigation was being conducted on the feasibility of exploiting these deposits. Reportedly Rand Mines Ltd. might develop a new colliery if a large quantity of coal could be sold to Japanese steel producers.

Iron Ore.—Plans were made for construction of a plant to beneficiate the lower-grade iron ore at Bomvu Ridge.[92] Several investigations were underway on the feasibility of concentrating low-grade ores by pelletizing. The Swaziland Iron Ore Development Co. Ltd. and several Japanese steel mills signed an agreement for purchase by the Japanese of an additional 7.5 million tons of medium-grade ore, extending the life of the Ngwena mine by 5 years. There are several large low-grade iron ore occurrences mainly in the Pigg's Peak, Havelock, Nottingham Peak, and Iron Hill areas; these were being tested for beneficiation purposes under a UNDP project. Employment at the mine totaled 485 persons in early 1970.

Miscellaneous.—In addition to the principal minerals listed previously kaolin, barites, pyrophyllite, and quarry stone are mined. Kaolin occurs in the Mahlangatsha area in the Manzini district. It is mined by Kaolin Swaziland (Pty) Ltd. and exported to the Republic of South Africa. Barite is mined by Swaziland Barytes Ltd. at a deposit on Bomvu Ridge and exported to the Republic of South Africa. Several pyrophyllite deposits occur in the southwestern Highveld area. Swaziland Industries (Pty) Ltd. mine a deposit near Sicunusa and export the ore to the Republic of South Africa.

TOGO[93]

More steps were taken to diversify Togo's mineral indutry in 1970, but those activities have had little affect as yet on the nation's economy. Production of phosphate continued to account for practically the entire income derived from mining during the year.

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[90] Where necessary, values have been converted from South African rands (R) to U.S. dollars at the rate of R1=US$1.40.

[91] Ministry of Commerce Industry and Mines (Mbabane). Annual Report of the Geological Survey and Mines Department. 1970, p. 11.

[92] Barclays Overseas Review (London). Swaziland. October 1970, p. 38.

[93] David G. Willard, economist, Division of Nonmetallic Minerals.

A decline in phosphate rock prices would have caused a decrease in the value of exported minerals in 1969, despite a larger quantity shipped had there not been an increase in the value of reexported diamond. Nevertheless, the sales success of Togolese phosphate rock in the world market has induced plans for further expansion of the mine.

Marble production failed to reach the expected level in 1970 but should be helped by an anticipated increase in construction activity in 1971. Plans were underway for the development of cement and salt industries, and a cement clinker plant was under construction. Programs of exploration for petroleum and metals continued in various parts of the country and offshore, but no major discoveries were reported during the year.

PRODUCTION

The mine of Compagnie Togolaise des Mines du Bénin (CTMB) produced 1,508,000 metric tons of phosphate rock in 1970, 2 percent above the 1969 level. However, the value of phosphate rock exports (practically the entire production is exported) appeared to have declined, as the result of lower prices in the highly competitive world market.

Output of marble from the newly opened quarry at Gnaoulou increased in 1970, the first full year of operation, but the total of 3,801 tons was far below the expected level of 10,000 metric tons. No production was reported in 1970 for the brick and ceramics plants that are associated with the marble mill.

Sand and gravel and crushed stone are also produced for local use, but no statistics are available on their output.

Data on mineral production in Togo for the last 3 years are included in table 1.

TRADE

Togo's overall trade increased substantially in 1969, the latest year for which data are available, but the perennial trade deficit widened as the growth of imports outraced the expansion of exports. The balance of mineral trade, though favorable, was smaller than in 1968 because the value of phosphate rock shipments rose less than the cost of mineral imports. The imbalance of prices that resulted from devaluation of the Communauté Financiere Africiane franc was partially responsible for these shifts in trade balances. Also, the total trade deficit was probably lessened by a considerable clandestine trade, which was believed to be in Togo's favor. The official balances of overall and mineral trade are shown in the following tabulation in million dollars.

	1967	1968	1969
Total commodity trade:			
Exports	32.2	39.0	41.4
Imports	45.4	47.4	52.6
Balance	−13.2	−8.4	−11.2
Mineral commodity trade:			
Exports	14.4	14.8	16.1
Imports	5.2	5.4	7.0
Balance	9.2	9.4	9.1

Note: Exports and import figures are not directly comparable because exports are valued f.o.b. (cost only); imports are valued c.i.f. (cost, insurance, freight). A rule of thumb is that cost represents about 90 percent of c.i.f. value.

The country's balance of mineral trade declined slightly in 1969. Exports of phosphate rock remained the principal source of foreign exchange earnings from mining. Because of a drop in the average price, total phosphate rock export sales value declined 1 percent to $13.0 million despite a 5-percent increase in the quantity shipped. None of the marble quarried was exported during 1969. The only other mineral commodities exported were minor quantities of metals, reexports of diamond and refined petroleum products, and miscellaneous crude nonmetals.

Imports of mineral commodities rose 30 percent as a consequence of increased economic activity in the country. Togo's mineral imports consist mainly of refined petroleum products and iron and steel semimanufactures. Imports of the former gained 18 percent, from $2.2 million to $2.6 million; purchases of the latter were up 46 percent, from $1.5 million to $1.9 million. Other imported mineral materials included nonferrous metal forms, cement and other building materials, and various crude nonmetallic minerals such as fertilizer materials.

Preliminary figures for 1970 indicate little change in the situation. Phosphate rock exports rose slightly in quantity but may have actually declined in value because of lower prices. Very little of the marble quarried appears to have been shipped abroad. Meanwhile, imports of minerals and materials are expected to have remained on an uptrend, in line with the nation's growth. Development of markets for marble and the substitution of domestic cement for imports should improve the mineral trade balance in future years.

Statistics on exports and imports of selected mineral commodities in Togo for the years 1968–69 appear in table 28.

Table 28.—Togo: Foreign trade in selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969
EXPORTS		
METALS		
Copper and alloys unwrought	245	317
Iron and steel semimanufactures	14	39
Lead and alloys semimanufactures	--	19
NONMETALS		
Diamond ... value, thousands	$1,497	$2,811
Fertilizer materials crude, calcium phosphate ... thousand tons	1,259	1,320
Precious and semiprecious stones except diamond ... value, thousands	--	$67
Salt	47	1,651
Sand and gravel	--	42
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	40
Petroleum refinery products ... thousand 42-gallon barrels	(1)	8
IMPORTS		
METALS		
Aluminum and alloys semimanufactures	296	752
Copper and alloys semimanufactures	13	20
Iron and steel:		
Scrap	36	108
Steel, crude	--	6
Semimanufactures	r 7,590	10,087
Lead:		
Ore and concentrate	7	10
Oxides	1	2
Metal and alloys semimanufactures	6	7
Silver metal ... value, thousands	$1	$1
Tin and alloys semimanufactures ... long tons	--	1
Zinc and alloys semimanufactures	48	86
NONMETALS		
Abrasives, natural	2	--
Barite and witherite	9	--
Cement, hydraulic	62,234	85,833
Clays and products:		
Refractory	62	444
Nonrefractory	639	569
Diatomite and related materials	2	4
Fertilizer materials:		
Manufactured:		
Nitrogenous	630	132
Phosphatic:		
Thomas slag	748	18
Other	5	50
Potassic	216	18
Mixed	2	50
Ammonia	1	2
Gypsum	11	10
Lime	521	472
Pigments mineral, natural	34	160
Salt	7,160	6,857
Sand and gravel	2,816	5,533
Sodium and potassium compounds n.e.s	234	223
Stone, dimension worked	409	170
Sulfur, elemental	12	28
Talc and related materials	200	32
Other:		
Crude n.e.s	--	4
Oxides of strontium, barium, and magnesium	1	--
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	22	20
Carbon black	9	3
Coal	66	10
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	92	112
Kerosine and jet fuel ... do	91	103
Distillate fuel oil ... do	179	233
Residual fuel oil ... do	112	150
Lubricants ... do	9	10
Liquefied petroleum gas ... do	2	3
Other ... do	8	24
Total ... do	493	635
Crude chemicals from distillation of coal, gas and petroleum	154	136

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

Cement.—The clinker-crushing plant at Lomé was under construction in 1970 and is expected to be in operation by 1971. Its capacity of 100,000 tons per year will satisfy local requirements at least until the opening of the large cement works at Avéta. The latter, a project of Société Lambert Freres and the Governments of Togo and the Ivory Coast, is projected to begin operation in 1973, although its financing is not yet assured.

Marble.—A shipment of 300 tons to Italy in February 1970 inaugurated the export of Togolese marble. However, few other shipments occurred during the year; most of the production was consumed locally. No production was reported at the brick and ceramics plants that are associated with the marble mill in the Lomé industrial center. A construction boom currently under way in the area should stimulate the production of building materials in 1970.

Petroleum.—Union Carbide Petroleum Corp., operator for the group of American oil companies who hold the exploration concession off Togo's coast, drilled a second wildcat well in 1970. So far, no oil discovery has been reported.

Phosphate Rock.—Capacity of the phosphate rock mine reached 1.8 million tons per year in 1970, and CTMB is considering further expansion plans. Togo's high-grade phosphate rock is finding a growing market despite severe competition.

Other Minerals.—Prospecting programs were being carried out in several parts of the country by the Togolese Service de Mines and the United Nations Development Program. Areas of metalliferous deposits were investigated for copper, chromite, gold, and other minerals. A German firm, Uzanerzberg Baugnh, was searching for uranium.[94]

UPPER VOLTA [95]

Mineral activity in Upper Volta consisted mainly of minerals exploration by teams from the United Nations Development Program (UNDP), the French Bureau de Recherches Géologiques et Minières (BRGM), the French Aid Organization (FAO), and the consortium for the study of copper at Gaoua. The UNDP and the United Nations Special Fund continued technical and economic evaluation of the manganese deposits in the area around Tambao. Also the United Nations Special Industries Service and the UNDP conducted a feasibility study of a proposed dry cell battery plant. There was prospecting for minerals in the vicinity of Ouahigouya and Tiebelé by the French Fonds d'Aide et de Coopération. At yearend the Canadian International Development Agency (CIDA) was preparing to start an airborne geophysical prospecting program that would cover a large area of Upper Volta. The project, scheduled to begin in January 1971, was to last 2 years and cost $1.12 million.[96]

There was no production of mineral commodities in 1970, except for the local output of stone and sand and gravel for construction purposes. There has been virtually no minerals production in Upper Volta since 1966, when the Société des Mines de Poura closed down its small gold mine. In 1970 this firm organized a new company to reopen the gold mining operations and also conducted minerals research. Upper Volta's Government obtained a majority interest in the new company.

Upper Volta's trade in mineral commodities in 1970 was confined to imports of petroleum products valued at $3.8 million, iron and steel semimanufactures valued at $1.8 million, cement valued at $845,000, and salt valued at $653,000. In 1969 these imports were valued at $3.0 million, $1.8 million, $1.4 million, and $473,000, respectively. Total imports in 1970 were valued at $46.8 million, compared with $45.0 million in 1969.

There was no export of mineral commodities. Statistics on foreign trade in mineral commodities are shown in table 29.

The Diénéméra copper deposits near Gaoua were being studied by a consortium consisting of the Government, Anglo-Amer-

[94] U.S. Embassy, Lomé, Togo, State Department Airgram A-36, May 15, 1971, pp. 1–2. (Reference for all commodity review items).

[95] Henry E. Stipp, physical scientist, Division of Ferrous Metals.

[96] Where necessary, values have been converted from Communauté Financiere African Francs (CFAF) to U.S. dollars at the rate of CFAF277.71=US$1.00.

Table 29.—Upper Volta: Apparent imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1968	1969
Cement, hydraulic	2,650	6,136
Clay products nonrefractory	234	192
Copper metal and alloys unwrought and semimanufactures	--	16
Iron and steel semimanufactures	3,892	5,698
Petroleum refinery products:		
Lubricants ..... 42-gallon barrels	7,084	3,710
Other ..... do	84	196

[1] Compiled from report statistics of selected trading partner countries.

Source: Statistical Office of the United Nations, 1968 and 1969 editions of Supplement to the World Trade Annual. V. 3 (Africa), published by Walker and Co., New York, 1970 and 1971.

ican Corp., BRGM, and Compagnie de Products Chimiques et Electrometallurgiques Péchiney. An ore deposit of 40 million tons containing 0.8 percent copper and 2 grams of gold per ton has been discovered. Research is continuing in order to find another deposit containing at least 2 percent copper. The consortium also was studying other metal deposits. Copper and molybdenum occurrences near Kaya and Kongoussi north of Ouagadougou were being studied by BRGM.

Lead deposits near Ouahigouya, zinc deposits near Po, and several bauxite occurrences were being examined by a team from the FAO. Also the FAO was working on a plan for future mineral research to be conducted by the Government of Upper Volta.

The manganese deposit at Tambao, which has been studied by a UNDP team, reportedly contains 13 million tons of manganese ore averaging 53.9 percent manganese. Exploration of the manganese ore body and also a 6-million-ton limestone occurrence at Tin Hrassan, 25 miles from Tambao depends upon construction of infrastructure. Extension of the Abidjan to Niger railway through Ouagadougou to Tambao and providing water for a mine were the main problems hindering development of the deposits.

A 6-million-ton deposit of white bauxite, about 60 miles north of Ouagadougou, was studied for development at the rate of 100,000 tons per year. Investment of about $3 million would be required to exploit the deposit.

The Mineral Industry of Other Near East Areas

By Staff of the Division of Fossil Fuels

CONTENTS

BAHRAIN [1]

The status of Bahrain as a member of the proposed Federation of Arab Amirates (FAA) became clouded in 1970. FAA is the new nation being formed by the nine Persian Gulf riparian sheikhdoms, which until the end of 1971 have special treaty relationships with the United Kingdom. At that time the United Kingdom will terminate the treaty and remove its protective forces from the area. The conference of rulers of the member states which was scheduled for October 26, 1970, was postponed indefinitely when discussions of key clauses in the proposed constitution broke down during a preparatory meeting. Contending issues were representation on the proposed federal assembly and consideration of a proposed federal capital.

The country's economy continued to move forward at an impressive rate and the Government's income is expected to reach an equivalent of U.S. $38 million in 1971. Slightly more than half of this (51 percent) will be derived from oil revenues. Excluded from total government revenues is the royal privy. Total oil revenues in 1971 should reach $50 million, up from an estimated $30 million in 1970. These include income from Abu Safah field offshore from Saudi Arabia.

Bahrain's mineral industry, which has been dominated by petroleum and natural gas production and processing, will be expanded in 1971 to include an aluminum smelter. The only other mineral industry activity is the production and preparation of stone, sand, and aggregate for basic building and highway construction. Information on the latter activities is not reported.

Major mineral industry commodities traded other than petroleum, were imports and reexports of cement, iron and steel, and oil industry equipment. Reexports were mainly to Qatar and the Trucial States.

Construction of the new aluminum plant adjacent to the Bahrain Petroleum Co., Ltd. (Bapco), refinery continued during the year and is expected to be completed by mid-1971. Ownership of Aluminium Bahrain, Ltd. (Alba), was altered during the year by the addition of Kaiser Aluminum and Chemical Corp. as a consortium partner having a 17-percent share. Others include the Bahrain Government; 19 percent; General Cable Corp. (a U.S. firm), 17 percent; British Metal Corp., 17 percent; Aktiebolaget Electrokopper (a Swedish firm), 12 percent; Bretton Investments (owned equally by the United Kingdom and West Germany interests), 9.5 percent; and Western Metals Corp. (a U.S. firm), 8.5 percent.

Although originally set at 55,000 tons

[1] Prepared by David A. Carleton, supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

per year and then at 90,000 tons per year, the final initial capacity of the new plant will be 120,000 tons per year which should be reached by the end of 1972. Alumina will be supplied by the British Metal Corp. under a $250 million contract covering 20 years with a renewal option for an additional 10 years. Alumina will be provided by Western Aluminium of Australia, a subsidiary of Aluminum Company of America (Alcoa). The contract provides for increased deliveries up to 172,000 tons annually by the start of 1972. When the plant is completed, it will comprise three one-half-mile-long pot rooms, a 300-megawatt powerplant, an anode factory, and a billet and pig aluminum casthouse. The pothouse will hold 400 pots, each capable of producing three-fourths of a ton of aluminum per day.

Alumina and coke required for smelting will be unloaded at a new pier on a man-made island 2 miles offshore. The port will be able to handle 35,000 deadweight ton ore carriers and the stockpile area will have a capacity of 32,700 tons of ore. Alumina and coke will be transported to the plant by a 68-pylon aerialway (skyhook). Finished aluminum for export will be returned to the pier in the same manner. Alba's finished products will be marketed by each of the owner companies in proportion to their equity participation. The Government's share will be marketed abroad by the other partners on behalf of the Government.

Bapco, the only petroleum producer in the Sheikhdom, expanded and improved operations. Land and underwater gravimetric surveys were conducted during the year in the hope of finding areas suitable for closer investigation. The world's first gravity meter survey from a Hovercraft was performed in Bapco's offshore concession area where reefs and shoals prevented exploration by conventional means.

A new development well was completed and producing oil at yearend. Wells receiving workover and maintenance totaled 93. Further testing was carried out on the two Khuff Zone gas wells which are to supply natural gas to Alba's powerplant. In addition, work continued on the installation of a natural gas dehydration unit, a scrubber, and a pipeline. These facilities will permit the delivery of gas to the new aluminum plant.

The daily average throughput at the Bapco refinery was 254,041 barrels, an increase of more than 6 percent compared with 1969 and well above the alltime record set in 1967. On June 9, 1970, a total of 310,024 barrels was processed, a 24-hour record. In September a new monthly high of crude oil run of 285,500 barrels per day was established. A further record was set when a tanker lifted 537,388 barrels of distillate and residual fuel oil in one cargo.[2] For production of crude petroleum and petroleum refinery products see table 1.

The owners of Bapco, Standard Oil Co. of California, and Texaco, Inc., were considering the installation of an additional 300,000-barrel-per-day capacity at the Bapco refinery. The expansion would be geared to the Japanese market of Nippon Oil Co. also a subsidiary of Bapco's owners. Emphasis will be placed on low-sulfur residual fuel oil production. The plans' prospects will depend upon the endorsement of Japan's Ministry of International Trade and Industry. The growth of environmental pollution makes it increasingly difficult to find refining sites in Japan. One major obstacle to the plan is the present high level of import duties on refined petroleum products. The reduction of these duties is required to make the project economically attractive.

On December 17, 1970, Superior Oil Co., a U.S. firm, was granted an oil concession by the Government. The concession, to last 35 years, covers about 1,500 square miles divided into two blocks. The first comprises an offshore area north of the island which was relinquished by Continental Oil Co. in 1968. The second block covers the Hawar Islands located southeast of Bahrain Island near the Qatar Peninsula. The income tax will be according to the prevailing rate in the area, calculated on the basis of posted prices with provisions for revision whenever regional changes occur. There will be a sliding-scale royalty expensed according to Organization of Petroleum Exporting Countries (OPEC) terms, which starts at 12.5 percent and rises progressively to 16 percent when output reaches 200,000 barrels per day. Other terms include a 25-percent relinquishment every 5 years for a period of 15 years.

[2] Bahrain Petroleum Co., Ltd. Annual Report, 1970.

Table 1.—Other Near East Areas: Production of mineral commodities

Area, commodity, and unit of measure	1968	1969	1970 p
BAHRAIN [1]			
Gas, natural:			
Gross production ---- million cubic feet	e 33,000	33,440	25,406
Marketed production ---- do	e 9,500	10,906	12,305
Petroleum:			
Crude ---- thousand 42-gallon barrels	27,598	27,774	27,973
Refinery products:			
Gasoline and naphtha ---- do	12,956	15,648	15,687
Jet fuel ---- do	15,227	13,752	13,892
Kerosine ---- do	1,895	1,102	1,076
Distillate fuel oil ---- do	13,682	17,101	16,993
Residual fuel oil ---- do	35,574	35,651	39,347
Other ---- do	1,345	59	1,287
Refinery fuel and losses ---- do	3,866	4,063	4,443
Total ---- do	84,545	87,376	92,725
JORDAN [1]			
Cement ---- thousand metric tons	381	488	378
Gypsum ---- do	e 25	e 35	26
Fertilizer materials, crude, phosphate rock ---- do	1,162	r 1,177	891
Lime ---- do	e 40	e 40	45
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	609	738	825
Kerosine ---- do	510	534	590
Distillate fuel oil ---- do	908	921	762
Residual fuel oil ---- do	593	759	853
Liquefied petroleum gas ---- do	129	333	161
Asphalt ---- do	203	r 230	168
Refinery fuel and losses ---- do	147	197	161
Total ---- do	3,099	3,712	3,520
Salt ---- metric tons	r 17,493	19,416	25,000
Stone:			
Limestone ---- thousand metric tons	NA	NA	1,000
Marble ---- thousand square meters	NA	NA	75,000
LEBANON [1]			
Cement ---- thousand metric tons	906	1,253	1,339
Gypsum ---- do	40	35	35
Lime ---- do	90	120	130
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	2,949	2,957	3,490
Jet fuel ---- do	1,473 (Jet fuel and kerosine combined)	1,379	1,599
Kerosine ---- do		270	265
Distillate fuel oil ---- do	2,096	2,375	2,673
Residual fuel oil ---- do	6,030	5,888	6,636
Other ---- do	267	445	469
Refinery fuel and losses ---- do	581	608	694
Total ---- do	13,396	13,922	15,826
Salt e ---- metric tons	30,000	28,000	37,000
OMAN [1]			
Gas, natural:			
Gross production e ---- million cubic feet	14,000	20,000	20,000
Marketed production ---- do	(2)	(2)	(2)
Petroleum, crude ---- thousand 42-gallon barrels	87,854	119,710	121,210
PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN [1]			
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	2,961	2,410	1,591
Jet fuel ---- do	2,145	4,878	7,384 (Jet fuel and kerosine combined)
Kerosine ---- do	2,304	2,134	
Distillate fuel oil ---- do	4,327	5,006	8,100
Residual fuel oil ---- do	17,711	29,399	23,551
Other ---- do	4,433	311	5,100
Refinery fuel and losses ---- do	3,794	2,865	2,219
Total ---- do	37,675	47,003	47,945
Salt ---- metric tons	78,610	e r 60,000	e 50,000
QATAR [1]			
Cement ---- thousand metric tons	--	50	100
Gas, natural:			
Gross production ---- million cubic feet	79,605	125,687	127,000
Marketed production ---- do	23,030	37,290	e 39,000

See footnotes at end of table.

Table 1.—Other Near East Areas: Production of mineral commodities—Continued

Area, commodity, and unit of measure	1968	1969	1970 p
QATAR—Continued			
Petroleum:			
Crude ..... thousand 42-gallon barrels	r 125,266	r 129,746	132,456
Refinery products:			
Gasoline ..... do	r 63	63	68
Kerosine ..... do	r 36	33	34
Distillate fuel oil ..... do	r 56	50	56
Residual fuel oil ..... do	23	80	77
Refinery fuel and losses ..... do	r 27	21	19
Total ..... do	205	247	254
SYRIAN ARAB REPUBLIC [1 3]			
Asphalt, natural ..... thousand metric tons	60	65	65
Cement ..... do	r 916	r 934	968
Gypsum e ..... do	15	r 15	15
Petroleum:			
Crude ..... thousand 42-gallon barrels	r 9,955	16,771	29,356
Refinery products:			
Gasoline ..... do	1,361	1,696	3,264
Kerosine and jet fuel ..... do	r 1,274	1,588	1,821
Distillate fuel oil ..... do	1,749	2,179	2,723
Residual fuel oil ..... do	r 2,913	3,629	4,063
Other ..... do	332	414	1,087
Refinery fuel and losses ..... do	286	355	1,376
Total ..... do	7,915	9,861	14,334
Salt e ..... thousand metric tons	20	22	22
Sand, glass e ..... do	12	13	15
TRUCIAL STATES [1 4]			
Abu Dhabi:			
Gas, natural:			
Gross production ..... million cubic feet	191,691	283,841	266,200
Marketed production ..... do	21,167	23,740	e 25,000
Petroleum, crude ..... thousand 42-gallon barrels	181,756	218,798	252,179
Dubai:			
Gas, natural:			
Gross production ..... million cubic feet	--	e 3,000	e 25,000
Marketed production ..... do	--	(2)	(2)
Petroleum, crude ..... thousand 42-gallon barrels	--	3,800	31,321
YEMEN			
Salt e ..... thousand metric tons	85	105	80

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

1 In addition to the commodities listed, crude construction materials, such as clays, stone, sand and gravel presumably also are produced, but output is not recorded and general information is inadequate to make reliable estimates of production levels.

2 No marketed production is reported, however there may be some small field use.

3 In addition to the commodities listed, natural gas presumably also is produced but output is not recorded and general information is inadequate to make reliable estimates of production levels.

4 In addition to the two Trucial States listed in this table, there are five other states; Ajman, Fujairah, Ras al-Khaimah, Sharjah and Umm al-Qaiwain, which record no production, but which presumably produce small quantities of crude construction materials.

Table 2.—Bahrain: Trade of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1968	1969	1970
EXPORTS			
Petroleum refinery products:			
Gasoline and naphtha	12,538	15,395	16,261
Jet fuel	15,236	13,681	13,710
Kerosine	2,097	1,032	992
Distillate fuel oil	13,165	15,915	20,823
Residual fuel oil	28,971	29,750	28,818
Other	1,665	1,001	572
Total	73,672	76,774	81,176
IMPORTS			
Crude petroleum	55,881	58,230	63,518
Petroleum refinery products:			
Gasoline and naphtha	1,057	1,588	1,712
Kerosine	157	174	39
Distillate fuel oil	50	--	--
Residual fuel oil	16	--	--
Lubricants	10	11	18
Total	1,290	1,773	1,769

JORDAN [3]

Internal disorders of mid-1970 and the September Civil War had deteriorating effects upon the Jordanian economy, resulting in a 16-percent decline in the gross national product during 1970. Phosphate rock production, cement manufacture, and petroleum refining based on imported crude, the nation's principal mineral industries, suffered production declines or transportation and marketing difficulties during 1970.

Phosphate rock production totaled less than 1 million tons in 1970, 24 percent below 1969 production level. Mine and plant properties at Ruseifa were undamaged during the civil disorders; however, production at El Hasa was curtailed due to inability of trucking contractors to repair vehicles damaged during the disturbance. Maintaining production levels and sustaining export markets in this commodity are vital to the economy as phosphate rock exports provide 30 percent of Jordan's foreign exchange earnings. A cut in the Indian market from 368,000 tons in 1969 to 51,000 tons contributed to the 1970 decline in phosphate exports earning an estimated $8.5 million [4] for the year. Expanded deliveries to India, Turkey, and Romania as contracted through trade agreements for 1971–72 should bring the value of phosphate exports well beyond the 1968 peak level of $12 million by the close of 1971.

The cement industry suffered a 21-percent reduction in sales with resulting production declines due to stagnation in the construction industry. The insecure investment climate of 1970 cut construction activities in the populated centers of Amman and Zerka idling the newly installed capacity at the Jordan Cement Company plant.

The Zerka refinery capacity expansion from 7,500 to about 15,000 barrels per day was near completion by yearend and should be on stream as scheduled early in 1971. Expansion activities were contracted to Chiyoda Chemical Engineering Company at a cost of $8.5 million. Crude oil supplies for the Zerka refinery totaled 9,644 barrels per day via a Trans-Arabian Pipeline Co. (TAPline) extension. Deliveries to the refinery were uninterrupted during 1970; however, the stoppage of TAPline crude flow to the Mediterranean cost Jordan an estimated $2.4 million loss in revenue during 1970.

For production of mineral commodities in Jordan see table 1.

[3] Prepared by Bernadette Michalski, foreign mineral specialist, Division of Fossil Fuels.
[4] Where necessary, values have been converted from Jordanian dinar (JD) to U.S. dollars at the rate of JD1=US$2.80.

Table 3.—Jordan: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

	1968	1969
METALS		
Aluminum unwrought	178	289
Copper matte	658	872
Iron and steel:		
Metal scrap	4,158	2,913
Semimanufactures	107	296
NONMETALS		
Cement	64,636	30,061
Fertilizer materials, phosphatic	1,094,227	928,297
Stone, sand and gravel:		
Dimension stone crude and partly worked:		
Calcareous	1,222	1,047
Granite	8,050	13,715
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	8,007	4,923
Gas, hydrocarbon, natural	1,196	790

Table 4.—Jordan: Imports of mineral commodities
(Metric tons unless otherwise specified)

	1968	1969
METALS		
Aluminum and alloys, semimanufactures	r 554	514
Copper and alloys, all forms	189	150
Gold unworked troy ounces	1,222	--
Iron and steel:		
Pig iron, ferroalloys, and similar materials	925	4,131
Steel, primary forms	2,487	34,152
Semimanufactures	r 42,485	49,950
Lead:		
Oxides	268	696
Metal including alloys	448	888
Other:		
Base metals including alloys unwrought, n.e.s	--	42
NONMETALS		
Cement	5,143	11,698
Clays, crude	497	783
Fertilizer materials crude or manufactured:		
Nitrogenous	4,229	3,874
Phosphatic	6,132	7,461
Potassic	876	857
Lime	2,025	2,605
Sodium and potassium compounds, caustic soda	--	684
Stone, sand and gravel, dimension stone, calcareous (marble)	610	935
Sulfur	788	1,847
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	1,276
Coal and briquets	469	--
Coke and semicoke	--	464
Petroleum, crude thousand 42-gallon barrels	r 3,099	3,712
Refinery products:		
Gasoline do	12	33
Kerosine do	233	200
Lubricants do	46	55
Other, bituminous mixtures do	--	1
Total do	r 291	289

r Revised.

LEBANON [5]

Lebanese mineral commodity output during 1970 was limited to several nonmetallic minerals, refinery products derived from imported crude petroleum, and metal semimanufactures based on imported crude metal forms. On the basis of manufacturers' selling price per ton delivered at railhead, Beirut, production of cement was valued at $23.7 million.[6] Refinery throughput of crude oil was valued at $33.5 million, based on posted prices at the Tripoli terminal ($2.21 per barrel for 9 months and $2.41 per barrel for the remainder) and the Sidon terminal ($2.17 per barrel for 9 months and $2.37 per barrel for the remainder). Value of petroleum refinery products was estimated at $36.4 million on the basis of yearend exrefinery prices.

The Iraq Petroleum Company (IPC) pipeline operated at maximum capacity during 1970, increasing its throughput and exports by 2.3 and 3.5 percent, respectively, compared with 1969 figures. A rupture in the line resulted in closure of TAPline, from May 3d through the close of 1970 cost Lebanon an estimated $6.1 million in transit and related fees. It reduced pipeline throughput and exports by 50 and 47 percent, respectively, when compared with 1969 figures and by 64 and 65 percent, respectively, when compared with 1968 figures. The last full year of TAPline operation was in 1968.

Crude oil throughput at Lebanon's two refineries averaged 43,359 barrels per day as compared with 38,142 barrels per day in 1969. With the closure of TAPline, feedstock for the Mediterranean Refining Co. (MEDRECO) refinery was supplied by tanker from the IPC terminal at Tripoli. While domestic refineries have traditionally supplied Lebanon's total consumption requirements for motor gasoline, kerosine, and fuel oil, gasoline consumption requirements growing at a rate of 5 percent per year have exceeded refining capacity neces-

[5] Prepared by Bernadette Michalski, foreign mineral specialist, Division of Fossil Fuels.

[6] Where necessary, values have been converted from Lebanese pounds (L£) to U.S. dollars at a rate of L£1=US$0.3246.

sitating imports of a gasoline-type blendstock, aviation gasoline, and premium gasoline. In an attempt to meet the increased gasoline demand, IPC undertook the construction of a catalytic cracking unit; however, the Lebanese Government halted the construction activity. Rather than permit expansion of present refinery capacities, the Lebanese Government considered construction of a third refinery with Saudi Arabian participation through General Petroleum and Mineral Organization (Petromin), the national oil company, and possibly a third party.

For production of mineral commodities in Lebanon see table 1.

Table 5.—Lebanon: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal including alloys, all forms	3,888	5,221
Copper metal including alloys, all forms	572	482
Gold unworked or partly worked ... troy ounces	230,424	87,386
Iron and steel:		
Scrap	r 26,129	24,474
Pig iron	23	--
Steel, primary forms and semimanufactures	28,794	23,146
Lead metal including alloys, all forms	454	305
Magnesium semimanufactures	19	2
Molybdenum	--	2
Nickel metal including alloys, all forms	--	9
Platinum group including alloys, all forms ... troy ounces	r 1,520	1,863
Silver including alloys, all forms ... do	r 1,554,870	176,829
Zinc metal including alloys, all forms	3	3
Other, precious, waste and scrap	r 24	61
Other ores and concentrate of base metals n.e.s	--	60
NONMETALS		
Abrasives, natural, pumice, emery, natural corundum, etc	r 284	307
Cement	66,833	354,569
Chalk	28	4
Clays and products:		
Crude	23	69
Products:		
Refractory	123	338
Nonrefractory	687	1,137
Diamond, all grades ... carats	r 21,590	18,175
Diatomite	6	14
Fertilizer materials:		
Crude	r 2,073	170
Manufactured:		
Nitrogenous	r 1,393	99
Phosphatic	38,116	57,021
Potassic	11	1
Other	r 1,111	3,101
Ammonia	15	28
Gem stones, precious and semiprecious except diamond ... carats	r 124,710	771,470
Graphite	646	7
Gypsum and anhydrite	1,092	2,148
Lime	38,415	55,140
Pigments, mineral	31	10
Pyrite	224	800
Salt	4	16
Sodium and potassium compounds, caustic soda and caustic potash	78	45
Stone, sand and gravel:		
Dimension stone crude and partly worked:		
Calcareous	1,837	1,932
Noncalcareous	32	400
Dimension stone worked	1,311	3,185
Gravel and crushed rock	1,337	1,768
Sand	1,182	1,300
Sulfur:		
Elemental, all forms	355	3,987
Sulfuric acid	1,328	1,217
Talc and steatite	80	51
Nonmetals n.e.s	34,692	157
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	58	2
Coal, all grades	959	420
Coke and semicoke	1,843	1,594
Gas, natural	1,804	2,846
Petroleum refinery products:		
Gasoline ... thousand 42-gallon barrels	r 239	371
Kerosine ... do	r 1,857	2,023
Gas oil ... do	r 4,555	3,697
Lubricants ... do	r 7	236
Other petroleum products ... do	r 3	14

r Revised.

Source: Direction Generale des Douanes, Statistiques du Commerce Exterieur. V. 1, 1968 and 1969.

Table 6.—Lebanon: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum:		
Oxide and hydroxide	972	1,751
Metals including alloys, all forms	5,049	8,052
Copper metal including alloys, all forms	630	872
Gold unworked or partly worked thousand troy ounces	2,297	2,106
Iron and steel:		
Scrap	r 4,901	3,411
Pig iron and ferroalloys	r 11,893	10,716
Steel, primary forms	100,055	101,846
Semimanufactures	r 120,039	167,754
Lead:		
Oxide	66	107
Metal including alloys, all forms	1,432	1,222
Magnesium metal including alloys, all forms	1	2
Mercury 76-pound flasks	182	671
Nickel metal including alloys, all forms	10	8
Platinum group including alloys, all forms troy ounces	4,261	5,305
Silver including alloys, all forms do	19,774	24,049
Tin including alloys, all forms long tons	38	27
Titanium, oxide	888	1,167
Zinc:		
Oxide	71	105
Metal including alloys, all forms	866	881
NONMETALS		
Abrasives, natural, pumice, emery, natural corundum, etc	r 726	2,675
Asbestos	6,647	6,023
Barite	50	20
Cement	22,583	1,285
Chalk	1,684	1,933
Clays and products:		
Crude	5,254	5,436
Products:		
Refractory	2,619	3,229
Nonrefractory	7,239	7,034
Diamond, all grades carats	73,240	58,205
Diatomite	295	286
Feldspar and fluorspar	774	510
Fertilizer materials:		
Natural:		
Phosphate rock	123,538	91,200
Other	6,300	6,825
Manufactured:		
Nitrogenous	28,083	17,466
Phosphatic	3,194	100
Potassic	8,018	5,510
Other	13,499	1,101
Ammonia	28,494	8,937
Gem stones, precious and semiprecious except diamond:		
Natural thousand carats	6,002	4,767
Manufactured do	3,005	3,112
Powder, waste, etc	2,070	150
Graphite	93	28
Gypsum and anhydrite	37,776	45,716
Lime	20	22
Magnesite	5	1
Mica, all forms	9	15
Pigments, mineral including processed iron oxides	224	246
Pyrite	6	18
Salt	228	411
Sodium and potassium compounds	3,811	3,235
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked:		
Calcareous	20,088	19,700
Noncalcareous	3,563	2,350
Worked	150	129
Dolomite	6	6
Gravel and crushed stone	9,700	11,969
Limestone	--	11
Quartz and quartzite	26	23
Sand	1,457	557
Sulfur:		
Elemental, all forms	41,431	57,196
Sulfuric acid	22,521	15,182
Talc and steatite	405	593

See footnotes at end of table.

Table 6.—Lebanon: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	14	81
Carbon and carbon black	56	65
Coal, all grades	1,855	1,150
Coke and semicoke	5,843	11,546
Peat	16	108
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	2,886	2,990
Kerosine do	363	347
Gas oil and fuel oil do	4,281	4,697
Lubricants do	111	122
Liquefied petroleum gas do	580	713
Mineral jelly and wax do	r 5	5
Other do	73	198
Mineral tar and other coal, petroleum, or gas derived crude chemicals	r 504	616

r Revised.

Source: Direction General des Douanes. Statistiques de Commerce Exterieur. V. 1, 1968 and 1969.

Table 7.—Lebanon: Crude oil pipeline statistics

(Thousand 42-gallon barrels)

	1969	1970
Trans-Arabian Pipeline Co. (TAPline)		
Throughput	121,336	60,496
Average per day	332	166
Export	113,757	60,519
Average per day	312	166
Iraq Petroleum Co. (IPC) [1]		
Throughput	167,537	177,288
Average per day	459	486
Export	158,996	169,994
Average per day	436	466

[1] Data provided by IPC in long tons; factor of 7.5 barrels per long ton used for conversion to barrels.

OMAN [7] [8]

Until recently, the Sultanate of Oman was one of the most inaccessible and underdeveloped areas in the Arab world. With the overthrow of the former Sultan by his son in 1969, there have been profound changes as Sultan Qaboos strives to move his country slowly into the modern world.

The key to Oman's economy is the petroleum industry, the revenues from which are by far the biggest contributor to the nation's income. Payments to the Government by Petroleum Development (Oman), Ltd. (PDO), the country's only crude oil producing company, totaled $107 million. These payments which include royalties, taxes, and a small annual rental for the Dhofar area concession, were equivalent to $0.88 per barrel produced. PDO payments in 1969 totaled $92 million or about $0.77 per barrel. Although Oman is not a member of the Organization of Petroleum Exporting Countries (OPEC), the Sultan and PDO have signed an agreement applying the latest OPEC increase in payment schedules to Oman petroleum operations. Except for petroleum, some unused associated natural gas, and possibly some basic nonmetallic construction materials, there are no minerals produced in Oman.

Production of crude oil in Oman totaled 121,210,000 barrels (332,082 barrels per day), up only 1 percent from that of 1969. Although production had exceeded 350,000 barrels per day in the first quarter of 1970, production had to be curtailed because of reservoir performance and delays in development drilling. Three fields were in production—Fahud, Natih, and Yibal. A water injection system is being planned for Yibal. Additional facilities have been

[7] Name changed during 1970 from Muscat and Oman.

[8] Prepared by David A. Carleton, supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

installed at Fahud to dispose of increasing amounts of water produced with the crude. Eighteen development wells were drilled, including four at the new field, Al Huwaisah, scheduled for production in early 1971.

Exploration drilling included six outstep wells and a wildcat at Qura in southern Oman. A serious well fire, which was uncontrolled for several months, was extinguished at a cost of about $4 million. At the export port of Mina al Fahal on the Gulf of Oman a 900,000-barrel tank was added and equipment was installed to handle large tankers.

The mixed international group which has an 8,000-square-mile concession offshore in the Gulf of Oman drilled a dry hole in shallow water in the northern end of the area. A second well is planned for 1971 farther south. The group which originally consisted of seven companies has been reduced to five and will be reduced further during 1971. Ownership then will be Wintershall, A.G., the operator, 59 percent; the Royal Dutch/Shell Group, 24 percent; Deutsche Schachtbau- und Tiefbohrgesellshaft m.b. H., 10 percent; and Participations and Explorations Corp., 7 percent.[9]

It was announced in November 1970 that a member of the Royal Dutch/Shell Group had concluded an agreement in principal with the Sultan of Oman for mineral exploration, particularly chrome ore occurrences.

Except for additions to stocks, all crude oil produced is exported. No other mineral commodities are exported. Mineral commodities imported are petroleum products, cement, and salt. According to custom's statistics, which exclude oil company and government imports, these were valued at $333,500.[10]

PEOPLE'S DEMOCRATIC REPUBLIC OF YEMEN [11]

Little information is published on the mineral developments in the People's Democratic Republic of Yemen (Southern Yemen). During 1970 mineral industry activities centered around the refining of imported crude oil, salt production, and mineral exploration. The principal economic development activity involved infrastructure such as road building and irrigation construction.

Output of the Aden refinery of BP Refinery (Aden), Ltd., increased slightly over that of 1969. Production, which averaged 125,277 barrels per day in 1970 was only slightly under the plant's record high of 130,112 barrels per day in 1965. Major sources of crude oil supply were the Gulf of Suez fields of the United Arab Republic of Egypt and fields in Kuwait and Iran. Products refined from Egypt crude are exported back to Egypt. This arrangement is expected to continue until the two Egyptian refineries at Suez, which were severely damaged in 1969, are repaired or replaced.

The only known mineral produced is evaporated salt, most of which is exported. Historically all exported quantities have been shipped to Japan. During 1970 Japanese imports of Southern Yemen salt amounted to 41,734 metric tons which was down considerably from the average of about 100,000 tons in the early 1960's. It is not known whether the problem is declining productibility or marketability. Reportedly, a group of mainland Chinese experts arrived in Aden during December 1970 to assist in the extraction and manufacture of salt. For production of mineral commodities in Southern Yemen see table 1.

There have been no reports on the oil exploration activities in Southern Yemen. In 1969 the Algerian state oil company, Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH) obtained 49 percent of a joint operation in which the Southern Yemen Government has 51 percent.

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[9] Petroleum Press Service. V. 38, No. 6, June 1971, p. 215.

[10] Where necessary, values have been converted from Riyal Saidi (RS) to U.S. dollars at the rate of RS1=US$1.00.

[11] David A. Carleton, supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

Table 8.—People's Democratic Republic of Yemen: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970
Cement	282	NA	NA
Iron and steel	256	NA	NA
Petroleum refinery products:			
Gasoline ... thousand 42-gallon barrels	2,673	1,625	1,510
Kerosine and jet fuel ... do	4,194	6,194	7,980
Distillate fuel oil ... do	3,714	4,397	8,070
Residual fuel oil ... do	14,934	26,011	21,858
Other including LPG and feedstocks ... do	4,329	1	6,409
Total ... do	29,844	38,228	45,827
Salt	89,701	[1] 57,668	[1] 41,734

NA Not available.
[1] Apparent.

QATAR [12]

During 1970 Qatar continued the slow steady economic development characteristic of the Sheikhdom during the past decade. Although petroleum production continued to dominate the economy, initial efforts are being implemented to broaden the industrial base as well as broadening the economic infrastructure.

Petroleum production continued as the mainstay of the economy. Production in 1970, valued at about $200 million, returned an estimated $120 million to the Government in the form of taxes and royalties. As a result of renegotiated price and payment arrangements, effective November 14, 1970, the Government should net an additional $50 million in 1971 from crude oil production for a total oil income of about $170 million. For production of crude petroleum and petroleum refinery products see table 1.

Crude oil production, which averaged 362,893 barrels per day in 1970, was up only 2 percent from that of 1969. Although the water injection program for Dukhan field by the Qatar Petroleum Co., Ltd. (QPC) successfully increased production in 1969, output from that field declined 5 percent in 1970. Other than a continuing workover program, QPC developments were limited to field evaluations, core drilling, and miscellaneous well maintenance.

It was announced by QPC that an agreement had been signed with the Qatar Government for the construction of a $60 million plant to produce liquefied petroleum gas from associated gas produced from the Dukhan oilfield. The project, which will take 3 years to complete and will have a capacity of 800,000 tons (9.6 million barrels) per year of gas liquids, will involve the construction of compression facilities at Dukhan, a 60-mile pipeline to transport gas to Umm Said, separation units, and storage facilities at the Umm Said export terminal. Methane gas will be supplied to the fertilizer plant under construction at Umm Said and to powerplant facilities and water distillation facilities at Doha. The liquid products (propane and butane) will be marketed primarily in Japan.

Production from the two offshore fields of Shell Oil Co. of Qatar, Ltd., averaged 172,222 barrels per day, an 11-percent increase from that of 1969. Much of the increase was made possible by the implementation of a water-injection system. At yearend 1970 Shell had 26 producing wells and 20 other types of wells. One of the latter wells is a shut-in well of the Bul Hanine field discovered in 1970. The well tested 3,050 barrels daily of 36° API oil. Another well, Halul-1 was being drilled at yearend near the Bul Hanine find.

Qatar Oil Co., Ltd., a Japanese company which received a 3,360-square-mile offshore concession in 1969, continued seismic surveying in 1970. At yearend evaluations were completed and plans were being prepared by the drilling contractor, Sea Drilling Corp., a U.S. firm, to drill an exploratory well. The company expected to obtain preliminary results by April 1971.

On March 26, 1970, a U.S. firm,

[12] Prepared by David A. Carleton, supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

Southeast Asia Oil and Gas Co., was awarded a 30-year concession covering about 3,300 square miles offshore from Qatar. The acreage comprises Area No. 2 of the territory opened in May 1969 and formerly held by Continental Oil Co. of Qatar, Ltd. Under the terms, 70 percent of the area will be relinquished in 8 years; there will be a fully expensed sliding royalty rising from 12.5 percent of the posted price to 15 percent when production reaches 200,000 barrels per day; and the Qatar Government has the right to a 50-percent equity participation following the discovery of oil in commercial quantities.

The Umm Said fertilizer plant being built by Qatar Fertilizer Co. is scheduled for completion in 1972. According to Qatar's 1971 development plan, the new plant will have an annual capacity to produce 330,000 tons of urea and 100,000 tons of ammonia. Ancilliary facilities include desalination units, a deep-water pier, a powerplant, and a gas pipeline.

The Qatar National Cement Co. has decided to double the capacity of its Umm Bab cement plant to 600 tons per day (about 220,000 tons per year). Furthermore, the company has decided to proceed in planning for the construction of a plant for the manufacture of asbestos cement pipe and corrugated sheeting. The plant would use about 160 tons of cement per day.

Other mineral industry projects under discussion include a steel rolling mill, an aluminum smelter, and a 6,000-barrel-per-day refinery.

Table 9.—Qatar: Exports of crude petroleum and imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1968	1969	1970
EXPORTS			
Crude petroleum	124,000	129,598	131,765
IMPORTS			
Petroleum refinery products:			
Gasoline	270	302	NA
Kerosine	30	23	NA
Distillate fuel oil	137	172	NA
Lubricants	10	11	25
Asphalt	53	124	74
Total	500	632	NA

NA Not available.

SYRIAN ARAB REPUBLIC [13]

The year 1970 marked the close of the second 5-year economic plan for the Syrian Arab Republic. The overall economic growth rate averaged only 5 percent annually during 1966–70, falling short of the planned 7.2-percent growth rate. The mineral industry developed at a more rapid rate during the period, attributable chiefly to the opening of the northeastern petroleum fields and development of phosphate rock deposits. The mineral industry contributed an estimated 10 percent of the 1970 gross national product of $1.6 billion.[14]

The production of crude petroleum at a level of 80,427 barrels per day dominated Syria's mineral output in 1970. While the nation also produces a variety of nonmetallic minerals, output remained relatively stable with significant increases reported in production of phosphate rock as a result of development activity in the Palmyra area. For production of mineral commodities in Syria see table 1.

Value of total imports was reported at $360 million in 1970 and $369 million in 1969. Mineral commodity imports contributed about one-fifth of this total or about $74 million in 1969. Mineral commodity imports are limited in quantity but extend through a wide range of commodities. Most significant by value is iron and steel estimated at $8 million in 1969 with East Europe as the major supply source.

[13] Prepared by Bernadette Michalski, foreign mineral specialist, Division of Fossil Fuels.

[14] Where necessary, values have been converted from the Syrian pound (S£) to U.S. dollars at the rate of S£3.82=US$1.00.

Total exports were reported at $203 million in 1970 and $207 million in 1969. The value of mineral commodity exports, principally crude petroleum, was estimated at $35 million and $24 million, respectively.

The State-operated Syrian General Petroleum Company reported a total of 80,427 barrels per day as Syrian crude output in 1970. The bulk of production was exported with only 13,811 barrels per day processed at the Homs refinery where domestic low gravity crudes were combined with 23,921 barrels per day of light Iraqi crude delivered via the Iraq Petroleum Company, Ltd. (IPC), pipeline. Expansion of the Homs refinery capacity from 30,000 barrels per day to 54,000 barrels per day was near completion in 1970 and should be accomplished as scheduled in the spring of 1971. Construction activity at Homs, conducted by the Czechoslovakian firm Skodaexport (Technoexport), also included installation of modifications to permit processing of Syria's low-gravity, high-sulfur crudes.

The Syrian General Organization for Petroleum has allocated $231 million for the development of the petroleum industry in the third 5-year plan (1971–75). Of this total $42 million was budgeted for exploration. During the 5-year development program, Syria plans to produce a total of 350 million barrels of crude petroleum reaching a production level of 258,500 barrels per day by 1975 from its northeastern fields of Suwaidiyah, Karatchuk, Rumailan, and Al Juhaisah. The latter field discovered late in 1969 yields a light crude of 40° API gravity contrasting sharply with the heavier crudes of 19° to 29° API gravity from Syria's older fields.

The 480,000-barrel-per-day capacity Trans Arabian Pipeline (TAPline) runs a length of 79 miles through Syria earning $6.3 million in transit and related fees in 1968 and $4.2 million in 1969 when the line was shut down for a period of 110 days. Crude flow through TAPline was again interrupted on May 3, 1970, when a rupture occurred near Deraa. Economic and political factors delayed repair of the pipeline resulting in its closure throughout the remainder of 1970. Revenue losses as a result of the closure were estimated at $5 million by yearend; however, these losses were partly offset by the 15- to 20-percent increase in crude petroleum prices following the tightening of Mediterranean crude supplies. The IPC pipeline crosses about 306 miles of Syrian territory, earning an estimated $55 million in transit revenues. IPC pipeline operations suffered no major interruptions in 1970, delivering 615,000 barrels per day to the Port of Banias and 487,000 barrels per day to the Port of Tripoli (Lebanon) as well as 23,921 barrels per day of feedstock to the Homs refinery.

Syria's phosphate rock deposits near Palmyra contain a reported proven reserve of 830 million tons of phosphate rock of 24 percent P_2O_5 content. Development activity has been underway since 1968 with Bulgaria, Poland, and Romania providing equipment and technical assistance. East European investments will be compensated by phosphate rock exports. Syria anticipated an export of 450,000 tons of phosphate rock in 1970 with Bulgaria receiving 300,000 tons, Poland 100,000 tons, and Romania 50,000 tons. Indications were that mining development did not reach planned levels and export goals were not met.

In support of phosphate rock mining activities, Romania has undertaken construction of additional port facilities at Tartous including storage silo capacity of 50,000 tons as well as ship loading installations.

TRUCIAL STATES [15]

The Trucial States are a group of seven independent States (sheikhdoms consisting of Abu Dhabi, Ajman, Dubai, Fujairah, Ras al-Khaimah, Sharjah, and Umm al-Qaiwain. Each has a special treaty relationship with the United Kingdom, which in 1967 announced its intention to terminate the long-term arrangements and withdraw its armed forces from the area by the end of 1971. In February 1968, these seven States plus Bahrain and Qatar announced their intention to form a new federation to be called Federation of Arab Amirates (FAA). However, meetings of State rulers have been inconclusive with a divergent opinion on a constitutional framework. Prospects for an early agreement and actual federation are dim.

[15] Prepared by David A. Carleton, supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

Although petroleum and natural gas are the only principal mineral commodities produced, preliminary plans are being prepared to diversify the mineral industry. Basic schemes involve the utilization of natural gas currently being produced in association with crude oil but being either flared, vented, or wasted for lack of markets.

Crude oil was produced only in Abu Dhabi and Dubai; however, petroleum exploration concessions cover both onshore and offshore areas of each of the seven sheikhdoms. Plans call for a petroleum refinery, a cement plant, a natural gas processing plant, and sulfur facility in Abu Dhabi. Cement plants are planned for Ras al-Khaimah and Dubai.

Red oxide (ochre) has been exploited on a small scale on several of the islands in the Persian Gulf for many years and is still providing a livelihood for a small number of people in Sharjah and Ras al-Khaimah. The Golden Valley Colours, Ltd., has received a concession for the island of Abu Musa from the ruler of Sharjah, for the Tunb Islands from the ruler of Ras al-Khaimah, and for eight other islands from the ruler of Abu Dhabi. The annual output of these three Trucial States is about 16,000 tons. The ore is used for making paints and cosmetics.

Abu Dhabi.—Petroleum production in Abu Dhabi increased a substantial 15 percent during 1970, reaching a total of 252 million barrels (690,900 barrels per day). Abu Dhabi Petroleum Co., Ltd. (ADPC), the onshore producing concessionaire accounted for 417,100 barrels per day or 60 percent of the total. Abu Dhabi Marine Areas, Ltd. (ADMA), the offshore producing concessionaire, accounted for the remainder. The Government income in the form of taxes and royalties from production by these companies total $240 million.

ADPC continued the development of their producing properties by raising Murban field's productive capacity to about 520,000 barrels per day. A third degassing station has been added in the Bu Hasa section of the field, a 24-inch pipeline from the field to Jebel Dhanna was completed, and a third tanker berth was added to Jebel Dhanna. At Abu Jidu field southeast of Murban several appraisal wells were drilled and three main domes were identified. Light, low-sulfur oil was encountered at Zubaya in the mud-flats 21 miles southwest of Abu Dhabi town. ADPC also found oil at Rumaitha 23 miles south of Zubaya and at Zarrara in the far south about 48 miles south of Abu Jidu.

ADMA has also continued to expand their two producing fields. Productive capacity of Zakum field was increased to 300,000 barrels per day and that of Umm Shaif field was raised to 100,000 barrels per day. On the Abu Dhabi side of the Persian Gulf median line, ADMA's Abu al Bukhush field proved to be an extension of Sassan field now being produced by Lavan Petroleum Co. for Iran. No developments were reported for the offshore Umm Addalkh discovery 16 miles northwest of Abu Dhabi town or Saath al-Razbut, 28 miles southwest of Zakum field.

The parent companies of ADMA, British Petroleum Co., Ltd. (BP), and Compagnie Française des Petroles (CFP) have been negotiating with Japanese firms for the marketing of liquefied natural gas from Abu Dhabi in Japan. The scheme would include a liquefaction plant on Das Island. At yearend 1970 details had not been worked out and discussions had not been concluded.

A new company was formed to develop the Bunduq oilfield discovered offshore by ADMA several years ago. The new Bunduq Oil Co. will be owned one-third by BP, one-third by CFP, and one-third by Joint Oil, Inc. a Japanese group of four companies. For their part, Joint Oil, Inc., will sell BP's share of Bunduq production in Japan and possibly BP production from other areas. Revenues from Bunduq field, which lies astride the Abu Dhabi-Qatar offshore boundary, will be shared by both governments.

The offshore acreage previously relinquished by ADMA and opened for bids during the year was awarded to a trio of small North American companies headed by the U.S. firm Pan Ocean Oil Co. with a 60-percent interest. Other share holders are the Canadian companies Syracuse Oils, Ltd. (20 percent) and Wingate Enterprises, Ltd. (20 percent). The contract called for a $2.5 million signature bonus, an expenditure commitment of $19 million for an 8-year exploration period, and an option by the ruler of Abu Dhabi to purchase 50 percent of the operation if commercial quantities of crude oil are found.

Plans are to drill the first well by mid-1971.

The ruler of Abu Dhabi has commissioned a subsidiary of the Japanese firm Mitsubishi Heavy Industries Ltd. to carry out a feasibility study for the establishment of a refinery. The considered capacity is between 5,000 and 10,000 barrels per day. Both ADPC and ADMA have agreed to supply the projected refinery with crude oil at cost plus $0.18 per ton, the going arrangement in the area.

The Japanese company Abu Dhabi Oil Co. Ltd. (ADOCO), which has had an offshore concession since 1967 discovered what may be a second oilfield in its area. The new well, situated in the western section of its two-section concession area, was tested at a rate of 4,000 barrels per day of light, low-sulfur crude oil. ADOCO's first discovery was found on the Mubarraz structure about 100 miles east of the most recent find. Mubarraz now has four producible wells with flow rates between 3,000 and 5,000 barrels per day. ADOCO plans to start production from the field at an initial rate of 30,000 barrels per day in early 1972.

The Japanese company Middle East Oil Co. has been granted a new concession in Abu Dhabi. Its first concession was awarded in 1968. The company is owned by five companies of the Mitsubishi Heavy Industries group, having a combined holding of 54.3 percent; the state organization, Japan Petroleum Development Corp., 42 percent; and two other Japanese firms, 3.7 percent. The concession is for 35 years and will initially cover 3,500 square miles. Three relinquishments in the next 9 years will reduce the area to 875 square miles. A minimum of $20 million is to be spent during the first 8 years and bonuses include $2.25 million at signing, $3 million when a commercial deposit is found, and $3 million when production reaches 100,000 barrels per day. Royalties and taxes will follow the Organization of Petroleum Exporting Countries (OPEC) percentage and allowances.

Natural gas produced in association with crude oil totaled 266.2 billion cubic feet. Of this amount 26 billion cubic feet was used by the two producing companies (ADPC and ADMA) and 0.7 billion cubic feet were sold to Abu Dhabi power and desalination plants. The remainder, 239.5 billion cubic feet, was flared. This latter amount had a calorific value estimated to equal about 45 million barrels of oil or about 125,000 barrels per day. At yearend 1970 ADMA was developing preliminary plans for establishing a liquefied natural gas plant on Das Island terminal for its activities.

A major dispute occurred during 1970 concerning the ownership of several small islands in the Persian Gulf and involving oil industry operations. One of these islands, Abu Musa, is claimed by both Sharjah and Iran. The former extended their claim of territorial waters from 3 to 12 miles. As applied to Abu Musa this claim affects the offshore boundaries of both Umm al-Qaiwain and Ajman whose joint concessionaire, Occidental Oil Co. was about to start drilling. Sharjah meanwhile had awarded exploration rights to Buttes Gas and Oil Co. and Clayco Petroleum Corp., both U.S. firms. By reason of their special treaty with the Trucial States, the United Kingdom imposed an injunction against drilling. At yearend the problem was being mediated.

Ajman.—In early 1970 Occidental Petroleum Co. was awarded an onshore-offshore exploration concession covering 255 square miles, which is Ajman's total area. The terms call for Occidental to pay $1 million initially and for rentals to total $2.4 million during the first 4 or 5 years. In the event of a discovery, profits will be shared on a 50–50 basis with the Government. The concession is for 40 years.

Dubai.—Production of crude oil in 1970, the first full year of production, totaled 31.3 million barrels, an average of 85,812 barrels per day. During the last quarter of 1970 production averaged 106,770 barrels per day. All production comes from the offshore Fateh oilfield of Dubai Marine Areas, Ltd. Ownership of this offshore concession was altered on December 30, 1970, when Continental Oil Co., operator of the concession, reduced its participation from 35 to 30 percent interest. The 5 percent was sold to Delfzee Dubai Petroleum N.V., a subsidiary of Wintershall, Inc., a West German company. Other ownership remained unchanged with Compagnie Française des Pétroles, 25 percent; Hispanica de Petroleos, S.A., 25 percent; Deutsche Texaco, A.G., 10 percent; and Sun Oil Co., 5 percent. The production gain in 1970 was attributable to the completion of nine additional wells. Development wells in Fateh field have indicated greater reserves and a higher initial production rate per well than previously expected. In December 1970, an exploratory well located 7 miles southwest of Fateh field tested oil in two zones, both of which are productive in Fateh field. The initial test well flowed at a maximum rate of 1,350 barrels per day. Results suggest the presence of substantial reserves and development drilling is scheduled for 1971. Continental Oil Co., has announced plans to expand production capacity to 300,000 barrels per day by 1973. Included in the expansion will be two more 500,000-barrel undersea storage tanks with platforms installed on top of each for production equipment.

Areas previously relinquished offshore by Dubai Marine Areas, Ltd., and onshore by Dubai Petroleum Co. (also operated by Continental Oil Co.) have been awarded to a joint venture of two U.S. companies, Buttes Gas and Oil Co. and Clayco Petroleum Corp. This, together with a new concession in Sharjah, is the first foreign operation for both companies. Reportedly the agreement will be for a period of 40 years covering an area of 770 square miles. The signature bonus was $2 million.

Although Dubai Petroleum Co. still holds title to its concession onshore, no wells have been drilled since a third well was abandoned in 1968. Continental Oil Co., the concession operator, abandoned its first well at a record depth of 15,041 feet. The company recently reported that they planned to drill 10 wells in Dubai, both offshore and onshore. Revenues from oil royalties and taxes totaled about $32 million in 1970. With the substantial increase in posted prices for crude oil in the Persian Gulf countries and with the anticipated rise in production, petroleum revenues are expected to increase by 50 percent in 1971.

The entrepôt trade has been the major source of income for Dubai for many decades. Gold purchases have been the backbone of this trade. Gold is bought in Western Europe, principally, the United Kingdom, Switzerland, France, and the Netherlands and is flown to Dubai. Custom's rates in Dubai are low. The gold is then illegally transported into India and Pakistan. India's ban on gold imports as a means of conserving foreign exchange has been in effect since 1947. The delivered price in India is believed to be about twice the going rates in Western Europe. During the first 10 months of 1970, shipments into Dubai totaled 220 metric tons which at $35 per troy ounce would have been worth about $200 million. Dubai gold receipts during recent years were as follows, in metric tons:

1969	139
1968	167
1967	105
1966	127
1965	118

Reportedly, the decline in gold shipment in 1969 resulted from Indian authorities equipping their coastal patrols with faster vessels; the uptrend in 1970 reflects installation of faster equipment by the illegal traders.[16]

Reportedly the ruler of Dubai planned to sign a contract in 1971 for the construction of a 1,500-ton-per-day cement plant.

Fujairah.—There was no activity in the onshore/offshore concession held jointly by Shell Minerals, Ltd., and Bochumer Mineralölgesellschaft G.m.b.H. and Co. (Bomin). Ras al-Khaimah-Shell Hydrocarbons, N.V., the onshore concessionaire in this principality performed four party-months of seismic surveying during 1970.

Ras al-Khaimah.—The sheikhdom's major oil concessionaire, Ras al-Khaimah Oil Co., operated by the U.S. firm Union Oil Co., continued its offshore drilling operations. At yearend 1970 contractors for Union were drilling a well about 30 miles offshore which had reached a depth of 13,000.

A major project for the near future is a 700-ton-per-day cement plant near Ras al-Khaimah town. The facility, in which the ruler of Abu Dhabi has a 25-percent interest, is slated to cost about $13 million. The project will be managed by Swiss technicians and is scheduled for completion in 1973.

Sharjah.—At yearend Shell Hydrocarbons, Ltd., was drilling its first well in Sharjah. The well, Al Faya-1 is located 18 miles inland from Sharjah town in the Juweisa area. During the year Shell performed 11 party-months of seismic surveying. Two previous wells have been drilled

[16] Financial Times (London). Dec. 2, 1970, p. 26–27.

in the Juweisa area by previous concessionaires. The first, a dry well, was drilled to 13,000 feet in 1958 and the second to a depth of 12,000 feet in 1966. Sharjah's offshore Persian Gulf territories are leased to a joint venture of Buttes Gas and Oil Co. and Clayco Petroleum Corp. Activities by this venture were restricted during the year because of the Abu Musa dispute.

Umm al Qaiwain.—This sheikhdom's only mineral activity involves petroleum exploration. Shell Hydrocarbons, Ltd., which obtained an onshore concession in 1969, carried out 4 party-months of seismic surveying during 1970. Plans for drilling were not made available. The offshore concession is held by Occidental Petroleum Corp. Exploration in the concession area has been limited by the dispute over Abu Musa ownership. Occidental's plans to drill an exploration well 9 miles east of Abu Musa were curtailed when the British Government enforced a temporary suspension of drilling operations in the disputed area.

YEMEN [17]

Yemen's only mineral commodity of commercial significance was salt produced from an opencast mine about one-fourth of a mile from the Red Sea port of Salif. The salt, which assayed at 98 percent sodium chloride, NaCl, is 15 to 20 feet under a covering of sand and dirt. All production was exported to Japan. Because some of the equipment at the mine is in disrepair, the mine owners, Salif Salt Mining Co., were able to produce in 1970 only 80,000 tons of the 100,000 tons they contracted to deliver annually to Japanese interest. The c.i.f. price of the 79,386 metric tons of Yemeni salt imported into Japan in 1970 was $885,000. During 1970 the Kuwait Fund for Arab Economic Development extended a loan to the Government of Yemen amounting to U.S.$1.96 million.[18] The money is to be used to improve operations at the Salif Salt project. The loan carries an annual interest of 2.0 percent.

In 1970 the Algerian state oil company, Société Nationale pour la Recherche, la Production, le Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH) commenced geophysical exploration. SONATRACH is a 50-percent partner in the Yemen Petroleum and Minerals Industries Co. which has an oil and mineral exploration concession for much of Yemen. The Yemeni Government holds the remaining 50 percent. Other than crude oil, the company is looking for copper ore.

Reportedly, small quantities of building stone, limestone, gypsum, soapstone, and agate are produced for domestic consumption. Some agate is believed to be exported.

[17] Prepared by David A. Carleton, supervisory foreign mineral specialist (petroleum), Division of Fossil Fuels.

[18] Where necessary, values have been converted from Kuwaiti dinars (KD) to U.S. dollars at the rate of KD1 = US$2.80

The Mineral Industry of Other Far Eastern and South Asian Areas

By Staff, Bureau of Mines

CONTENTS

AFGHANISTAN [1]

Afghanistan's contribution to the world's mineral supply continued to be minor compared with nations with well-developed mineral industries. The country's major mineral output was in the area of fuels, with production of natural gas rising from 18 billion cubic feet in 1967 to an estimated 72 billion cubic feet in 1970. Natural gas production from the Khwaja Gogirdak region of Shibarghan province is expected to increase to 150 billion cubic feet by 1973 in order to meet current and future demand for export to the U.S.S.R. via pipeline. Current estimates place reserves at the Shibarghan fields at 5.5 trillion cubic feet. Additional exploration has intimated that almost three times this quantity may be available in the gas field.

During the year, work was continued on the construction of a fertilizer plant and power project at Mazar-e Sharif. (This project previously was reported as having been completed in 1969.) The project is located in a rugged semiarid area about 10 miles from Mazar and is under the direction of the Ministry of Mines and Industry. Powerplant construction was almost completed and urea plant construction made substantial progress. In addition, gravel roads, a water pumping station, and housing facilities have been constructed. Initial production of urea was anticipated in the spring of 1973, with maximum capacity production of 104,000 metric tons per annum expected by the summer of 1976. Production cost was estimated at $70 per ton, which is higher than the cost of imported urea landed in Kabul. The high production cost may be offset by a higher nitrogen content in the domestically produced material which is expected to be purer than presently imported urea.

The country's coal production has shown some variation during the past several years, rising slowly from 113,000 tons in 1964 to a peak in 1967 of 152,000 tons. Thereafter, production declined slightly and then rose to an estimated 140,000 tons in 1970. Production can be expected to rise slowly to meet industrial and other domestic demand. Coal is currently mined from the Karkar, Ishpushta, and Darri-i-Suf mines. Under the country's current 5-year plan (March 1967 to March 1972), the Darri-i-Suf mine is expected to become the major source of coal because of anticipated coal depletion in the Karkar and Ishpushta mines. Coal reserves at Darri-i-Suf

[1] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals.

are rated at 60 million tons. Factors such as its remote location and poor transportation facilities may slow the development of the Darri-i-Suf coal mine.

Preliminary examinations of known evaporite deposits at locations such as Hamun-i-Puzak (31°30′N;61°48′E), Namaksar Herat (34°05′N;60°46′E), Namaksar Ankhui (36°37′N;65°04′E), Namaksar Tashkurghan (36°57′N;67°27′E), have been made. Chemical analysis of surface samples from these locations indicate the presence of potassium, magnesium, and sodium chloride salts and sulfates in significant amounts. A proposal has been made to initially evaluate these deposits on the basis of a chemical analysis that assumes the presence of several common salts and sulfates. A theoretical production base in terms of annual product tons, preliminary plant construction cost estimates in Afghanistan, potential production costs, and cost of moving finished products to local markets or seaports in surrounding countries would be developed. If any of the sites involved appear capable of supporting a commercial operation, then drilling to delineate the deposit and a feasibility study may be started.

The remaining mineral production consists of salt and lapis lazuli. Other known mineral deposits consist of iron, copper, beryllium, and mica. However, the heavy cost of development and transportation hinders their development.

This country's current Mining and Petroleum Code is being revised to attract foreign investment.

Table 1.—Other Far Eastern and South Asian Areas: Production of mineral commodities

Area,[1] commodity, and unit of measure	1968	1969	1970 p
AFGHANISTAN [2]			
Cement, hydraulic ......thousand metric tons..	92	105	e 110
Coal, bituminous ......do....	r 125	136	e 140
Gas, natural marketed production [3] ......million cubic feet..	59,364	71,653	e 72,000
Gem stones, lapis lazuli ......metric tons..	10	10	e 10
Salt, all types ......thousand metric tons..	r 38	37	e 40
BRUNEI [2]			
Gas, natural:			
Gross production ......million cubic feet..	113,555	123,266	126,654
Marketable production ......do....	8,662	7,655	7,965
Natural gas liquids:			
Condensate ......thousand 42-gallon barrels..	10	15	16
Natural gasoline ......do....	535	489	465
Liquefied petroleum gas ......do....	196	210	207
Petroleum:			
Crude ......do....	r 44,653	45,624	50,233
Refinery products:			
Gasoline ......do....	107	108	93
Distillate fuel oil ......do....	150	184	218
Residual fuel oil ......do....	5	r 5	2
Other ......do....	19	7	15
Refinery fuel and losses ......do....	(4)	(4)	45
Total ......do....	4 281	r 4 304	373
Stone, gravel and cobblestone ......cubic meters..	NA	NA	340,657
CAMBODIA [2]			
Cement ......metric tons..	60,000	59,000	39,000
Gold mine output e ......troy ounces..	4,000	4,000	4,000
Petroleum refinery products:			
Gasoline ......thousand 42-gallon barrels..	--	292	256
Jet fuel ......do....	--	110	183
Kerosine ......do....	--	183	146
Distillate fuel oil ......do....	--	1,059	803
Residual fuel oil ......do....	--	657	365
Other ......do....	--	511	365
Refinery fuel and losses ......do....	--	219	137
Total ......do....	--	3,031	2,255
Salt e ......metric tons..	45,000	45,000	45,000

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	1968	1969	1970 p
CEYLON			
Cement, hydraulic ---- thousand metric tons	222	283	326
Coke, gashouse ---- metric tons	e 10,500	10,584	10,434
Clays:			
Ball ---- do	NA	NA	1,333
Kaolin ---- do	2,867	3,084	2,209
Other ---- do	[5] 41,005	[5] 71,543	130,000
Feldspar, crude and ground ---- do	586	604	1,293
Gem stones, precious and semiprecious, except diamond [6] thousand carats	196	225	NA
Graphite, all grades [6] ---- metric tons	10,802	11,418	9,786
Mica, scrap ---- do	--	--	468
Petroleum refinery products:			
Gasoline and naphtha ---- thousand 42-gallon barrels	--	385	1,219
Kerosine ---- do	--	r 476	2,069
Distillate fuel oil ---- do	--	873	3,170
Residual fuel oil ---- do	--	1,381	4,652
Other ---- do	--	332	1,148
Refinery fuel and losses ---- do	--	390	819
Total ---- do	--	r 3,837	13,077
Rare earth, monazite concentrate, gross weight ---- metric tons	42	56	16
Sand and gravel, glass sand ---- do	3,058	3,417	5,361
Stone:			
Dolomite ---- do	7,898	5,700	3,408
Limestone ---- thousand metric tons	[5] 210	[5] 375	511
Quartz, massive ---- metric tons	1,659	1,565	2,392
Salt, marine ---- do	r 98,396	r 113,703	64,570
Titanium:			
Ilmenite concentrate, gross weight ---- do	r 74,609	r 82,855	84,558
Rutile concentrate, gross weight ---- do	1,152	r 2,755	e 2,800
Zirconium concentrates, zircon, gross weight ---- do	25	68	112
HONG KONG [2]			
Cement, hydraulic ---- thousand metric tons	r 375	r 378	528
Clays, kaolin ---- metric tons	5,664	r 4,411	3,784
Feldspar ---- do	1,607	1,940	1,621
Graphite, all grades ---- do	r 506	199	--
Iron ore and concentrate ---- do	161,594	165,946	170,256
Quartz ---- do	3,693	6,317	5,350
LAOS [2]			
Salt, rock ---- metric tons	3,200	2,400	1,169
Tin mine production ---- long tons	500	621	629
MONGOLIA [2]			
Cement, hydraulic e ---- metric tons	75,000	120,000	120,000
Coal e ---- thousand metric tons	1,250	r 1,450	1,750
Fluorspar, all grades e ---- metric tons	70,000	r 78,000	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	90	90	90
Refinery products:			
Gasoline e ---- do	165	165	165
Distillate fuel oil e ---- do	55	55	55
Residual fuel oil e ---- do	220	220	220
Total e [7] ---- do	440	440	440
Salt e ---- metric tons	8,000	8,000	8,000
SINGAPORE [2]			
Cement, hydraulic ---- thousand metric tons	567	623	726
Petroleum refinery products:			
Gasoline ---- thousand 42-gallon barrels	8,465	8,554	11,169
Jet fuel ---- do	r 9,885	r 11,887	8,094
Kerosine ---- do	r 363	r 3,837	1,918
Distillate fuel oil ---- do	r 11,621	r 11,675	13,127
Residual fuel oil ---- do	r 30,541	r 8,374	33,850
Lubricants ---- do	257	355	375
Asphalt ---- do	711	680	1,203
Other ---- do	189	20,004	603
Refinery fuel and losses ---- do	r 1,096	r 2,457	4,568
Total ---- do	r 63,128	r 67,323	74,907
Stone, granite ---- thousand cubic meters	NA	NA	1,496

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	1968	1969	1970 [p]
VIETNAM, NORTH [8]			
Cement [e] thousand metric tons	500	500	500
Coal, anthracite [e] do	3,000	3,000	3,000
Fertilizer materials, crude, phosphatic:			
Apatite [e] do	1,000	1,200	1,000
Phosphate rock [e] do	50	50	50
Salt [e] do	150	150	150
VIETNAM, SOUTH			
Cement, hydraulic do	145	247	286
Clays:			
Kaolin metric tons	700	[e] 1,000	[e] 1,000
Other do	127,575	NA	NA
Laterite [9] do	504,700	NA	NA
Salt, marine do	158,280	118,319	[e] 120,000
Sand and gravel:			
Silica sand thousand metric tons	96	NA	NA
Other sand and gravel do	NA	NA	8,002
Stone:			
Basalt, rhyolite metric tons	15,225	NA	NA
Granite and porphyry thousand metric tons	NA	NA	12,338
Limestone do	NA	NA	286
Sandstone do	372	NA	NA
Schist do	144	NA	NA

[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, and sand and gravel and may have initiated production of cement in 1969, but no production data are available and 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, and 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] Gross production not reported, but presumably exceeds marketed production by only a small quantity, because the quantity vented, flared, and reinjected is apparently small.

[4] Available sources do not indicate any fuel and losses, presumably total is deficient by this quantity.

[5] For cement production only.

[6] Exports.

[7] Total of listed figures only, no allowance is made for other products (if any) nor for refinery fuel and losses.

[8] 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 prepare reliable estimates of output.

[9] As reported, use unspecified.

Table 2.—Afghanistan: Imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1968	1969 [e]	1970
Gasoline:			
Aviation	28	128	70
Other	51		710
Jet fuel	39	39	73
Kerosine	27	113	173
Distillate fuel oil	50	39	630
Residual fuel oil	3	4	183
Lubricants	10	1	29
Other	21	52	37
Total	229	376	1,905

[e] Estimate.

BRUNEI [2]

Mineral production in Brunei contributed about $7.3 million dollars more to the nation's earnings in 1970 than in 1969, representing a growth rate of some 8 percent. As usual, greater output of crude petroleum accounted for practically the entire increase. Production values of individual commodities in 1969 and 1970 in thousand dollars, follows:

Commodity	1969	1970
Crude petroleum (less refinery input)	83,004	90,229
Refined petroleum products	1,009	1,098
Natural gas sales	150	158
Natural gas liquids	1,037	1,024
Other commodities (estimated)	1,800	1,775
Total	87,000	94,284

No completely new developments occurred in the mineral sector during 1970, but considerable planning activity followed the liquefied natural gas agreement of the previous year.

Government Policies and Programs.—Brunei's Legislative Council passed additional petroleum tax legislation in May 1969, which was not reported in the 1969 Minerals Yearbook. The new laws include a provision for the posted price of Persian Gulf oil to be considered the Brunei price for tax purposes, and a requirement for quarterly rather than semiannual payment of royalties.

PRODUCTION

Crude oil remained the only mineral commodity of commercial significance in Brunei, representing more than 95 percent of the total value of all minerals produced in 1970. Output rose to 50,233,000 barrels, a gain of 10 percent over the 1969 production of 45,624,000 barrels. Production at the Seria refinery also increased slightly, as did the output and sales of natural gas. Statistics on the production of mineral fuels in Brunei appear in table 1.

TRADE

Complete statistics are not yet available on Brunei's external trade in 1969 or 1970, but petroleum provided the base for the country's favorable trade balance in 1968. Shipments of mineral commodities worth $89,302,000 constituted 97 percent of the $91,932,000 value of all exports. Total imports amounted to $68,513,000, including $10,109,000 of mineral products, leaving a trade surplus of $23,419,000.

A total of 43,505,000 barrels of crude oil worth $87,580,000 were sent by pipeline to the refinery at Lutong, Sarawak, in 1968. (Pipeline shipments of crude oil in 1969 were up to 46,936,000 barrels). Other mineral commodities which were exported in 1968 included small amounts of refined petroleum products, cut stone, brick, and iron and steel shapes and scrap; the last group consisting entirely of reexported materials. The bulk of these commodities were shipped to neighboring Sarawak, except for the scrap which went mainly to Singapore.

Imports of mineral products in 1968, as in earlier years, were made up largely of semimanufactured iron and steel goods purchased from various industrial nations. Sizable amounts of refined petroleum products, obtained chiefly from Singapore, and cement from several sources also were imported.

COMMODITY REVIEW

Natural Gas.—Plans for construction of the facilities required to ship liquefied natural gas to Japan moved ahead during 1970. The series of liquefaction plants—to be located at Lumut, about 10 miles east of Seria—will cost from $100 to $150 million and will constitute the largest liquefied natural gas facility in the world. Early in 1970 the contract for design and construction of the complex was awarded to a joint venture of Japan Gasoline Company (Tokyo) and Procon, Inc. (Des Plaines, Illinois). Financial assistance in the form of a loan and loan guarantee was authorized by the U.S. Export-Import Bank. The complex will include four liquefaction plants, storage capacity, and two pipelines to transport the gas to tankers waiting offshore. In addition to the facilities in Brunei, the entire project will require six specially designed tank ships and the regasification plants and distribution system in Japan, for a total investment cost estimated at about $200 million. Production is still scheduled to start late in 1972.

[2] Prepared by David G. Willard, economist, Division of Nonmetallic Minerals.

Petroleum.—Exploratory drilling in the Tutong District concession by Sun Oil Company and its partners was suspended late in 1969 following completion of a second unsuccessful test well. However, the group stated that it is retaining its concession and that wildcat drilling may be resumed after further studies are made.

CAMBODIA [3]

As a result of the internal situation in Cambodia in 1970, the country's small mineral industry experienced a rocky year. Industrial production and economic development suffered a severe setback because of political insecurity, war damage, and heavy military expenditures which increased the Cambodian budgetary deficit considerably.

Relatively few mineral commodities are produced annually in Cambodia, and 1970 was no exception. Outputs of many mineral commodities were not officially reported. Petroleum refinery production and cement output were lower than those of the previous year, and most likely, that also was true of fertilizer materials. Apparently, Cambodia continued to produce small quantities of limestone, phosphate rock, precious and semiprecious stones, and simple construction materials in addition to the commodities shown in table 1.

Plans were postponed for mineral industry projects in the fourth year of the country's second 5-year development plan. The plans included the construction of a second cement plant, an ammonia (urea) plant, and a small steel mill. In addition, no work was undertaken on the construction of a water supply system and powerplant and facilities at the Port of Kompong Som, formerly Sihanoukville.

COMMODITY REVIEW

Nonmetals.—As a result of war damage to the state-owned and- managed National Cement Company plant at Chakrey Ting near Kampot, the plant was inoperative during the latter part of the year, and cement output was only 39,000 tons in 1970 compared with 59,000 tons in 1969.

Plans for the construction of a second cement plant with an annual production capacity of 200,000 tons and a small steel mill (using scrap) to produce wire and iron for reinforced concrete were postponed because of financial difficulties and the general unstable situation.

Planned construction of a 35,000-ton-per-year ammonia plant at Kompong Som was postponed near yearend. The plant was to be constructed by Azote et Produits Chimiques with financial assistance through a new French loan extended to Cambodia in February.

Mineral Fuels.—Production at the Cambodian-controlled Société Khumère de Raffinage oil refinery was interrupted by the war in 1970; however, the refinery resumed normal operations by November. The refinery produced gasoline, kerosine, diesel oil, fuel oil, and lubricants, but production data were not reported. Transport of petroleum products by road to Phnom Penh, the capital, was disrupted in April and May, but a railway line laid between Kompong Som and the capital at yearend 1969, provided a transportation link from the oil refinery.

A French company, ELF-ERAP (ELF Cambodge, a subsidiary of Enterprise de Recherchés et d'Activities Pétrolières, (ERAP) explored offshore along the Cambodian coast for oil deposits. The first stage of the survey was completed in April; the second stage had not started at yearend.

CEYLON [4]

The mineral industry of Ceylon provided a significant contribution to the economy of the country with major production of mineral commodities such as ilmenite and rutile concentrates, salt, clays, and graphite. Data on the value of mineral production and the country's gross national product are unavailable and no comparisons can be made. Significant quantities of ilmenite, graphite, gem stones, and refined petroleum products were exported.

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[3] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals.

[4] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals.

Ceylon is probably best known for its good quality graphite which is in demand by industry. Graphite production declined 14 percent from that of 1969 to slightly under 10,000 tons in 1970. Exports were shipped primarily to Japan, the United States, and the United Kingdom for various industrial uses. Reserves of graphite have not been quantified on the island, but the deposits consist of graphite veins cutting igneous and metamorphic rocks across a large area in the southwestern part of the island. These veins vary in size from under 1 inch to several feet and are from a few feet to several hundred feet in length. The deposits are considered a large potential world supply of natural amorphous and crystalline lump graphite.

Cement production has increased steadily from 75,000 tons in 1964 to 326,000 tons in 1970 under the control of the State Cement Corporation. The corporation opened a new cement plant at Puttalam which has an initial production capacity of 220,000 tons per year. When fully completed the plant's capacity will be double the plant's initial production capacity. Ceylon has two other cement plants at Kankesanturi in the northern peninsula and Galle in the southern province. These plants have production capacities of 275,000 and 100,000 tons per annum, respectively. All cement plants have modern equipment and up-to-date cement production technology. The plants consume domestic raw materials for the bulk of their requirements.

The Ministry of Industries has recommended nationalization of all mineral rights in Ceylon and government control of the graphite industry. Cabinet approval is sought for the establishment of a State Graphite Corporation with an initial capital of $410,000. This has been recommended as an effort to recapture Ceylon's share of the world graphite market and the consequent foreign exchange earnings.

The production of ilmenite and titanium concentrates has become increasingly important to the country's minerals industry and has for several years surpassed the production of graphite. Producers are located primarily in the Pulmoddai area on the east coast of the island. Other production facilities have been established on the west coast at Beruwala. Production is exported almost entirely to Japan.

A proposal has been made that the Government establish a Gem Corporation primarily for the purpose of stopping illegal trade rather than to promote production. Legislation for this purpose has been prepared. Recorded production of gem stones has been increasing for the past few years. Exports in 1969 were to West Germany, Hong Kong, and Japan. All these countries have a domestic cutting and polishing industry specializing in the preparation of precious and semiprecious gem stones.

Other minerals produced in Ceylon are feldspar, mica, monazite, clays, stone, sand and gravel, and zircon concentrates.

Ceylon has no producing oil or gas wells but does import crude oil for processing into various refined petroleum products. In 1970 Ceylon imported crude oil valued at $22.4 million and converted this material to gasoline, naphtha, kerosine, gas oil, diesel fuel, heavy fuel oil, asphalt, refinery fuel, and unfinished oils.

The island's mineral industry provides only a small portion of its total international trade. The following tabulation details the relationship between mineral and total trade.:

	Value (million dollars)	
	Mineral commodities (including fuels)	Total trade
Exports and reexports:		
1968	2.13	342
1969	2.24	322
Imports:		
1968	72.1	365
1969	54.1	427

Table 3.—Ceylon: Exports and reexports of mineral commodities

Commodity	1968	1969	Principal destinations, 1969
METALS			
Ilmenite____metric tons__	r 73,917	84,700	Japan 83,112.
NONMETALS			
Graphite, natural____do____	r 10,802	11,419	Japan 4,071; United States 3,135; United Kingdom 1,970.
Mica, all forms____do____	133	396	Libya 300; Thailand 91; Japan 5.
Precious and semiprecious stones (except diamond) carats__	196,039	[1] 217,040	West Germany 88,319; Hong Kong 60,272; Japan 34,781.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum and refinery products:			
Gasoline____42-gallon barrels__	501	193	NA.
Kerosine____do____	683	3,052	NA.
Distillate fuel oil____do____	1,653	1,351	NA.
Lubricants____do____	147	104	NA.

r Revised. NA Not available.
[1] Includes an unspecified quantity valued at $22,889.

Table 4.—Ceylon: Imports of mineral commodities

(Metric tons and U.S. dollars unless otherwise specified)

Commodity	Quantity		Value	
	1968	1969	1968	1969
METALS				
Aluminum:				
Oxide and hydroxide	--	[1] 11	--	$6,355
Metal including alloys, all forms	2,351	(2)	$1,787,474	2,520,485
Arsenic trioxides, pentoxides, and acids	--	(2)	--	153
Chromium oxides and trioxides	--	8	--	8,271
Cobalt oxides and hydroxides	--	(3)	--	1,396
Copper including alloys, all forms	841	(2)	987,924	1,176,146
Iron and steel:				
Ore and concentrate	--	[1] 93	--	18,255
Pig iron, ferroalloys and similar materials	2,049	521	141,062	54,136
Steel, primary forms	37,606	[1] 27,082	2,921,152	2,011,603
Semimanufactures:				
Bars, rods, angles, shapes and sections	17,355	28,605	2,137,798	2,197,347
Universals, plates and sheets	18,725	[1] 27,385	2,883,307	5,270,808
Hoops and strips	2,797	2,947	447,118	1,184,174
Rails and accessories	1,941	129	208,641	41,422
Wire	7,551	3,303	1,154,823	816,572
Tubes, pipes and fittings	6,810	(2)	1,555,461	1,377,171
Castings and forgings, rough	--	(2)	--	9,494
Lead:				
Oxides	11	7	3,387	2,817
Metal including alloys, all forms	508	401	201,451	153,240
Manganese oxides	511	698	93,232	131,961
Mercury____76-pound flasks__	21	16	11,738	6,813
Molybdenum	--	(1)	--	2,348
Nickel including alloys, all forms	16	(2)	5,963	57,566
Rare earth:				
Oxides____kilograms__	--	436	--	921
Metals including alloys, all forms____do____	--	2,947	--	4,621
Silver including alloys, all forms____troy ounces__	52,267	(2)	2,948	152,615
Tin including alloys, all forms____long tons__	[1] 3,430	[1] 220	703,843	143,018
Titanium oxides	203	196	99,748	86,631
Tungsten including alloys, all forms	--	6	--	71,836
Zinc:				
Oxides	256	306	72,671	92,659
Metal including alloys, all forms	r 2,170	1,950	344,737	823,002
Others:				
Ores and concentrates of base metals n.e.s	--	93	--	18,243
Oxides, hydroxides, and peroxides of metals n.e.s.	4	358	10,463	34,955
Metal including alloys, all forms n.e.s	116	[1] 11	41,050	31,880
NONMETALS				
Abrasives, natural n.e.s.:				
Pumice, emery, natural corundum, etc	32	22	10,363	10,055
Grinding and polishing wheels and stones	61	96	73,262	135,161
Asbestos	844	6,843	198,196	1,554,329
Barite	--	3	--	1,106
Boron materials:				
Crude natural borates	11	278	1,714	33,734
Oxide and acid	12	26	2,574	5,756
Cement	183,060	130,518	2,787,560	2,303,872
Chalk	165	1,210	11,012	45,527

See footnotes at end of table.

Table 4.—Ceylon: Imports of mineral commodities—Continued

(Metric tons and U.S. dollars unless otherwise specified)

Commodity	Quantity 1968	Quantity 1969	Value 1968	Value 1969
NONMETALS—Continued				
Clays and products (including refractory brick):				
Crude n.e.s	2,204	1,850	$132,650	$110,550
Products	1,317	[1] 827	187,472	334,593
Diatomite and other infusorial earths	10	60	2,803	16,916
Fertilizer materials:				
Crude:				
Nitrogenous	--	544	--	31,131
Potassic	1,466	25	78,553	1,044
Other	916	878	34,000	28,238
Manufactured:				
Nitrogenous	165,117	128,763	9,098,048	6,884,982
Phosphatic:				
Thomas slag (basic)	10	--	504	--
Other	25,747	39,499	713,235	1,464,981
Potassic	56,247	46,016	2,824,420	2,410,671
Other including mixed	85,478	3,950	5,153,663	255,424
Ammonia	69	--	31,567	--
Gypsum and plasters	1,029	3,658	193,296	66,992
Lime	617	1,078	24,187	40,868
Magnesite	--	34	--	2,030
Mica, all forms	2	[1] 29	2,076	14,898
Pigments, mineral including processed iron oxides	213	408	100,388	95,824
Salt and brines	3,315	187	34,767	8,918
Sodium and potassium compounds n.e.s	2,402	2,794	177,472	233,659
Stone, sand and gravel:				
Dimension stone	224	15	13,090	2,645
Dolomite, chiefly refractory grade	--	23	--	1,266
Gravel and crushed rock	46	468	2,254	24,568
Limestone (except dimension)	104	--	3,962	--
Quartz and quartzite	--	3	--	319
Sand excluding metal bearing	(3)	41	312	2,770
Sulfur:				
Elemental, all forms	460	976	62,608	130,973
Sulfuric acid	540	682	73,654	114,140
Talc, steatite, soapstone, and pyrophyllite	1,161	1,346	70,216	83,177
Other nonmetals:				
Crude, n.e.s	1	852	373	40,159
Slag and ash including kelp	--	32	--	1,449
Oxides and hydroxides of magnesium, strontium, etc	98	27	20,811	61,143
Building materials of asphalt, asbestos and fiber, cement and unfinished metals n.e.s	29	360	49,276	88,468
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	1,161	1,346	204,749	1,189,630
Carbon black and gas carbon	1,040	1,130	294,754	305,114
Coal and coke including briquets	38,123	21,632	663,751	650,052
Gas, hydrocarbon	14	4	2,426	1,183
Hydrogen, helium and rare gases	30	5	38,773	20,391
Petroleum:				
Crude and partly refined ... 42-gallon barrels	264,886	166	$611,221	$6,695
Refinery products:				
Gasoline (including natural) ... do	2,035,617	705,793	5,653,126	1,869,476
Kerosine and jet fuel ... do	2,051,209	1,451,561	7,955,767	5,210,510
Distillate fuel oil ... do	6,022,977	2,920,873	15,077,934	6,280,461
Residual fuel oil ... do	243,980	5,387,797	512,780	959,410
Lubricants ... do	87,169	113,735	2,698,624	2,222,451
Mineral jelly and wax ... do	605	454	161,171	162,360
Others n.e.s ... do	658	44,326	185,669	706,314
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals ... do	860	[1] 113	64,876	88,678

[r] Revised.

[1] Source indicates that an additional unspecified quantity was imported, for which only value was reported; this additional value is included in the appropriate value column.

[2] No tonnage figure reported but an unspecified quantity, valued as indicated, was imported.

[3] Less than ½ unit.

HONG KONG [5]

Hong Kong is an industrial-commercial area with an economy based on foreign trade rather than on internal resources. A significant portion of this trade annually includes various mineral commodities imported for both local industry and reexport. Total value of Hong Kong's trade in 1970 was not available at the time of this publication; however, for the first 9 months of the year compared with the same period in 1969, imports, exports, and reexports were reported to be higher by 21,22, and 9 percent, respectively.[6] In 1969 mineral commodities accounted for 10 percent of the total value ($4.6 billion) of Hong Kong's trade.

The extractive and processing sectors of Hong Kong's mineral industry contribute little to the colony's economy. In 1970 hydraulic cement and iron ore and concentrate were the major mineral commodities produced. The quantity of cement produced (528,000 metric tons) in 1970 was 40 percent more than in 1969. The quantity of iron ore and concentrate produced also increased, but by only 3 percent. Smaller quantities of clays (kaolin), feldspar, and quartz were mined in 1970 than in 1969 for domestic needs and/or for export.

Mineral production on Hong Kong is available in table 1.

Production of steel bars by Hong Kong's small steel rolling mills in 1969 was reported to be 57 percent of installed capacity compared with only 40 percent of installed capacity in 1968. The increased domestic demand in early 1970 coupled with reduced competition from low-cost imports was expected to allow the industry to raise installed capacity to 75 percent by yearend.

[5] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals.
[6] Far Eastern Economic Review. Hong Kong. 1971 Yearbook. December 1970, p. 151.

Table 5.—Hong Kong: Exports and reexports of mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite and concentrate	268	454	Mainly to Taiwan.
Oxide and hydroxide	39	6	Mainly to Ceylon.
Metal including alloys, all forms	r 8,252	9,798	Singapore 1,450; Republic of Korea 1,216; Japan 1,165.
Arsenic:			
Natural sulfides	2	--	
Trioxides, pentoxides, and acids	44	17	Mainly to Taiwan.
Chromium oxide and hydroxide	18	7	Taiwan 3; Singapore 2; Indonesia 1.
Cobalt oxide and hydroxide	2	3	Mainly to Thailand.
Copper including alloys, all forms	r 9,207	8,703	Japan 6,099; West Germany 1,148; Taiwan 226.
Gold unworked or partly worked thousand troy ounces	711	728	All to Macau.
Iron and steel:			
Ore and concentrate thousand tons	r 153	166	All to Japan.
Metal scrap do	r 117	134	Japan 68; mainland China 28; United Kingdom 27.
Steel, primary forms do	--	2	All to Thailand.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	84	76	Thailand 25; Indonesia 17; Cambodia 13.
Universals, plates and sheets do	6	5	Indonesia 2; Thailand 1.
Other do	2	2	Mainly to Indonesia.
Lead including alloys, all forms	r 663	644	Taiwan 527; Republic of South Africa 55; West Germany 27.
Magnesium including alloys, all forms	6	1	All to Australia.
Manganese oxide	6	385	Cambodia 306; Taiwan 67; Indonesia 12.
Mercury 76-pound flasks	--	5	All to West Malaysia.
Nickel including alloys, all forms	6	4	Cambodia 2; mainland China 1.
Platinum group including alloys, all forms thousand troy ounces	3	1	Mainly to West Germany.
Silver including alloys do	1,849	764	Mainly to United Kingdom.
Tin including alloys, all forms long tons	95	145	United Kingdom 49; Singapore 36; Denmark 33.
Titanium oxide	340	253	West Malaysia 94; Taiwan 75; Singapore 69.

See footnote at end of table.

Table 5.—Hong Kong: Exports and reexports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS—Continued			
Zinc:			
Oxide	24	13	Taiwan 8; Thailand 3.
Metal including alloys, all forms	r 1,183	1,163	Mainland China 668; Cambodia 192; Taiwan 169.
Other:			
Oxides, hydroxides, and peroxides of metal, n.e.s	1	6	Australia 3; Singapore 2; Republic of Korea 1.
Metals including alloys, all forms:			
Metalloids	1	2	Mainly to Australia.
Base metals including alloys, all forms, n.e.s	4	2	All to Indonesia.
NONMETALS			
Abrasives, natural n.e.s	27	22	Indonesia 5; Republic of Korea 4; Thailand 4.
Asbestos	1	76	Indonesia 68; Ghana 7.
Barite and witherite	43	76	Mainly to Taiwan.
Cement	47,946	55,705	South Vietnam 16,403; Cambodia 14,149; Oceania n.e.s. 11,096.
Clays and products (including all refractory brick):			
Crude n.e.s	5,748	8,156	Taiwan 5,727; Japan 1,796; Philippines 273.
Products	1,191	1,214	Indonesia 837; Sabah 166; Brunei 138.
Cryolite and chiolite	2	3	Mainly to Thailand.
Diamond, gem not set or strung thousand carats	r 163	219	Belgium-Luxembourg 59; Israel 53; Japan 46.
Diatomite and other infusorial earths	6	14	India 5; Indonesia 4.
Feldspar and fluorspar	r 338	627	Thailand 387; Philippines 177; South Vietnam 54.
Fertilizer materials:			
Crude	121	331	Sarawak 209; Singapore 94; United States 17.
Manufactured, nitrogenous	53	--	
Ammonia	2	4	Sabah 3; Singapore 1.
Graphite, natural	r 229	473	United States 272; Thailand 166; Cambodia 35.
Gypsum and plasters	75	156	Singapore 109; Japan 18; Indonesia 18.
Lime	383	291	Sabah 233; Macau 44; Brunei 9.
Mica, all forms	10	63	Japan 46; mainland China 9; Taiwan 4.
Pigments, mineral including processed iron oxide	354	317	Taiwan 295; Indonesia 22.
Salt and brines	290	242	Sarawak 164; Indonesia 78.
Sodium and potassium compounds n.e.s	63	409	Indonesia 268; Australia 116; Oceania n.e.s. 14.
Stone, sand and gravel:			
Dimension stone	1,902	1,462	Sabah 567; Thailand 395; Singapore 301.
Gravel and crushed rock	3,870	21,956	Brunei 21,369; Sabah 467; Singapore 59.
Limestone (except dimension)	21	--	
Quartz and quartzite	844	1,627	Thailand 1,429; Taiwan 45; Senegal 36.
Sulfur:			
Elemental, all forms	154	180	Mainly to Macau.
Sulfuric acid	8	16	Sabah 7; Tanzania 6.
Talc, steatite, soapstone, and pyrophyllite	r 420	1,133	Indonesia 935; Cambodia 134; Japan 47.
Other n.e.s.:			
Crude	74	167	Taiwan 155; Singapore 8.
Oxides, hydroxides of magnesium, strontium, and barium	1	--	
Building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals n.e.s	184	64	Indonesia 49; Brunei 5.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon	24	86	Cambodia 67; Taiwan 13.
Coal and coke including briquets	1,115	34	Macau 16; Singapore 15.
Gas hydrocarbon	344	579	Macau 451; South Vietnam 127.
Petroleum refinery products:			
Gasoline (including natural) thousand 42-gallon barrels	22	28	All to Macau.
Kerosine and jet fuel do	45	47	Mainly to Macau.
Distillate fuel oil do	r 253	278	Do.
Residual fuel oil do	7	11	All to Macau.
Lubricants do	124	131	South Vietnam 36; Singapore 35; Taiwan 29.
Mineral jelly and wax do	48	54	Philippines 22; Taiwan 14; South Vietnam 13.
Other do	2	5	Mainly to Taiwan.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	11	4	Philippines 3; Taiwan 1.

r Revised.

Table 6.—Hong Kong: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	584	531	Mainland China, 477; Japan 45; Netherlands 9.
Oxide and hydroxide	231	256	West Germany 142; Japan 75; United Kingdom 27.
Metal including alloys, all forms	r 18,648	19,845	Canada 6,286; Japan 3,829; Australia 3,352.
Arsenic trioxides, pentoxides, and acids	85	68	Mainly from mainland China.
Chromium oxide and hydroxide	169	206	West Germany 67; United Kingdom 53; United States 43.
Cobalt oxide and hydroxide	30	71	Belgium 55; United Kingdom 16.
Copper:			
Copper sulphate	19	27	Mainly from United Kingdom.
Metal including alloys, all forms	r 16,223	13,377	Japan 4,422; Australia 2,026; United Kingdom 1,669.
Gold unworked or partly worked thousand troy ounces	1,359	2,372	Australia 1,007; United Kingdom 892; Netherlands 425.
Iron and steel:			
Metal:			
Scrap thousand tons	r 70	52	United Kingdom 23; West Germany 16; Australia 4.
Pig iron, ferroalloys, and similar materials do	8	2	Mainland China 1; Japan 1.
Steel, primary forms do	2	22	Mainly from Australia.
Semimanufactures:			
Bars, rods, angles, shapes, sections do	109	145	Mainland China 77; Japan 39; Taiwan 10.
Universals, plates and sheets do	122	143	Japan 56; United Kingdom 44; Australia 16.
Others do	49	57	Japan 18; Taiwan 13; mainland China 9.
Lead including alloys, all forms	r 391	1,007	Australia 414; United Kingdom 116.
Magnesium including alloys, all forms	10	4	Japan 2; Canada 2.
Manganese:			
Ore and concentrate	1	120	Mainly from Thailand.
Oxides	2,833	3,921	Japan 2,492; Thailand 1,223; mainland China 205.
Mercury 76-pound flasks	457	425	United Kingdom 292; Spain 50; Italy 33.
Nickel including alloys, all forms	223	162	United Kingdom 53; United States 21; France 20.
Platinum group including alloys, all forms thousand troy ounces	83	65	West Germany 25; United Kingdom 23; Netherlands 10.
Rare earth oxides	3	4	United States 3; India 1.
Silver including alloys thousand troy ounces	484	347	Philippines 196; Japan 42; North Korea 32.
Tin including alloys, all forms long tons	137	241	United Kingdom 50; West Malaysia 49; mainland China 37.
Titanium:			
Ore and concentrate	137	126	All from Australia.
Oxides	3,259	3,363	Australia 1,071; Japan 866; United Kingdom 621.
Tungsten including alloys, all forms	109	1	Mainly from United Kingdom.
Zinc:			
Oxides	991	925	France 489; Australia 141; West Germany 126.
Metal including alloys, all forms	r 8,563	8,911	Australia 2,656; Canada 2,207; Japan 2,128.
Others:			
Ashes and residue containing nonferrous metals	457	365	All from United Kingdom.
Oxides, hydroxides and peroxides of metals, n.e.s	3	30	Norway 14; West Germany 6; United States 6.
Metal including alloys, all forms:			
Metalloids	18	16	United Kingdom 8; United States 2; West Germany 2.
Base metals including alloys, all forms, n.e.s	35	32	Mainly from mainland China.
NONMETALS			
Abrasives, natural, n.e.s	405	484	United States 208; Japan 199; West Germany 28.
Grinding and polishing wheels and stones	401	471	Mainland China 150; United Kingdom 124; Japan 94.

See footnote at end of table.

Table 6.—Hong Kong: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Asbestos	241	272	Canada 150; mainland China 120; Japan 2.
Barite and witherite	139	125	Mainly from mainland China.
Boric oxide and acid	90	200	Mainly from the United States.
Cement thousand tons	r 265	373	Mainland China 311; Japan 43; Taiwan 15.
Chalk	11	18	All from Switzerland.
Clays and products (including all refractory brick):			
Crude n.e.s	6,746	7,390	United States 5,100; mainland China 974.
Products [1]	19,020	20,611	Japan 8,958; mainland China 8,428.
Cryolite and chiolite	26	33	All from Denmark.
Diamond, gem not set or strung thousand carats	540	654	Belgium-Luxembourg 203; Israel 182.
Diatomite and other infusorial earths	r 215	225	Mainly from the United States.
Feldspar and fluorspar	r 1,158	455	Mainly from mainland China.
Fertilizer materials:			
Crude	570	434	Mainland China 331; Indonesia 94.
Manufactured:			
Nitrogenous	1,080	1,057	Mainly from Japan.
Phosphatic	9	--	
Potassic	12	31	Mainly from Italy.
Other including mixed	5,079	5,482	West Germany 4,723; Belgium-Luxembourg 231.
Ammonia	656	671	Japan 553; United Kingdom 60; Taiwan 37.
Graphite, natural	181	320	Mainland China 282; Japan 21; Ceylon 12.
Gypsum and plasters	r 20,272	16,780	Mexico 11,356; Australia 3,565; mainland China 606.
Iodine	1	1	
Lime	r 25,898	34,576	Mainland China 18,550; Japan 6,521; North Vietnam 5,281.
Magnesite	51	83	All from mainland China.
Mica, all forms	16	31	India 18; Nepal 4; West Germany 3.
Pigments, mineral including processed iron oxides	580	608	West Germany 423; United Kingdom 113; mainland China 50.
Salt and brines	37,393	31,133	Mainland China 24,205; Thailand 2,486; Netherlands 1,999.
Sodium and potassium compounds, n.e.s	13,350	14,678	Mainland China 8,998; Japan 4,002; Taiwan 1,030.
Stone, sand and gravel:			
Dimension stone	2,083	3,476	Italy 1,948; mainland China 1,314; Taiwan 97.
Gravel and crushed rock	1,537	1,324	Mainland China 1,073; Japan 131; Italy 72.
Limestone (except dimension) thousand tons	r 244	310	Mainly from Japan.
Quartz and quartzite	r 2,835	1,960	Mainly from mainland China.
Sand excluding metal bearing	87	1,543	Japan 1,403; New Zealand 62; mainland China 43.
Sulfur:			
Elemental all forms	1,552	1,819	West Germany 752; Poland 357; France 290.
Sulfuric acid	527	478	Japan 417; United Kingdom 60.
Talc, steatite, soapstone, and pyrophyllite	r 1,701	2,474	Mainland China 2,025; North Korea 196; Italy 88.
Other nonmetals n.e.s.:			
Crude	720	1,423	Mainland China 1,026; Mozambique 292; Republic of Korea 45.
Slag, dross and similar waste, not metal bearing	111,762	99,898	Taiwan 83,054; Japan 15,812; Thailand 967.
Oxides and hydroxides of magnesium, strontium, and barium	2	3	Mainland China 2; Japan 1.
Bromine, iodine, and fluorine	1	1	Mainly from the United States.
Building materials of asphalt, asbestos and fiber, cement, and unfired nonmetals n.e.s.	13,277	11,980	United Kingdom 5,040; Sinagpore 2,192; mainland China 2,141.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	168	160	Trinidad and Tobago 113; United Kingdom 24; United States 23.
Carbon black and gas carbon	684	808	Japan 627; United States 136; Australia 24.

See footnote at end of table.

Table 6.—Hong Kong: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coal, coke, and peat including briquets	88,486	52,806	Mainland China 42,549; North Vietnam 4,885; Japan 3,861.
Gas hydrocarbon	15,256	18,429	Philippines 5,390; Japan 4,619; Taiwan 4,434.
Petroleum refinery products:			
Gasoline (including natural) thousand 42-gallon barrels	780	949	Singapore 433; Bahrain 238; Iran 191.
Kerosine and jet fuel do	r 3,555	4,457	Iran 1,796; Singapore 1,693; Saudi Arabia 352.
Distillate fuel oil do	r 3,746	4,319	Philippines 1,128; Singapore 813; Iran 802.
Residual fuel oil do	r 12,170	14,356	Singapore 5,013; Saudi Arabia 4,293; Japan 3,915.
Lubricants do	r 304	308	United States 135; Netherlands Antilles 52; Japan 45.
Mineral jelly and wax do	84	90	Singapore 34; Burma 21; mainland China 18.
Other do	98	104	Singapore 60; United Kingdom 13; Taiwan 5.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	87	189	Japan 120; United Kingdom 66.

r Revised.
1 Excludes bricks and other clay products valued at 4,364,971 HK$ for 1968 and 6,637,766 HK$ for 1969.

LAOS [7]

Tin mining remained the only significant mineral industry in Laos during 1970. Despite heightened military activity and a national budget devoted mainly to defense that continued to hold back economic growth, the Laotian mineral industry sector showed signs of improvement, notably in tin production, exports of tin concentrates, and electricity consumption. The country's principal mineral imports in 1970 were cement, petroleum products, and iron and steel semimanufactures.

Consumption of petroleum products was slightly lower than in 1969, primarily because the use of distillate fuel oils for power generation declined as a result of the substitution of imported electric power from Thailand.

In order to compete with Singapore as chief gold entrepôt of Southeast Asia, Laos further reduced the gold import tax from 7.5 percent in 1969 to 5.5 percent in 1970.

COMMODITY REVIEW

Metals.—The known alluvial gold occurrences in Laos, especially along the Mekong River and its tributaries, have not yet been developed. However, Laos trades heavily in gold which is imported from West European countries and reexported to Thailand, South Vietnam, and other Asian countries. About 5 to 10 percent of the imported gold in 1970 probably remained in Laos and was used for jewelry purposes.

Production of low-grade tin concentrates, which recently has been averaging about 1,200 tons per year, showed a significant increase in tonnage in 1970 although little change in metal content. Exports of tin concentrates—all to Malaysia—rose sharply, specifically from 1,031 tons in 1969 to 1,370 tons in 1970. As in previous years, the French-managed Phon Tiou tin mine and the Laotian-run, Nong Sun tin mine, both near Thakhek in Southern Laos, accounted for all of the tin production. A modernization program for the Nong Sun mine, hitherto much the smaller of the two mines, was in the planning stage in 1970. Through the purchase of new beneficiation equipment, mine owners of Nong Sun expect to raise tin output by about 80 percent.

Available tin production data are as follows, in long tons:

Year	Tin concentrate	Tin content
1968	r 1,155	r 500
1969	1,242	621
1970	1,397	629

r Revised.

Nonmetals.—Salt output in 1970 was 1,169 tons, a substantial decrease from 2,400 tons in 1969. Most of the production was from brine operations near Vientiane.

[7] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals.

MONGOLIA [8]

Mongolia's small mineral industry apparently made substantial progress in 1970, with estimated gains of 21 percent for all mining and approximately 23 percent for the fuels and construction materials industries. Apparently the 1970 goal of a 12-percent increase in electric power generation compared with 1969 figures was met.

Presently, coal production accounts for almost two-thirds of Mongolia's mineral output by value. During the year, coal output increased 21 percent over 1969 figures, apparently meeting the indicated goal. Most production came from the Sharyn Gol surface coal mine with an annual output of about 1 million tons. Nalaikha, the country's only other important coal mine, has in recent years, failed to reach its target.

No official Mongolian trade data are published. However, because Mongolian trade is chiefly with the U.S.S.R., officially recorded Soviet trade statistics are believed highly indicative of total Mongolian mineral commodity trade. Soviet imports of Mongolian fluorspar were given as 67,500 tons in 1968 and 75,800 tons in 1969. Small quantities of ferrous scrap and unspecified ores and concentrates including tungsten are also imported. Iron and steel exports from the U.S.S.R. to Mongolia were 17,300 tons in 1968 and 19,000 tons in 1969. Small quantities of nonferrous metals, refractories, coal and coke also were imported from the U.S.S.R. Cement imports, from the U.S.S.R., totaling 48,000 tons in 1968 and 20,000 tons in 1969, were probably reduced to relative unimportance in 1970 by the recent expansion at the Darkhan cement plant. The principal Soviet trade contribution to the Mongolian mineral economy continued to be refined petroleum products, which accounted for the greater part of Mongolian demand and the supply of crude oil to keep the small Dzuun Bayan refinery operating at full capacity. Together these totaled about 1.9 million barrels in 1968 and 2.1 million barrels in 1969.

The important construction materials sector apparently fulfilled its goals. Specific information was unavailable on the expansion of the cement industry that was expected by 1970, however the expansion presumably was nearing completion.

All fluorspar and tungsten output, Mongolia's only mineral export items of consequence, are shipped to the U.S.S.R. Export statistics indicate that fluorspar production increased approximately 2 percent above that of 1969 to the 80,000-ton level.

As a result of large-scale geological prospecting, extensive deposits of phosphate rock have been outlined in northern Mongolia near the U.S.S.R. border. A deposit of white marble, reportedly of quality equal to Italian marble, has also been discovered in the northern part of the country.

NEPAL [9]

The National Planning Commission of Nepal published a draft of the country's Fourth Economic Development Plan for the period 1970–75 calling for a total expenditure of about $350 million. About one-fifth of the anticipated expenditure was allocated to commerce, industry, and mining. Implementation of this development plan can cause the production and consumption of minerals to pass their current unimportant status and add significantly to the country's gross national product in the future.

The Kingdom of Nepal, consisting of an area of 54,000 square miles and a population of about 10.8 million people, remained a very minor mineral producing and consuming nation in 1970. Although the country has a rich ancient mining history, modern mining development has yet to commence. The country awaits the application of modern mineral exploration methods such as aerial photography and surveying, photogrammetry, and seismic surveying that can help indicate the location of various mineral commodities. Lack of utilization of modern surveying techniques and the country's rugged terrain have tended to limit the discovery and development of Nepalese mineral deposits.

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[8] Donald C. Wininger, physical scientist, Division of Nonmetallic Minerals.

[9] Prepared by Benjamin Petkof, physical scientist, Division of Nonmetallic Minerals.

Current information of the country's geology indicates that there are three major geologic zones. These are: the southern 40 kilometer strip made up of recent alluvial plains of the Churia Range; the mountains of the Mahabharat Range, immediately north of the Churia Range containing igneous, sedimentary, and metamorphic rocks that have been intruded by pegmatite dikes and small granitic intrusive masses; and the Great Himalayas and Tibetan Sedimentary Zone that lies farther north containing carbonates granites and gneisses.

Various mineral deposits in Nepal have been investigated to some degree and some information on reserves and grade of reserves is available. Some deposits that are presently considered to be economically and technically feasible for commercial utilization are the Chobhar limestone, located in the Patan District of the Kathmandu Valley, containing 15.3 million tons of proved reserves including possible cement-grade material; Bhainse (Kitni) limestone, located in the Makwanpur District, in the Narayani Zone containing 8.2 million tons of proved reserves including possible cement-grade limestone; Gadavari Marble, available also in the Patan District of the Kathmandu Valley, containing 350,000 tons of easily minable calcareous marble of various colors and 1.2 million tons of dolomitic marble; Phulchoki iron ore, found in the Patan District of the Kathmandu Valley, with over 2 million tons of proven reserves but without specification of the grade; Karra Khola silica sand found in the Makwanpur District of the Narayani Zone, containing over 3 million tons of indicated reserves. Other deposits containing various minerals such as magnesite, talc, ocher, iron pyrite, lead, and zinc have only been partially investigated.

At present there is no production of oil or natural gas in Nepal and demand is met by imports. However, there is limited geological evidence that oil and gas bearing strata may be present in the country.

Increasing internal sociologic and economic pressures within Nepal may generate demand for native minerals and hasten the development of the Nation's mineral industry.

SINGAPORE [10]

The economy of Singapore continued to advance during 1970 with the gross domestic product (GDP) and industrial production increasing about 15 percent and 20 percent, respectively. The 1970 GDP was approximately $1.87 billion (5.6 billion Singapore dollars). This rapid economic growth has led to changes in legislation pertaining to foreign investment. Companies investing in excess of $50 million and those with more than half local capital were given special consideration. For investments topping $330 million, the provision concerning Singaporan capital is waived. Large companies investing in Singapore during the year included Philips Industries Inc. with an investment of $10 million, Plessey with $25 million, General Electric Co., Siemens, and Rollei Werke. Singapore Government policy also favored companies that brought in skilled technicians or established training programs as a shortage of skilled workers became evident despite the Government's rather elaborate vocational training program.

The most spectacular growth in mineral enterprise occurred in the petroleum sector. During the year Singapore became the largest petroleum refining center in Southeast Asia. At yearend 1970, three of the four refineries in Singapore were undergoing expansion and a fifth was being built by an American-Singaporan joint venture. In 1970 Standard Oil Company (New Jersey) and Esso Standard Eastern also completed a 81,000-barrel-per-day refinery on the island of Pulau Ayer Chawan just off the Jvrong Estate. Even before the refinery was in operation, Esso announced that its capacity would be further increased to 231,000 barrels per day.

Singapore not only strengthened its position as a shipping, shipbuilding, trading, and industrial center during 1970 but also as the regional headquarters for petroleum and other mineral exploration activities in Southeast Asia, particularly in relationship to Indonesia. Many additional petroleum and industrial companies, exploration and drilling firms, and specialized construction companies have established offices on the island to utilize the many services Singapore could provide.

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[10] Prepared by A. F. Grube, industry economist, Division of Nonmetallic Minerals.

PRODUCTION

The only significant mineral activities in Singapore outside of the petroleum area was the quarrying of crushed granite and the manufacture of cement. Singapore produced 1,956,754 cubic yards of crushed granite and 725,516 metric tons of cement. Due to difficulties at the cement clinker grinding plant, cement production in Singapore was not sufficient to meet local demand. Requirements were extremely high on account of the construction boom in Singapore. Consequently 760,429 metric tons of cement had to be imported to make up for the shortage. Production of refinery products are shown in table 7 for the years 1967–70. In 1970 crude oil processed at Singapore's refineries amounted to 72,281,000 barrels.

TRADE

Singapore's total foreign trade increased to $4.1 billion in 1970, up 12 percent as compared with 1969. Exports increased only marginally while imports rose from $2.07 billion to $2.50 billion. Singapore Government officials were not overly concerned about the trade deficit because of the inflow of foreign long-term capital as well as capital goods and the large sums of invisible expenditures by foreign businessmen and tourist. The above figure do not include the trade of Indonesia which may account for part of the apparent deficit. Entrepôt earnings in 1970 dropped by 5 percent.

Trade increases in recent years indicate that Singapore may well replace Tokyo-Yokohama of Japan as the world's third largest port in the near future. In 1969, ships discharged 22,569,400 freight tons of cargo at Singapore and loaded 15,334,800 freight tons. Petroleum in bulk accounted for more than three-quarters of the total tonnage. Discharged petroleum amounted to 17,543,80 and loading of petroleum amounted to 11,664,300 freight tons during 1969.

As a result of the increased volume of trade and a corresponding rise in ships entering the port of Singapore, the country has developed a significant ship and aircraft bunkering business. Bunkering of ships has been very profitable for the Singapore petroleum companies. In fact, the amount of residual fuel oil sold for bunkering in 1970 was equivalent to approximately three-fourths of Singapore's output of this refined oil product.

COMMODITY REVIEW

Metals.—*Steel.*—For a number of years the Singapore Economic Development Board has been attempting to interest foreign steel companies in the construction of a steel mill in Singapore. During 1970 discussons were held with Japan's Nippon Steel Corporation, the world's largest steel company with negotiations meeting an impasse because agreement on the size of the steel mill could not be reached. Singaporan negotiators reportedly were thinking in terms of a 5-million-metric-ton steel plant, but the Japanese company felt that a plant of this size would be too large since Singapore's annual demand is only about 1 million tons and that 4 million tons of the output would have to be exported. Nippon Steel Corporation's views probably were influenced in part by the steel export difficulties Japanese steel companies have been encountering since about mid-1970.

In mid-1970 the Singapore National Iron and Steel Company was awaiting the approval of the Singapore Government to launch a long-discussed project for a 400,000-ton-steel mill based upon a feasibility study prepared by the Broken Hill Pty. Co. Ltd., Australia. This plan would apparently involve a partnership comprised of National Iron and Steel Company, the Development Bank of Singapore, and Broken Hill Pty. At yearend 1970, however, no firm plans had been agreed upon.

Mineral Fuels.—*Petroleum.*—The Mobil Oil Corp., one of the first U.S. investors in Singapore, announced plans to increase capacity of its refinery from 18,000 barrels per day to between 150,000 and 175,000 barrels per day. Construction is to be carried out in two phases. In the first phase ending 1973, a 75,000-barrel-per-day unit will be completed and in the second phase ending 1975, another 50,000- to 75,000-barrel-per-day unit will be completed. This added construction will raise Mobil's investment in Singapore to a total of about $60 million.

A new 65,000-barrel-per-day refinery was planned to be built by a joint venture of two United States firms and the Develop-

Table 7.—Singapore: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
METALS			
Aluminum:			
Bauxite and concentrate	190	301	Taiwan 301.
Oxide and hydroxide	617	2,315	Malaysia 2,313.
Metal including alloys, all forms	529	867	Malaysia 559; Cambodia 76; Hong Kong 71.
Chromium oxide and hydroxide	10	7	All to Malaysia.
Copper:			
Ore and concentrate	1,270	1,016	All to Japan.
Metal including alloys, all forms	r 705	562	Malaysia 536.
Iron and steel:			
Ore and concentrate	26,645	99,263	Japan 99,094.
Metal including alloys:			
Scrap	602	1,123	France and Monaco 944; Malaysia 75; Australia 43.
Pig iron and ferroalloys	r 925	260	All to Malaysia.
Sponge iron, powder and shot	12	6	Malaysia 4; Brunei 2.
Steel, primary forms	3,318	1,945	Malaysia 1,826; Brunei 94.
Semimanufactures:			
Bars, rods, angles, shapes, sections	33,179	12,811	Malaysia 8,764; Brunei 2,085; New Guinea 1,118.
Universals, plates, and sheets	29,655	31,255	Malaysia 27,924; Brunei 1,020; Ceylon 326.
Hoop and strip	819	1,070	Malaysia 1,041; Thailand 23.
Rails and accessories	1,780	962	Malaysia 588; Philippines 374.
Wire	8,604	7,748	Malaysia 5,471; Cambodia 1,880; Brunei 325.
Tubes, pipes, and fittings	33,060	19,096	Malaysia 11,891; Zambia 1,618; Brunei 1,329.
Castings and forgings, rough	521	232	Malaysia 202; Brunei 26.
Total	r 107,618	73,174	
Lead:			
Oxides	8	6	Malaysia 6.
Metal including alloys, all forms	696	831	Malaysia 329; Denmark 164.
Manganese:			
Ore and concentrate	2,082	2,452	Malaysia 2,211; Ceylon 241.
Oxides	48	42	All to Malaysia.
Mercury ... 76-pound flasks	47	13	Hong Kong 10; Malaysia 3.
Nickel including alloys, all forms	11	18	Malaysia 18.
Platinum including alloys ... troy ounces	598	277	Hong Kong 262.
Silver including alloys ... thousand troy ounces	3,541	1,486	United Kingdom 1,485.
Tin:			
Ore and concentrate ... long tons	3,545	1,419	Malaysia 852; Netherlands 465; Spain 42.
Metal including alloys, all forms ... do	142	223	Malaysia 91; Japan 27; Hong Kong 24.
Titanium oxides	210	323	All to Malaysia.
Zinc:			
Oxide	257	208	Malaysia 203; Australia 5.
Metal including alloys, all forms	2,412	2,246	Malaysia 2,049; Hong Kong 132.
Other:			
Ore and concentrate	9	17	United States 14.
Ash and residue containing nonferrous metals	1,090	1,364	Malaysia 962; Japan 197; Taiwan 123.
Oxides, hydroxides, and peroxides of metals n.e.s	20	33	Malaysia 25; Thailand 7.
Metals including alloys, all forms:			
Metalloids	5	4	Thailand 2; Malaysia 2.
Alkali, alkaline earth and rare earth metals	684	1	All to Malaysia.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	13	13	Do.
Grinding and polishing wheels and stones	57	49	Malaysia 44.
Asbestos	47	83	Malaysia 63; South Vietnam 15.
Cement and clinker	11,109	10,148	Malaysia 3,579; Christmas Island 3,049; South Vietnam 950.
Clays and products (including all refractory brick):			
Crude n.e.s	1,372	1,552	Malaysia 1,439; Pakistan 97.
Products	4,207	3,743	Malaysia 2,041; Brunei 792; Austria 262.
Diamond, gem not set or strung ... value, thousands	$1,319	$1,711	Malaysia $1,189; Hong Kong $477.
Diatomite and other infusorial earths	5	(1)	NA.
Feldspar and fluorspar	1,455	2,836	All to Malaysia.

See footnotes at end of table.

Table 7.—Singapore: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal destinations, 1969
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Nitrogenous	12	12	All to Malaysia.
Phosphatic	17,254	11,803	Malaysia 11,725; Thailand 61.
Potassic	48	30	All to Malaysia.
Other	25,161	24,234	Malaysia 24,110; Brunei 103.
Manufactured:			
Nitrogenous	15,342	18,201	Malaysia 18,100; Brunei 75.
Phosphatic	46,218	24,775	Burma 18,295; Malaysia 3,892; Ceylon 2,525.
Potassic	32,647	46,843	Malaysia 42,446; South Vietnam 4,301.
Other including mixed	15,254	24,282	Malaysia 24,108; Brunei 172.
Graphite, natural	10	20	All to Malaysia.
Gypsum and plasters	332	1,414	Malaysia 892; South Vietnam 372; Thailand 78.
Lime	2,973	1,124	Malaysia 1,044; Brunei 60.
Magnesite	1,484	2,250	Malaysia 2,244.
Pigments, mineral	31	37	Malaysia 25.
Precious and semiprecious stones, except diamond value, thousands	$722	$753	Hong Kong $621; Japan $81; Malysia $34.
Salt	6,642	9,517	Malaysia 9,134; Brunei 298.
Sodium and potassium compounds n.e.s	1,393	1,256	Malaysia 1,240; Brunei 13.
Stone, sand and gravel:			
Dimension stone	506	234	Malaysia 184; South Vietnam 30.
Dolomite, chiefly refractory grade	15	4	All to Malaysia.
Gravel and crushed rock	21,698	31,165	Brunei 30,787; Malaysia 378.
Limestone (except dimension)	79	172	All to Malaysia.
Quartz and quartzite	2	22	Do.
Sand excluding metal bearing	164	235	Malaysia 106; Christmas Island 102.
Sulfur:			
Elemental, all forms	4,803	7,422	Malaysia 5,064; South Vietnam 2,105.
Sulfuric acid	714	1,030	Malaysia 482; Cambodia 312; Burma 102; Ceylon 102.
Talc, steatite, soapstone, and pyrophyllite	915	1,205	Malaysia 971; Cambodia 222.
Other nonmetals n.e.s.:			
Crude	6,124	7,687	Malaysia 7,219; Brunei 390.
Slag, dross and similar waste, not metal bearing	64	23	All to Malaysia.
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals n.e.s	16,944	17,646	Malaysia 10,326; Hong Kong 2,561; Kenya 1,347.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	46	16	All to Malaysia.
Carbon black	486	679	Malaysia 610; Ceylon 69.
Coal and coke including briquets	1,005	1,575	Malaysia 1,534.
Petroleum:			
Crude and partly refined..42-gallon barrels	r 86,103	926	All to Japan.
Refinery products: [2]			
Gasoline:			
Aviation thousand 42-gallon barrels	r 2,882	3,730	South Vietnam 2,538; Thailand 889; Papua 81.
Motor do	r 9,526	9,928	South Vietnam 4,628; Japan 1,629; Malaysia 981.
Kerosine and jet fuel do	r 18,577	19,192	South Vietnam 13,613; Thailand 4,170; Japan 1,257.
Distillate fuel oil do	r 17,387	17,322	South Vietnam 8,634; Malaysia 2,679; Thailand 2,348.
Residual fuel oil do	r 27,776	31,500	Japan 20,493; Hong Kong 5,251; South Vietnam 2,743.
Lubricants do	r 822	1,010	Thailand 311; Malaysia 271; South Vietnam 166.
Mineral jelly and wax do	111	220	Italy and San Marino 45; South Vietnam 28; Philippines 27.
Other do	r 780	467	South Vietnam 179; Malaysia 123; Thailand 57.
Total do	77,861	83,369	
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	146	158	Australia 123; New Zealand 20.

r Revised. NA Not available.

[1] Less than ½ unit.

[2] In addition to products listed, liquefied petroleum gas valued at $788,000 in 1968 and $1,005,000 in 1969 was also exported.

Table 8.—Singapore: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
METALS			
Aluminum:			
Bauxite and concentrate	699	581	Mainland China 499; Malaysia 51.
Oxide and hydroxide	5,186	7,234	Japan 4,724; mainland China 2,445; Malaysia 51.
Metal including alloys, all forms	4,914	7,466	Japan 3,122; Hong Kong 1,183.
Chromium oxide and hydroxide	13	8	Mainland China 3; West Germany 2; United Kingdom 1.
Copper:			
Ore and concentrate	508	1,016	All from Malaysia.
Metal including alloys, all forms	r 2,583	2,897	Japan 1,436; Australia 774; United Kingdom 213.
Iron and steel:			
Ore and concentrate	NA	71	Malaysia 68; Australia 3.
Metal:			
Scrap	24,688	31,608	Malaysia 17,393; United States 13,416; South Vietnam 440.
Pig iron, ferroalloys and similar material	r 21,086	6,652	U.S.S.R. 3,826; mainland China 803; United Kingdom 712.
Spong iron, powder, and shot	152	248	United Kingdom 156; Australia 38; India 27.
Ingots and other primary forms	r 28,258	32,562	Australia 23,220; Japan 4,959; mainland China 3,085.
Semimanufactures:			
Bars, rods, angles, shapes, sections	76,990	98,173	Japan 58,205; United Kingdom 6,603; mainland China 5,618.
Universals, plates, and sheets	179,154	244,504	Japan 201,040; Australia 10,114; United States 8,924.
Hoop and strip	14,595	20,490	Japan 17,230; Australia 2,694; Belgium-Luxembourg 168.
Rails and accessories	3,676	5,408	United Kingdom 2,394; Malaysia 1,530; Belgium-Luxembourg 505.
Wire	14,256	16,818	Japan 8,096; mainland China 4,820; Australia 414.
Tubes, pipes and fittings	20,125	48,832	Japan 37,784; United Kingdom 3,375; India 2,426.
Castings and forgings, rough	638	476	Japan 139; mainland China 122; India 69.
Total	r 309,434	434,701	
Lead:			
Ore and concentrate	NA	10	All from Morocco.
Oxide and hydroxide	77	6	Malaysia 6.
Metal including alloys, all forms	770	1,435	Malaysia 532; Australia 527; United Kingdom 162.
Manganese:			
Ore and concentrate	9,062	3,758	Unspecified Central African countries 3,048.
Oxides	291	261	Japan 241; Netherlands 12.
Mercury ... 76-pound flasks	98	16	Italy and San Marino 10; West Germany 4.
Nickel including alloys, all forms	17	40	Japan 24; United Kingdom 11.
Platinum group and silver:			
Waste and sweepings ... troy ounces	228,667	16,007	All from Malaysia.
Metals including alloys:			
Platinum group ... do	160	160	Australia 73; United Kingdom 58.
Silver ... do	267,356	159,366	Malaysia 107,362; Philippines 25,681; France and Monaco 10,747.
Tin:			
Ore and concentrate ... long tons	1,241	823	Malaysia 779; Thailand 29.
Oxide ... do	1	(1)	NA.
Metal including alloys, all forms ... do	421	219	Malaysia 81; United Kingdom 81; Hong Kong 41.
Titanium oxides	1,296	1,671	Australia 764; Japan 587; United Kingdom 106.
Zinc:			
Oxide and peroxide	693	648	Japan 170; Netherlands 155; Australia 106.
Metal including alloys, all forms	8,607	6,082	Japan 4,450; Canada 869; Australia 509.
Other:			
Ore and concentrate	1	19	Malaysia 16.
Ash and residue containing nonferrous metals	17	79	United Kingdom 70.
Oxides, hydroxides, and peroxides of metals n.e.s	58	138	United Kingdom 51; United States 49; U.S.S.R. 8.
Metals including alloys, all forms	998	2,024	Norway 904; Austria 788; U.S.S.R. 130.

See footnotes at end of table.

Table 8.—Singapore: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	120	34	United Kingdom 13; Netherlands 10.
Dust and powder of precious and semiprecious stones value	$782	$2,380	Australia $1,622; Japan $757.
Grinding and polishing wheels and stones	237	200	Mainland China 51; Japan 38; United Kingdom 36.
Asbestos	3,068	1,165	Canada 745; Other Countries of Africa 275.
Cement	r 553,819	656,215	Japan 251,982; Malaysia 244,514; Republic of Korea 99,541.
Clays and products (including refractory brick):			
Crude n.e.s	4,052	10,475	United States 5,836; Japan 1,951; mainland China 1,246.
Products:			
Refractory (including nonclay bricks)	5,534	6,419	Taiwan 1,879; Netherlands 1,374; United Kingdom 1,351.
Nonrefractory	13,867	20,483	Japan 10,190; mainland China 4,484; Malaysia 2,160.
Diamond:			
Gem not set or strung value, thousands	$488	$580	Malaysia $373; Belgium-Luxembourg $125; Israel $54.
Industrial do	$30	$26	All from United States.
Diatomite and other infusorial earths	114	152	India 113; United States 39.
Feldspar and fluorspar	3,012	5,212	Hong Kong 2,761; mainland China 2,189; Thailand 200.
Fertilizer materials:			
Crude:			
Phosphatic	15,824	10,980	Christmas Island 10,458; United States 508.
Potassic	15	(1)	NA.
Other	420	477	Malaysia 396; India 51.
Manufactured:			
Nitrogenous	13,859	21,143	West Germany 10,566; Japan 9,345; Malaysia 644.
Phosphatic	47,143	47,641	United States 46,201; Netherlands 840; West Germany 400.
Potassic	17,204	57,299	Canada 22,875; Israel 19,735; United States 13,447.
Other including mixed	16,544	27,993	West Germany 13,121; Belgium-Luxembourg 10,551; Malaysia 3,732.
Graphite, natural	154	131	Mainland China 70; United Kingdom 24.
Gypsum and plasters	24,135	24,812	Australia 16,975; Japan 6,144; mainland China 1,073.
Lime	9,549	7,746	Malaysia 5,942; United Kingdom 1,406; North Vietnam 350.
Magnesite	13	94	Austria 50; Japan 21.
Mica, all forms	40	334	United States 230; United Kingdom 90.
Pigments, mineral	34	73	Japan 28; India 12; Malaysia 12.
Precious and semiprecious stones, except diamond value, thousands	$416	$1,023	Hong Kong $491; India $141; mainland China $104.
Salt and brines	34,908	93,503	Mainland China 51,528; Thailand 31,562; India 8,659.
Sodium and potassium compounds n.e.s	1,743	1,967	United Kingdom 1,217; Belgium-Luxembourg 222; Japan 120.
Stone, sand and gravel:			
Dimension:			
Crude and partly worked	84,239	48,183	Malaysia 47,281; mainland China 657; Italy and San Marino 234.
Worked	919	1,421	Italy and San Marino 752; Malaysia 280; mainland China 278.
Dolomite, chiefly refractory grade	3,852	4,177	Malaysia 3,714; Austria 397; Switzerland 50.
Gravel and crushed rock	18,208	54,193	Malaysia 52,977; mainland China 841; Taiwan 79.
Limestone (except dimension)	10,449	14,439	Malaysia 8,260; Japan 6,058.
Quartz and quartzite	180	263	Mainland China 234; Hong Kong 20.
Sand excluding metal bearing	28,491	30,626	Malaysia 28,906; mainland China 1,289; Belgium-Luxembourg 392.

See footnotes at end of table.

Table 8.—Singapore: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1968	1969	Principal sources, 1969
NONMETALS—Continued			
Sulfur:			
Elemental, all forms	7,893	10,548	France and Monaco 5,000; Canada 4,055; Japan 1,181.
Sulfur dioxide	1	27	United Kingdom 27.
Sulfuric acid	31	274	Malaysia 263.
Talc, steatite, soapstone, and pyrophyllite	4,479	5,042	Mainland China 3,788; Norway 357; Republic of Korea 330.
Other:			
Crude	5,430	21,475	United Kingdom 10,827; Ireland 2,721; East Germany 2,600.
Slag, dross and similar waste, not metal bearing	113	46	Malaysia 26; mainland China 15.
Oxides, hydroxides, and peroxides of magnesium, strontium, and barium	3	9	West Germany 3; mainland China 2; Netherlands 2.
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals n.e.s.	4,458	8,990	Malaysia 8,258; Israel 282; United Kingdom 173.
MINERAL FUELS AND REALTED MATERIALS			
Asphalt and bitumen, natural	2,004	57	British Caribbean Federation 56.
Carbon black	2,683	3,710	Japan 2,440; Australia 682; United States 452.
Coal and coke including briquets	9,003	4,239	Taiwan 2,516; Netherlands 470; West Germany 440.
Peat including peat briquets and litter	4	NA	
Hydrogen, helium and rare gases value, thousands	$67	$212	Malaysia $172; Japan $22; India $5.
Petroleum:			
Crude and partly refined thousand 42-gallon barrels	r 65,953	69,724	Kuwait 52,361; Iran 8,057; Other Middle East Countries 2,785; Malaysia 2,785.
Refinery products:			
Gasoline:			
Aviation do	r 3,178	3,882	Iran 2,572; Netherlands Antilles 1,119; Other Central and South American Countries 69.
Motor do	r 4,449	5,170	Iran 2,044; Malaysia 1,205; Australia 910.
Kerosine do	r 2,149	2,317	Malaysia 1,721; Japan 263; Iran 172.
Jet fuel do	r 7,613	10,839	Malaysia 5,773; Iran 1,811; Netherlands Antilles 1,379.
Distillate fuel oil do	r 9,982	10,843	Kuwait 4,541; Saudi Arabia 1,766; Malaysia 1,256.
Residual fuel oil do	r 25,278	29,363	Malaysia 13,232; Iran 3,775; Saudi Arabia 2,797.
Lubricants do	r 1,071	1,319	Netherlands Antilles 557; Japan 475; Netherlands 100.
Mineral jelly and wax do	12	39	Burma 28; mainland China 6.
Other:			
Nonlubricating oil n.e.s. do	8	7	United States 3; United Kingdom 2.
Pitch and petroleum coke do	19	(1)	NA.
Bitumen and bituminous mixtures n.e.s. do	74	66	Malaysia 38; Taiwan 11; United Kingdom 9.
Total do	r 53,833	63,845	

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

ment Bank of Singapore. The new company is to be named the Singapore Petroleum Company. The American participants are Standard Oil Company of Indiana (AMOCO) and the Summit Industiral Corp. The refinery to be built on the island of Pulau Marlimau is scheduled to be completed by 1973. Ninety percent of the refinery's production will be exported. The refinery's cost has been variously estimated at between $30 and $70 million.

The Royal Dutch /Shell group of companies were making plans to build a fourth refinery of 100,000 barrels per day initially. When this refinery is completed in 1974, Shell's total capacity for all four of its refineries in Singapore will be 350,000 barrels per day.

Another oil project is the planned expansion of the British Petroleum Company (BP) refinery in Palau Bukum from 20,000 barrels per day to 25,000 barrels per day. BP's total investment in Singapore including marketing facilities is $20 million. Limitations in land area prevents a major expansion of BP's refinery.

In addition to the companies with refineries in Singapore, two United States firms, Caltex and Castrol Oil, also have lubricating oil blending plants in Singapore. Caltex has bunkering facilities and service stations at Singapore.

At yearend 1970, half of the foreign investment in Singapore was by oil refining companies. When Shell, Esso, B.P., Mobil, and Singapore Petroleum complete their various projects late in 1974, Singapore's refining capacity will total 810,000 barrels per day, or more than double the present capacity.

Several factors have encouraged the refineries to expand production on such a massive scale. One factor is that demand was rising at rates far exceeding expectations. Growing tanker and air traffic raised the demand for bunker fuel in 1970 to 24,888,000 barrels of fuel for ships and 812,000 for aircraft. Another factor was that bunker fuel prices had increased 40 percent in 1970.

As a result of the tremendous increase in refining capacity and a corresponding increase in the output of naphtha the Singapore Government, through the economic Development Board, has been actively promoting the establishment of a petrochemical industry in Singapore. Hitherto, the naphtha used has been for manufacturing gas by the Public Utility Board and for export to Japan where it is converted into various petrochemicals some of which have been returned to Singapore. By the establishment of a petrochemical industry in Singapore, the Government believes there would be a one-third saving in price as compared with imported petrochemicals.

The Government has suggested that a petrochemical complex be built on one of the offshore islands south of Singapore, such as Pulau Ayer Merbau which is adjacent to all the refineries. This location was recommended because of the scarcity of land on the Singapore mainland, the need to protect the public from accidents, and the advantages of a central control. Some Japanese and United States firms reportedly have expressed an interest in investing in petrochemicals although the Singapore Government had not yet received any firm commitments.

NORTH VIETNAM [11]

North Vietnam in 1970 continued to maintain a wartime economy despite the lull in fighting during the year. Although general claims were made to "splendid achievements in industrial production" and prewar level outputs, no real economic progress seemed evident, partly because the policy of industrial dispersion was apparently still in force throughout 1970. This policy made it difficult to coordinate production and caused serious transport bottlenecks. Efforts, as in 1969, were primarily devoted to the rehabilitation of local industry to satisfy domestic requirements. Industrial sectors, such as coal, chemicals, electricity, and engineering, claimed that their production plans in 1970 were fulfilled or overfulfilled, but many factories and plants worked under severe handicaps caused by acute labor shortages and breakdown of machinery and equipment.

COMMODITY REVIEW

Metals.—Ferrous and nonferrous metal output was claimed by North Vietnam to have exceeded the set norms of the 1970 plan by 4 percent and 13 percent, respectively. It was known, however, that the country imported substantial tonnages of steel and nonferrous metals from the Soviet Union.

The Thai Nguyen Iron and Steel Works was reported to have been operational in 1970, but production was not known.

In addition to iron ore, North Vietnam has mines that produced ores of chromium, tin, and zinc in 1970, but their output was not revealed.

Nonmetals.—The Haiphong cement plant was reported to have operated under

[11] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals.

many difficulties in 1970; other cement plants in the country most likely had similar situations. Cement output, believed to be around 500,000 tons in 1969, probably was about the same in 1970.

North Vietnam has substantial deposits of phosphate rock (apatite) at Laokay. Production of phosphate rock and apatite in 1970 was estimated to be 50,000 and 1 million tons, respectively. The Laokay apatite mine was reactivated late in 1970, and following improvements to the Port of Haiphong, mine shipments were resumed to North Korea. In the hope of establishing a trade agreement for Japanese fertilizers, North Vietnam shipped approximately 1,900 tons of apatite to Japan at yearend.

Mineral Fuels.—The country possesses substantial resources of anthracite coal, the bulk of which is produced by the well-known Hongay mines. Before war damage curtailed production in 1967, annual output from the mines was close to 3.5 million tons. Output in 1969 was estimated to be around 3 million tons, and most likely, it was about the same in 1970. Japan received approximately 227,000 tons of surplus anthracite from North Vietnam in 1970 compared with nearly 252,000 tons in 1969.

SOUTH VIETNAM [12]

The general economy of South Vietnam continued to be affected by the war in 1970. War-related service industries accounted for an estimated 75 percent of the country's gross national product. Industrial output from most sectors continued to decline, and the country's import-export ratio remained at 40 to 1. South Vietnam again relied heavily or entirely upon imports to meet domestic mineral requirements for cement, fertilizer, iron and steel products, nonferrous metals, and petroleum products. Known mineral production in 1970 was limited to cement, clays, salt, silica sand, and stone.

In order to halt the inflationary trend and help restore financial and economic stability, the Government of South Vietnam established a parallel market rate of foreign exchange on October 5. The new rate of VN piasters 275=US$1.00 was applied to all exports, certain imports, and other items not under the official exchange rate which remained at 118 piasters to US$1.00.

COMMODITY REVIEW

Metals.—South Vietnam continued to rely upon imports in 1970 to satisfy nearly all of its domestic requirements for manufactured steel products. Imports of steel products in 1969 amounted to 235,858 tons, which was more than twice those of 1968. The value of steel mill products, nonferrous metals, and metal manufactures imported in 1969 was $51.3 million, $7.9 million, and $4 million, respectively; final values for 1970 were not available.

Commercial steel fabricating—the making of products from billet steel—was initiated in the Vietnam Steel Casting and Rolling Mill (Vicasa) mill on the Bien Hoa industrial estate late in 1969. The country's other rolling mill is at Thu Duc, a suburb of Saigon, and is operated by Vietnam Kim Khi Cong Ty (Vikimko). Both mills, using locally available scrap, produced only reinforcing bar in 1970 for use in concrete. Reported capacity of the Vicasa mill was 25,000 tons per year and that of the Vikimko mill, 15,000 tons per year.

Galvanized metal sheeting was produced in 1970 in a plant at Phong Phu in Thu Duc. Estimated annual capacity of the plant was 40,000 tons.

Nonmetals.—Cement production in 1970 was 286,000 tons compared with 247,185 tons in 1969. Cement imports amounted to 469,000 tons in 1969 and about 289,000 tons for the first 6 months of 1970.

A study was completed in 1970 to determine the feasibility to expand the present cement plant in Can Tho and to construct a new plant at Van Xa, near Hue. Reportedly, the total cost involved for both operations would be about $50 million dollars.

Construction of a plant to produce prestressed concrete poles for the Vietnam Power Company and the Post and Telecommunications Service was completed in October.

The country's growing consumption of fertilizer for agricultural purposes was estimated to be 450,000 tons in 1970, com-

[12] Prepared by Arthur C. Meisinger, industry economist, Division of Nonmetallic Minerals.

pared with approximately 368,000 tons imported for consumption in 1969.

British and Japanese interests submitted proposals to the Government of South Vietnam near yearend to provide financial and technical assistance for the establishment of a government-owned fertilizer complex near Saigon. The proposed plant, projected to be operational by 1973, would produce 650 tons per day of ammonia and 1,200 tons per day of urea and would use imported naphtha. A pre-investment study by a London-based firm for a fertilizer complex to be constructed at Vung Tau near Ganh Rai Bay was also submitted to The Government of South Vietnam in 1970. This study proposed a three-phase investment plan for a 1000-ton-per-day ammonia plant and two 800-ton-per-day urea plants (Phase I) to be operational in 1974; a 1,600-ton-per-day complete fertilizer plant (Phase 2) to be operational in 1975; and a 1,200-ton-per-day complete fertilizer plant (Phase 3) to be operational in 1980.

South Vietnam possesses abundant resources of clays, salt, sand and gravel, silica sand, and various types of stone for domestic construction materials. The most recent officially reported output of these commodities was as follows: clays (including kaolin), 128,275 tons in 1968; salt, 118,319 tons in 1969; sand and gravel, 8 million tons in 1970; silica sand, 95,725 tons in 1968; and stone (principally granite), 12.3 million tons in 1970. Limestone production was 286,000 tons in 1970.

Mineral Fuels.—The country's only coalfield at Nong Son, 40 kilometers southwest of Da Nang, resumed operations in 1969 despite major interruptions. Although coal production tonnage was not reported, work was continued in 1970 with fewer interruptions than in 1969. The last year of reported coal production was 1964 when output reached 77,000 tons before the mines were flooded near yearend.

The proposed project for an oil refinery at Nha Trang, planned since 1963, made no headway in 1970. The country continued to rely on imports to meet all domestic requirements for petroleum products, such as gasoline, kerosine, and distillate and residual fuel oils.

A petroleum exploration and exploitation law, presented to the Vietnamese National Assembly in 1969 by the South Vietnam Government, was passed by the Assembly in August, 1970. The promulgation of the law in December established for the first time the terms under which oil companies would operate in order to explore and exploit possible offshore petroleum deposits.

The Mineral Industry of Other South Pacific Islands

By Staff, Bureau of Mines

CONTENTS

BRITISH SOLOMON ISLANDS [1]

The only mineral activity presumed to be occurring on the main islands of Guadalcanal, Choiseul, New Georgia, Santa Isabel, Malaita, San Cristobal, and Santa Cruz is the small production of gold from the alluvial deposits mostly on Guadalcanal. Recovery of World War II scrap metals could also be continuing.

Interest in the low-grade copper outlined on Guadalcanal by the British Solomon Islands Government and the United Nations mineral survey seems to have waned.

The existance of at least 20 million tons of good-grade bauxite on Rennell Island has been confirmed by Mitsui Mining and Smelting Co. of Japan. The company has asked for a long-term development concession and hopes to extract about 1.2 million tons per year of the ore.

New Broken Hill Consolidated, Ltd., of Melbourne, Australia, (formerly of London) has established a modest tonnage of low silica bauxite on Wagina Island and is investigating avenues of development.

Table 1.—British Solomon Islands: Gold production [1]

Year	Troy ounces
1966	349
1967	672
1968	654
1969	290
1970	9

[1] Exports of bullion.

CHRISTMAS ISLAND [2]

Christmas Island ranked about 10th among the more than 30 countries producing phosphate rock. The Island, located in the Indian Ocean south of Java and having an area of 55 square miles and 3,000 inhabitants, has only one commercial mineral activity—phosphate rock. Exports of phosphate rock and dust by destinations for fiscal years 1968-70 are shown in table 2.

Christmas Island Phosphate Commission (CIPC) handles the phosphate operations, but British Phosphate Commission (BPC) is the managing agent. Most of the phosphate rock output is shipped to Australia and New Zealand for agricultural purposes.

[1] Robert A. Clifton, chemist, Division of Nonmetallic Minerals.
[2] Donald E. Eilertsen, physical scientist, Division of Nonmetallic Minerals.

Table 2.—Christmas Island: Shipments of phosphate rock [1]

(Metric tons)

Fiscal year ending June 30 of year stated	Australia	New Zealand	Singapore	Malaysia	Cambodia	Indonesia	Total	Value U.S. dollars
1968	891,454	183,759	70,674	--	--	--	1,145,887	$9,606,296
1969	r 883,667	261,231	98,431	--	--	--	1,243,329	11,895,264
1970	751,575	258,305	12,340	68,319	7,503	686	1,098,728	10,481,844

r Revised.
[1] Average grade of phosphate rock, 36.5 percent P_2O_5.

Source: The British Phosphate Commissioners, Melbourne, Australia.

BPC awarded an A$500,000 contract for the purchase and installation of two new complete crushing and screening plants to produce sized phosphate for fertilizer manufacturers in Australia and New Zealand. Each plant will operate at a rate of 400 tons per hour.[3]

Christmas Island has approximately 200 million tons of phosphate ore reserves, of which 20 million tons are Christmas A-grade ore containing apatite as the major component. The B- and C-grades contain increasing quantities of crandallite and millisite. Most of the Island's phosphate ore is very low in silica.

The deposits have been studied intensely in recent years, and a number of scientific papers were prepared for presentation. The papers include research data on the mineralogy of the deposits' overburden, beneficiation of B-grade phosphate rock, production of superphosphate from A-grade ore, production of water-soluble phosphate fertilizer from C-grade ore, and production of fertilizers and smelter-grade alumina from B- and C-grade ores.[4]

FIJI ISLANDS [5]

The 844 islands (106 of which are inhabited) of the Fiji Island group are located nearly 2,700 kilometers east-northeast of Brisbane, Australia. Their combined area is 18,300 square kilometers. The capital is Suva on Viti Levu, the largest island, which has an area of 10,400 square kilometers. The Fiji Island population was estimated by the United Nations to be 505,000 in 1968. After being a British colony since 1874, the islands gained independence on October 10, 1970, as the Dominion of Fiji and became a member of the British Commonwealth.

The following major minerals are produced, in order of value: gold, cement, stone, sand and gravel, and manganese ore. The total value of minerals produced in 1970 was almost $6.9 million,[6] slightly below the $7.1 million recorded for 1969. Gold accounts for 52.2 percent and cement for 21.0 percent of the output in 1970, versus 53.9 percent and 18.4 percent, respectively, in 1969.

[3] Fertilizer Feed and Pesticide Journal. V. 67, No. 5, May 1970, p. 26.
[4] Australian Mining. Tech. papers pres. to the Australian Inst. of Min. and Met. 1971 Ann. Conf. V. 63, No. 4, p. 66.
[5] Francis C. Mitko, economist, Division of Nonferrous Metals.
[6] Where necessary, values have been converted from Fiji Dollars (FD) to U.S. dollars at the rate of FD1=US$1.136.

Table 3.—Fiji: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970
METALS			
Copper mine output, metal content (exports)	r 592	r 428	--
Gold mine output, metal content ... troy ounces	106,784	91,572	103,785
Manganese ore and concentrate, gross weight	r 8,845	20,790	24,543
Silver mine output, metal content ... troy ounces	54,518	37,951	26,640
NONMETALS			
Cement, hydraulic	51,396	54,563	60,658
Lime	3,374	4,477	2,885
Stone, sand and gravel:			
Limestone ... cubic meters	1,315	19,025	(1)
Quarried stone, other ... do	212,909	243,699	283,696
Sand and gravel	e 400,000	415,628	384,117
Sand (coral)	62,459	67,592	78,856

e Estimate. r Revised.
[1] Total not available; 4,719 metric tons produced as raw material for lime only.

Table 4.—Fiji: Exports and reexports of selected mineral commodities
(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Copper ore and concentrates	3,292	2,379
Gold:		
Nonferrous metals containing gold	1	--
In bullion troy ounces	106,784	95,346
Iron and steel:		
Metal:		
Scrap	849	1,153
Semimanufactures	--	384
Manganese ore and concentrate	r 11,019	11,295
Silver (in bullion) troy ounces	54,419	33,698
Other:		
Metallic ores and concentrates	--	142
Metal scrap of nonferrous	447	4,053
NONMETALS		
Cement	9,638	10,060
Fertilizer materials	12	6
MINERAL FUELS AND RELATED MATERIALS		
Coal, briquets and similar solid fuels	--	1
Petroleum refinery products: [1]		
Gasoline, motor and aviation thousand 42-gallon barrels	48	42
Kerosine and jet fuel do	663	567
Distillate fuel oil do	173	170
Residual fuel oil do	21	106
Lubricants do	3	3
Liquefied petroleum gas do	--	(2)
Total do	908	888
Mineral tar, and other coal-, petroleum-, or gas derived crude chemicals 42-gallon barrels	3	565

r Revised.
[1] Includes bunkers.
[2] Less than ½ unit.

Emperor Gold Mining Co. Ltd. continued mining gold but its financial position was such that the Government of Fiji granted $500,000 assistance, stipulating that the company must increase exploration and development and continue producing through 1976. In 1970, the company was looking outside Suva, where about 100 acres showed anomalous gold and silver values; zinc was the predominant metal. The Japanese-owned Banno Mining Co. of Fiji continued exploring for copper on the island of Vanua Levu. The company has a copper treatment plant on the island, but it was closed in 1969 after nearby copper and zinc deposits proved too small to justify operations. Southland Mining Ltd. produced manganese ore from mines on Viti Levu. Southland acquired an option on iron ore sands near Sigatoka, on Viti Levu's Coral Coast, and preliminary drilling of 120 surface holes was so encouraging that the company started a second-phase exploration program. Bauxite Fiji Ltd. set a mining goal of 250,000 tons per year of bauxite for export to Japan starting in 1972. The company, formed in 1968, has discovered a total of 5,000,000 tons of ore grading 49-percent alumina on Vanua Levu.

Coral sand mining off the Fiji coast near Suva was reported to be supplying the total lime requirement for the Fiji cement industry. The sole operator, Lami Cement Works, has two dredges in operation, one hydraulic and one clamshell.

Interest in offshore petroleum exploration in the Fiji Islands area mushroomed after the discoveries off the island of Tonga and the recognition of the relationship of the Fiji Islands to structural trends associated with the Tonga Trench. Southern Pacific Petroleum Fiji, Ltd. (comprised of Magellan Petroleum and Southern Pacific Petroleum), won the first license to explore around Fiji. The permit covers 1,929,600 acres of Bligh Water between the two main Fiji Islands. The initial seismic survey indicated sedimentary zones of considerable thickness. Barringer Research of Toronto, Canada, Formed Barringer Oil (Fiji) Ltd. and acquired a 3,000-square-mile oil lease offshore from the Fiji Islands. The lease is adjacent to the Southern Pacific lease and fringes on the Yasawa Island group. Other mineral concessions were granted to Longreach Oil Ltd. of Australia (all minerals, Viti Levu), Anglo-American Corp. of Australia, Ltd. (Viti Levu), Crawford Marine Specialists, Inc. (gold, Suva), and Bruno Campana, independent consulting geologist and former chief geologist for Rio Tinto Zinc Corp. (bauxite, phosphate, and manganese; all the Fiji Islands).

Table 5.—Fiji: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969
METALS		
Aluminum metal and alloys, unwrought and semimanufactures	55	NA
Copper:		
Matte	--	2
Metal, including alloys, all forms	76	94
Gold, metal, unworked or partly worked ... troy ounces	278	237
Iron and steel:		
Scrap	10	--
Pig iron, ferroalloys, and similar materials	--	188
Steel, primary forms	275	565
Semimanufactures	r 18,518	16,834
Lead metal including alloys, all forms	60	NA
Platinum group metals and silver, unworked and partly worked ... value	$287	$5,500
Tin metal, including alloys, all forms ... do	$80,394	$13,306
Titanium oxides	72	137
Other metals, including alloys ... value	$101,873	$9,923
NONMETALS		
Abrasives, natural, pumice, emery, natural corundum, etc	--	10
Asbestos	--	3
Barite and witherite	--	4
Cement	529	312
Chalk, earth colors, etc	--	59
Crude clays, n.e.s., kaolin and bentonite, etc	--	58
Diatomite and other infusorial earths	--	26
Fertilizer materials:		
Crude:		
Potassic	--	131
Mixed	21	61
Manufactured:		
Nitrogenous	26,815	22,858
Phosphatic	4,726	4,682
Potassic	450	323
Mixed	1,209	68
Gypsum and plasters	--	25
Lime	--	73
Precious and semiprecious stones, except diamond ... value	$184	$6,901
Salt	2,354	2,601
Sodium compounds, caustic soda	437	962
Stone, sand and gravel:		
Dimension stone	--	8
Dolomite	--	20
Sand, excluding metal bearing	--	88
Sulfur, elemental, all forms	--	1
Talc and steatite	--	11
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	--	4
Coal, coke and peat	2,331	1,403
Petroleum, refinery products:		
Gasoline, motor and aviation ... thousand 42-gallon barrels	283	283
Kerosine and jet fuel ... do	616	786
Distillate fuel oil ... do	r 581	641
Residual fuel oil ... do	r 177	235
Liquefied petroleum gas ... do	4	6
Lubricants (including grease) ... do	r 18	20
Other ... do	7	[1] 12
Total ... do	1,686	1,983
Mineral tar and other coal-, petroleum-, or gas- derived crude chemicals ... 42-gallon barrels	NA	[1] 655

r Revised. NA Not available.
[1] Partial figure.

NAURU AND OCEAN ISLAND [7]

Nauru's output of marketable phosphate rock (based on exports) was one of the largest in history, and that of Ocean Island was almost 10 percent below the record of 1969. Phosphate rock continued to be the only commercial mineral commodity produced in the Republic of Nauru and on Ocean Island, both of which are located in the Pacific Ocean, near the Equator, and about 1,600 to 1,800 statute miles northeast of Australia. Outputs of marketable phosphate rock of both Islands for 1966-70 are shown in table 6.

In 1970, Nauru's phosphate rock exports were: 1,270,000 metric tons to Australia, 492,482 tons to New Zealand, and 362,377 tons to Japan.

[7] Donald E. Eilertsen, physical scientist, Division of Nonmetallic Minerals.

Table 6.—Nauru and Ocean Island: Production of marketable phosphate rock [1]
(Thousand metric tons)

Year	Nauru	Ocean Island	Total
1967	r 1,806	452	r 2,258
1968	r 2,251	r 532	r 2,783
1969	2,198	564	2,762
1970	2,125	509	2,634

r Revised.
[1] Based on exports.

Source: The British Phosphate Commissioners, Melbourne, Australia, and Nauru Phosphate Corporation Aiwo, Nauru, Central Pacific.

British Phosphate Commission (BPC), which represents the Governments of Australia, New Zealand, and the United Kingdom, transferred its control of Nauru's phosphate operations to Nauru Phosphate Corp. headed by a Nauru Government-appointed Board of Directors, on July 1, as a result of an agreement reached in 1967 and Nauru attaining its independence on January 1, 1968. BPC, however, will continue to seek markets for the phosphate rock until the reserves are exhausted, which, based on current annual output, may last 20 years. Shipments of rock will also be made in Nauru-owned or Nauru-chartered vessels. BPC will continue to control phosphate mining operations on Ocean Island until those reserves are exhausted, perhaps by 1979.

Production of phosphate rock is expected to stay at about 600,000 tons per year. Prices of phosphate rock will be adjusted annually; the basic price of rock for crop year 1971, which was to end June 30, 1971, will be $12.30 per long ton f.o.b., in line with the price BPC agreed to pay for rock from Nauru.[8]

A paper describing the mining and handling of Nauru phosphate rock was prepared for presentation at the Australasian Institute of Mining and Metallurgy 1971 Annual Conference in New Zealand.[9]

NEW CALEDONIA [10]

In 1970, New Caledonia was the second largest free world producer of nickel. It was the only geographical and political entity that produced ferronickel, nickel matte, and crude ore for sale. The principal nickel producer on the island for the past 90 years has been Société Anonyme le Nickel S.A. Significant nickel production also came from a number of small operators of Le Syndicat Indépendant des Mines. Records for both production and exports of nickel ore and matte were made in 1970. As a result of the French Government's action in 1968 to increase nickel production on New Caledonia, a new era has evolved based on increased subsidies and a relaxation of Government controls. Huge industrial combines were formed to exploit large portions of the island's 2.5-billion-ton low-grade reserve of laterite ore, which assays only 1.75 percent nickel. Completion of four plants planned or under construction in 1970 will increase New Caledonia's production capacity from 43,800 tons to 200,000 tons by 1979.

PRODUCTION

Nickel remained practically the only mineral commodity mined and processed on New Caledonia in 1970. The newly formed partnership of Kaiser-Le Nickel, the New Caledonian Nickel Co., was the major factor in establishing a record output of 6.8 million tons of nickel ore in 1970, an increase of 25 percent over that produced in 1969. Since 1966, nickel ore production in New Caledonia has expanded 135 percent. This increase resulted from an improved nickel price and a growing demand for nickel, particularly by Japan. Le Nickel's Doniambo refinery produced a total 43,800 tons of nickel in 1970 (15,900 tons in matte and 27,900 tons in ferronickel), compared with a total of 39,800 tons of nickel the previous year (15,600 tons in matte and 24,200 tons in ferronickel).

TRADE

Mineral exports, composed principally of nickel ore, ferronickel, and nickel-cobalt matte, were valued at about $189 million in 1970. Exports of nickel ore, mainly to Japan, increased to over 4.1 million tons, a 33 percent increase over the 1969 ship-

[8] Industrial Minerals. Ocean Island Phosphate Rock Marketed as Before. No. 35, August 1970, pp. 30–31.
[9] Work cited in footnote 4.
[10] John D. Corrick, physical scientist, Division of Ferrous Metals.

ment. In the last 4 years, ore exports have increased about fourfold from the 1966 level of 1.1 million tons. During this period, nickel ore exported has risen from 38 percent to 59 percent of the total mined. Paramount among the reasons for the growth in exports of nickel ore during these years was the phenomenal industrial growth of Japan with the resulting increased demand for nickel. Although exports of crude nickel ore have increased, the nickel content of the ore has decreased from 2.8 percent nickel in 1968 to 2.7 percent in 1969 and 2.5 percent in 1970. Most of the exports of ferronickel, (81 percent) and matte (53 percent) went to France.

Table 7.—New Caledonia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970 [p]
METALS			
Iron ore (55 to 56 percent iron) ---- thousand tons	172	--	--
Nickel:			
Ore [1] ---- do	5,303	5,457	6,800
Metallurgical products: [2]			
Ferronickel (nickel-cobalt content)	22,425	23,886	27,965
Matte (nickel-cobalt content)	14,894	15,909	15,856
NONMETALS			
Giobertite [3]	664	1,294	1,099

[p] Preliminary.
[1] Mine-run ore, about 25 percent water; nickel content 2.8 to 3.5 percent by dry analysis.
[2] Ferronickel grading 24 to 28 percent nickel-cobalt, matte about 79 percent nickel-cobalt.
[3] Magnesium mineral used for refractories.

Source: Mines Service of New Caledonia.

Table 8.—New Caledonia: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1968	1969	1970
Iron ore	197,555	--	--
Nickel ore ---- thousand tons	2,489	3,093	4,127
Smelter products, nickel-cobalt content:			
Ferronickel:			
Electric grade (FN4 grade, 25.1 percent nickel-cobalt)	10,098	8,467	11,126
Sulfur extracted (FN3 grade 24.5 percent nickel-cobalt)	3,872	5,764	7,325
Refined (FN2 grade, 26.3 percent nickel-cobalt)	351	411	1,130
Overrefined (FN1 grade 27.5 percent nickel-cobalt)	8,566	9,550	8,405
Matte, nickel matte (79 percent nickel-cobalt)	15,708	15,649	15,627

Source: Mines Service of New Caledonia.

Table 9.—New Caledonia: Imports of selected mineral commodities

(Metric tons)

Commodity	1968	1969	1970
METALS			
Unwrought and semimanufactures, [1] not further described	17,218	24,234	NA
NONMETALS			
Cement, hydraulic	50,291	58,484	105,949
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke	236,077	199,472	258,403
Petroleum refinery products	301,450	278,918	459,539

NA Not available.
[1] Previous edition reported "metals" (unwrought) and "semimanufactures not further described" as two separate entries; material reported previously as semimanufactures actually consisted of metal manufactures (finished products) and as such has been excluded from this tabulation.

COMMODITY REVIEW

Metal.—*Nickel.*—Several major mine and smelter developments were underway in 1970 as a result of the French Government's desire to increase the output of nickel from New Caledonia. The Government, through subsidies and a liberalized policy toward foreign investments, has supplied the impetus to create a large-scale mining boom in New Caledonia. Le Nickel remained the principal producer of nickel and, through current and planned expansions, has assurred its position as premier producer on the island. Le Nickel was joined by Kaiser Aluminum and Chemical Corp. in 1967, forming the New Caledonian Nickel Co., to finance a 15,000-ton-per-year expansion at the Doniambo smelter. A second 15,000-ton expansion was underway in 1970 and should be completed by mid-1972. The partners will each market 50 percent of the nickel from the two expansions. Le Nickel planned to double its Doniambo smelter output to 83,300 tons by 1974. Doniambo's production could easily be expanded again by increasing the number of electric furnaces. Le Nickel's principal lateritic silicate ores were mined at Thio, Poro, Kouaoua, and Canala districts. The Thio district was expanded in 1970 with the opening of the Ningua and Ouenghi deposits and the installation of two ore upgrading units and a 21-kilometer ore transport system. The operation at Kouaoua improved with the construction of an ocean loading port for the Boa Caine mine. In 1970, Le Nickel began developing a new mining center at Napoui to supply the newly expanded Doniambo smelter. The Napoui mining center was to be composed of three major mines, Surprise, Si Reis, and Kopeto. Surprise began mining in 1970. Capacity of the district will eventually be 2.2 million tons per year. The mines will send ore to a central point from which it will be transported 14 kilometers by conveyor belt to Napoui for shipment to Doniambo. Le Nickel joined with Patino in 1969 forming Société Métallurgique Caledonienne to open a mine, build a power plant, town, port, and smelter at Poum. It is estimated that annual capacity would be 40,000 tons per year of nickel in ferronickel by 1972. In return for future deliveries of nickel, 19 Japanese companies agreed to finance the major portion of the $300 million required to develop the operation. The smelter at Poum will require its own 180,000-kilowatt power station, six rotating kilns, and 33,000-kilowatt electric furnaces. Le Nickel's final expansion was planned for southwestern New Caledonia on the northeast shore of the Baie de Prony. The deposit is a limonitic nickel deposit. The ore has been undergoing tests at Sherritt-Gordon's Canadian ammonium leach demonstration plant since February 1970 at a rate of 30 tons per day. The New Caledonian plant is planned for construction between 1975 and 1978.

International Nickel Co. of Canada Ltd. (Inco) and French associates formed Compagnie Française Industrielle et Minière du Pacifique (Cofimpac) in March 1969 to produce 50,000 tons per year of pure nickel from the Plaine des Lacs laterite deposit in the southwestern part of the island. Ore reserves were reported to be 500 million tons assaying 1.57 percent nickel. Inco held 61 percent of the financing, which called for an investment of $481 million. The operation will employ 1,420 people and will use Inco's carbonyl laterite process (ICLP) to produce pure nickel. The ICLP has several advantages over Inco's ammonia leach process in that 100-percent nickel pellets and 100-percent iron byproduct are formed. Moreover, the process employs low pressure, low temperature, and results in complete nickel selectivity and permits the recycling of carbon monoxide, the principal reagent. Late in 1970 Cofimpac ran into financial difficulties when some of the French participants withdrew financial aid. The withdrawal of these French companies removed 30 percent of the financing pledged for Cofimpac. The French company, Péchiney, offered to finance a portion of Cofimpac, but on its own terms.

American Metal Climax, Inc. (Amax) and Société Minière et Métallurgique de Peñarroya, S.A. (Penamax G.I.E.) were planning a joint venture to mine and refine laterite ores in the southern part of the island by 1975. The deposits were reported to be similar to those of nearby Cofimpac. Penamax drilling and initial mining delineated large ore reserves. The first shipment from the area, 10,000 short tons of test ore, arrived at Pascagoula, Miss., in 1970 from where it was transhipped to a pilot plant constructed by American Metal Climax (Amax) at Golden, Colo.

Pilot-plant testing was planned to continue through 1971. Penamax reportedly was planning the use of a new nickel extraction process possibly based on a segregation technique.

Pacific Metals Co. of Japan was planning to participate in a nickel mining venture with Eduard Pente Cost, a New Caledonian mining firm. Pacific Metals was to lend $750,000 worth of mining machinery to Eduard Pente Cost and send five mining engineers to explore and assist in development. In return, the firm would ship a yet undetermined amount of ore to Japan. Surveys by Pacific Metals indicated a deposit of 1 million tons of nickel ore assaying 2.4 to 2.7 percent nickel. Palgrave Corp. Ltd. was considering proposals for a feasibility study on the construction of a nickel concentration plant. The company announced in May that it had entered into an open pit lateritic nickel mining operation with Compagnie Minière du Pacifique (Sarl). Estimated reserves were reported to be 350,000 tons of nickel ore containing 2.4 to 2.6 percent nickel.

If all the proposed projects are developed in New Caledonia, the island will have the biggest mining boom of the 1970's, with $1.5 billion being spent on new mines, smelters, towns, ports, and ancillary facilities.

NEW HEBRIDES [11]

Mining activity in the New Hebrides is once again active. The Forari manganese and agglomerate mine on Efate Island, has contributed greatly to the economy of the Condominium of New Hebrides (governed jointly by France and the United Kingdom). The new owner, Le Manganese de Vate (LMV) was confident that the survey of resources and the readily available Japanese market added up to a profitable operation.

Table 10.—New Hebrides: Production and exports of manganese ore
(Metric tons)

	1968	1969	1970
Production:			
Ore	42,478	--	16,524
Agglomerate	49,356	--	--
Concentrate	--	--	15,601
Exports:			
Ore	--	--	--
Agglomerate	59,176	--	1,930
Concentrate	--	--	26,614

PAPUA AND NEW GUINEA [12]

The 1970 mineral production of the Australian administered territories of Papua and New Guinea (PNG), consisted only of small quantities of gold and silver with a total value of less than 1 percent of the territory's income. The territory has great mining potential, along with the small offshore islands of Bougainville, New Britain, New Ireland, and Manus. The development of its resources of ore and metal will greatly increase the territory's present small mining industry.

The current mineral activities in the territory may be divided into three fairly distinct types—general prospecting, petroleum exploration, and development of the Panguna Flats copper deposit on Bougainville Island, the major discovery to date. The Bougainville copper project, scheduled to begin production in 1972, is expected to process 30 million tons of ore per year, making Bougainville the world's largest mining operation in terms of the startup tonnage. The annual output of concentrates will yield 150,000 tons of copper, 500,000 ounces of gold, and 1,000,000 ounces of silver.

Smaller copper production will also come from other sources. The vast deposit at Ok Tedi is expected to be the next commercial

[11] Robert A. Clifton, chemist, Division of Nonmetallic Minerals.
[12] Charlie Wyche, physical scientist, Division of Nonferrous Metals.

project. Evaluation of the deposit is continuing, and the ore appears to be high-grade.

Tremendous interest in offshore oil exploration continues, but this has not resulted in any commercial discovery. Promising finds, however, of gas and condensate have been made in the Gulf District of Papua.

PRODUCTION

Mineral production for Papua and New Guinea during the last 3 years appears in table 11.

Table 11.—Papua and New Guinea: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity and country	1968	1969	1970
Copper:			
New Guinea	--	1	1
Gold:			
Papua ____ troy ounces	47	20	9
New Guinea ____ do	26,097	25,837	23,793
Platinum:			
New Guinea ____ do	--	--	(1)
Silver:			
Papua ____ do	8	5	2
New Guinea ____ do	18,131	17,201	17,178

1 Less than ½ unit.

COMMODITY REVIEW

Metals.—*Bauxite.*—There has also been increased activity in prospecting for other minerals such as phosphate and bauxite. The companies involved include CRA Exploration, Alusuisse, Comalco Industry Pty. Ltd., Canadian Superior Oil, and Carpentaria Exploration. Small bauxite deposits have been located on some of the New Guinea islands, and testing is underway to assess mining potential.

Copper.—Bougainville Copper Pty. Ltd. (BCP) made good progress in the construction of facilities for the development of the copper deposit on Bougainville Island. The scheduled time for commencement of production from this project remains unchanged at mid-1972. Presently BCP is owned 80 percent by Bougainville Mining Ltd., in which the interests are held 66-⅔ percent by Conzinc Rio Tinto of Australia Ltd. (CRA) and 33-⅓ percent by New Broken Hill Consolidated Ltd. The remaining 20-percent ownership of Bougainville Copper is held by the administration of the Territory of Papua and New Guinea on behalf of the local people. Other provisions include a royalty of 1¼ percent of f.o.b. sales and a maximum tax rate of 50 percent.

The ore mineral is predominantly chalcopyrite with some bornite principally along thin veins. Some intrusive rock has a minor amount of chalcopyrite disseminated with the rock fabric. The chalcopyrite contains gold and silver. Pyrite and magnetite are present along veins and in disseminated form, and a small quantity of molybdenite is present along the veins. The copper deposit extends into ridges bordering the valley floor. The primary ore is covered by layers of secondary and oxidized ore, placers, boulders, volcanic ash, alluvium, and soil. The ore reserve in the higher grade portion of the deposit has been estimated at 772 million metric tons containing 0.47 percent copper and 0.02 troy ounce of gold per ton. An additional 400 million tons of lower grade ore is adjacent to the main body.

BCP cleared the area and began hydraulicking to remove loose overburden in preparation for open pit mining. Deliveries of major mining equipment were made progressively during the second half of the year; mining operations began in November. Until commencement of commercial production, the mining equipment is being used to remove overburden from the ore body and also in stockpiling some ore.

The construction of company housing at Panguna, adjacent to the mine area, was continued. The first houses in the new town of Arawa were completed in September. In addition, a deep seaport was developed at Arawa Bay, and a new 16-mile highway was constructed to connect the port with the mine. Earthworks for the 81,000-ton-per-day concentrator, the power station and other service facilities were completed, and work has commenced on foundations and installations of components.

Nittetsu Mining Co. has announced a plan for a joint Japan-Australian venture (Laloki Copper Mining Pty. Ltd.) to exploit copper deposits in Papua. The agreement between Lionel Gross of Melbourne and Nittetsu and Kane-Matsu-Gosho Ltd., calls for ore development and production at the Laloki mine. Ore reserves at the mine are estimated at 360,000 tons. It is located about 19 miles east of Port Moresby. The firm will build an ore dressing plant with a capacity of 150 tons per day. Operations are expected to start early in 1972, with output of 1,000 to 1,500 tons of concentrates per month. All concentrates are to be shipped to Japan.

The Kennecott Copper Corp. is reported to be very encouraged by progress at Ok Tedi. Kennecott teams are outlining a potentially vast ore body estimated to contain several million tons. It is estimated that the group has taken out more than 50,000 feet of core samples from drill sites cut into the precipitous face of Mt. Fubilan, and drilling work is continuing. Although no official estimates have been made, Kennecott is said to have encountered copper grades ranging from 0.5 percent to as high as 2.5 percent, but which average around 1 percent. The Ok Tedi ore body is about 6,800 feet up the Papua's northwest highlands, at the headwaters of the Ok Tedi River, which eventually feeds the Fly River, flowing 600 miles to the coast. Other large mining companies are also prospecting in the area.

Iron Sands.—Australian Oil Gas Corp. is reported to have more than 400 million tons of iron sands along the 200 miles of beaches covered by its Papuan prospecting authorities. Further exploration and development work is underway. E. R. Hudson, the pioneer of the Savage River iron ore exporting project in Tasmania, is also continuing with iron development in Papua.

Nickel.—High interest in nickel exploration continues. Several major explorers have taken up large prospecting authorities to search for nickel in a zone parallel to the northeast side of the Owen Stanley Ranges. Papuan Nickel Exploration, a relative newcomer to the area, is looking for lateritic nickel on two prospecting authorities. Geologists' reports indicate in excess of 100 million tons of low-grade (0.6–1.4 percent) lateritic nickel in the two areas.

Mineral Fuels.—*Petroleum and Natural Gas.*—The Bureau of Mineral Resources announced that an airborne technique was devised to conduct reconnaissance seismic surveys. This method will be employed primarily in the swamp and jungle country of the Sepik-Ramu area of New Guinea.

Oil Search Ltd. is one of the pioneer companies and holds about 71 percent of the equity in the huge gas reserves at Kuru, Bwata, and Iehi; it is negotiating sales with American and Japanese interests.

Broken Hill Pty. Co. Ltd. has acquired an interest in two offshore areas in Papua and New Guinea. These are areas No. 6, Louisrade Archipelago, and No. 7, on the west coast of Bougainville. Hamatite Petroleum Pty. Ltd. will hold a 100-percent interest in the former area; in the latter, a consortium of Shell Development Australia Ltd., Australian Gulf Oil Co. and Hematite Petroleum Pty. Ltd. will be titleholder, and each party will have a one-third interest.